Riparian and Aquatic Habitat Assessment of Lower Tomichi Creek, Gunnison County, Colorado.

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Executive Summary

Riparian zones are important for their value in providing a variety of benefits often called ecosystem services, defined as "the conditions and processes through which natural ecosystems, and the species that make them up, sustain and fulfill human life" (Baron and others, 2003). Specifically, riparian zones, including those bordering the Gunnison River, provide the following services:

- water storage and release;
- aquifer recharge;
- maintaining a higher groundwater table;
- streambank stability;
- maintaining water quality;
- providing fish and wildlife habitat;
- and reduction of the power of floods.

Riparian areas also provide wildlife habitat, support the ecology of the Tomichi Creek fishery, maintain microclimatic conditions, provide marketable goods, and serve as migration corridors for a variety of organisms. Additionally, riparian zones provide many human services such as aesthetic values and places for recreation, housing and agriculture. With these functions and values in mind, we assessed the quality and function of the riparian and stream habitat of the Lower Tomichi Creek between the northeast toe of Tenderfoot Mountain to the confluence with the Gunnison River (Figure 3)

During this assessment, we focused on riparian areas directly associated with Lower Tomichi Creek channel and divided this reach of the Tomichi Creek into 10 "Assessment Segments" based on irrigation diversion structures, similar landscape and condition and in some cases property boundaries (Map 1). We mapped the riparian community from present and historical aerial photographs to determine changes; produced a soil map to indicate areas of plant community types, potential water storage/recharge zones and to determine recent historical condition; determined the extent of the active floodplain for potentially reducing the impacts of floods; and identified many of the diversion structures for reducing riparian impacts from maintenance. We assessed the riparian community for changes from historical condition, impacts that affect the ability of the riparian community to provide its functions and then prioritized some regions for protection, conservation or restoration.

We found that lower Tomichi Creek in these assessed sections is primarily dependent upon riparian vegetation to control the morphology of the stream, prevent streambank erosion and associated land loss yet these areas have moderate to very high sensitivity to disturbance. The wide floodplain and soil types indicate that these areas have potential for water storage during high flow yet slowly release water back to the stream over the course of the summer. This is

especially of value during the drier seasons where groundwater releases from riparian areas and other shallow aquifers augments where otherwise flows would decline and water temperatures would rise as snowmelt contributions to water quantity diminish.

Overall, we found that about 65% of the linear riparian areas are still healthy and are capable of functioning and providing most, if not all, of their benefits. However, we did document a loss of nearly all riparian vegetation in most segments upstream of Gold Basin road which is contributing to substantial decline in instream aquatic habitat, steam health, and possibly decreased water quality. The accounts for about 8,510 linear feet of bank (about 27%) were rated as NonFunctional. The primary impacts to riparian zones in this these areas were from riparian vegetation removal, grazing of streambanks with too high of an intensity and duration resulting in an absence of all or portions of the plant community, streambank erosion, land loss, increased sedimentation downstream and degraded instream aquatic habitat. Additionally, in some instances, the maintenance of diversion structures contributed to declines in riparian vegetation.

Riparian functions and human activities are often not congruent, however efforts can be directed to protect or restore strategic nodes to maximize riparian functions and values. Based on this, we propose the following:

- The Conservation properties immediately downstream of Gold Basin Road are an example of a high functioning condition and can be used as a comparison for what a functioning Tomichi Creek riparian and aquatic system can be. Since this area also is an example of mostly passive restoration, then the restoration of other areas of lower Tomichi Creek can mimic what has occurred here. These restored riparian areas are the best in the study reach and function to dissipate flood energy, maintain water quality and provide some degree of water storage for areas in the vicinity and downstream. Maintaining these riparian zones prevents streambank erosion and maintains healthy stream geomorphology while providing lateral connections between the associated groundwater that supports a higher groundwater table in the adjacent meadows. These sites also act in maintaining the stream continuum and supporting a healthy riverine ecology.

- Almost all of the lower Tomichi Creek from Tenderfoot Mountain to Gold Basin Road is in need of riparian revegetation and stream restoration. Most of this stretch has lost the riparian vegetation necessary to provide a functioning riparian zone and maintain the geomorphology of Tomichi Creek. Thus, Tomichi Creek is eroding and its geomorphology is changing to a wider and shallower channel.

- Developing a science based plan of restoration and land use management between the Colorado Parks and Wildlife upstream, Western State Colorado University, the City of Gunnison, the County of Gunnison, and the Gunnison-Crested Butte Regional Airport would provide a long term strategy to this issues of riparian and stream health.
- Also working with landowners to manage riparian grazing by domestic livestock so that riparian function is maintained. Recent studies have shown how important these are to healthy stream functions as well.

The highest priorities for restoration are:

- The areas upstream from Gold Basin Road along lower Tomichi Creek are in need of restoration. This should include restoration of woody vegetation including willows, thinleaf alders and norrowleaf cottonwoods, in addition to, wetland obligate rushes, sedges and grasses.
- Through a comprehensive land use management plan between the Gunnison County Regional Airport, the County of Gunnison and Western State Colorado University a corridor can extend from Gold Basin Road upstream and connects with Tomichi Creek State Wildlife Area. This would provide a complete area to protect water quality, enhance the fishery, provide wildlife habitat and provide a recreational opportunities for visitors and community members.
- Diversion structures and their associated headgates areas are found consistently throughout the study area and have impaired riparian zones and often caused downstream impacts due to diverting and concentrating stream energy. We recommend engineering and constructing diversion structures that minimize impact to the riparian zone and reduce maintenance costs while also ensuring water supply to the diversion users. The Pioneer Ditch is an example of recently redesigned and reconstructed diversion structure that is functioning well and allowing a stable streambank and channel.

Riparian areas are very complex systems that require working across many scales and land ownerships to maintain their functions; of whose importance has only begun to be partially understood within the last few decades. Ultimately, protecting riparian zones along the lower Tomichi Creek provides inexpensive water storage, maintains water quality, supports the fisheries and increases the recreation and quality of life values.

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Introduction to Riparian Ecology and Functions

Riparian zones are defined in various ways and these definitions are often context specific. In xeric (=drier) regions such as in the Gunnison River watershed, we define the riparian zone as an ecotone (=transitional zone or interface) between the aquatic area and the terrestrial area with a plant community dominated by shrubs such as willow and alder. Riparian vegetation can be classified into three types: Hydroriparian, Mesoriparian and Xeroriparian (Johnson and others, 1984). Hydroriparian systems occur on sites with hydric soils or substrates that are almost never dry (i.e. perennial or near perennial rivers or streams), Mesoriparian systems occur on sites with non-hydric soils and substrates that are seasonally dry (i.e. intermittent reaches of streams), and Xeroriparian systems occur on sites that only infrequently experience moisture in excess of precipitation (i.e. ephemeral streams)(Lichvar and others, 2004) . Along the Gunnison River, the riparian vegetation is exclusively Hydroriparian and Mesoriparian. Additionally, often in a management perspective and separate from an ecological definition, the riparian zone is defined as the width of the riparian buffer or a defined distance from a water body that is used to protect the aquatic or riparian habitat.

The riparian vegetation is often distinct from the surrounding vegetation within a watershed such as the Gunnison River and it is visibly more green and lush compared to the surrounding forests, shrublands, sage steppe and grasslands. This vegetation has a variety of functions including providing nutrients and energy in the forms of organic matter from leaf fall, woody material and other organic carbon sources along with other nutrient inputs that are released into the stream. These materials often "drive" the stream's ecology as well as providing habitat and substrate for aquatic animals such as bacteria, fungi, aquatic insects and fishes.

The riparian vegetation provides a change in microclimates along the stream such as shading the stream, altering the temperature regime, decreasing wind speed and maintaining humidity. Recent studies (Loheide and Gorelick, 2006) have further elucidated and quantified these connections in western U.S. streams by remotely measuring stream, riparian and meadow temperatures (Figure 1).

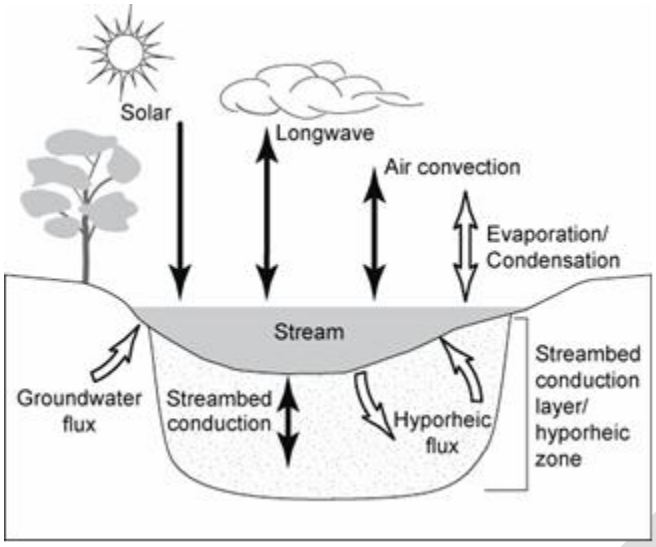


Figure 1. Heat exchange mechanisms affecting stream temperature. (from Loheide and Gorelick 2006).

All of these vary seasonally as the riparian vegetation changes. The riparian vegetation also can contribute to bank stability and help dissipate the energy of moving water to reduce erosion especially during flood events and protects humans and other organisms.

In particular, both large and small woody debris that predominately originates in riparian areas, provides geomorphic structure to the stream. The woody debris contributes to channel stability, diversifies the instream habitat, forms pools and provides habitat for a variety of species. This habitat is important to organisms seeking refuge from predators, provides a refuge from strong flows, and traps other matter providing additional habitat for a variety of organisms including fish. Woody debris provides a food source for the microbial layer growing in the stream (=biofilm) and is used for a carbon and nutrient source. The biofilm then in turn provides a food source for many small macroinvertebrates. Additionally, the wood provides habitat for other macroinvertebrates especially collector-filterers that filter particles from the passing water.

Riparian zones also function as a zone of the transmission of groundwater and upslope water from colluvium (i.e.; unconsolidated sediment at the base of slopes deposited by gravity), in the case of Tomichi Creek, into a stream, lake or wetland. In addition, exchanges from the stream to the groundwater in the riparian zone can occur thus ameliorating some of the drastic changes in flow throughout the year, season or day. In this way, riparian zones help maintain water quantity in streams (Figure 2) (Loheide and Gorelick, 2006; Loheide and Gorelick, 2006; Braatne and others, 1996). Many people and the agricultural industry along Tomichi Creek derive their water from the river and the hydrologically connected adjacent aquifer. Proper

management of the riparian zone in this region can help maintain this water supply and protect against changes in supply and provide a buffer against the variable nature of precipitation.

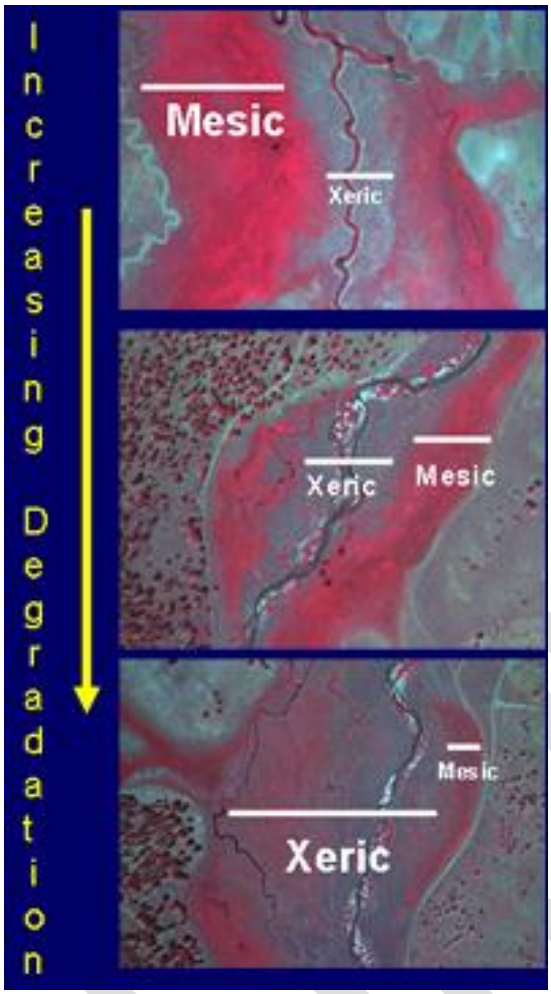


Figure 2. Illustration from Loheide and Gorelick (2005) showing the connection between degraded streams and riparian zones with increasing aridity in the valley.

These riparian zones act as filters to intercept sediment or nutrients that would enter the stream and otherwise decrease water quality. The sediment can be trapped by the riparian vegetation because the riparian zone has a lower gradient than the surrounding areas and thus reduces the velocity of water flowing overground. The vegetation also acts as a filter to slow the water velocity and to trap this sediment. The nutrients, such as phosphorus or nitrogen, or ions and metals from surrounding land use can be absorbed by the plants through the uptake of riparian groundwater. Thus, maintaining riparian vegetation is important to maintaining water quality.

Recently, the high degree to which aquatic habitats and riparian zones interact and are linked has been documented (Polis and others, 2004) and the scientific community has begun

understanding how these systems are energetically dependent on each other. The food energy and nutrient transfer between the two systems is considered a "cross ecosystem subsidy" where food energy from each system is supplied to the other. Some studies (Wipfli, 1997) have shown that fishes such as trout depend on terrestrial invertebrates from the riparian and upland zones for as much as 50% of their energy. Additionally, the flow of adult aquatic insects from the stream system feed terrestrial animals such as birds, bats and other insects.

Additionally, bears, dippers, otters and minks may also depend heavily on aquatic organisms for food sources. These systems are then linked energetically to other systems further away by the downstream movement of water. Due to this ecological connection, we can no longer think of these systems as separate systems but as one contiguous entity. These connections have important management implications on how riparian systems may affect aquatic systems, support productive fisheries and maintain rare species.

Healthy rivers and riparian zones are necessary wildlife habitat and corridors. These systems often comprise less than one percent of the landscape yet are often utilized by a disproportionately high number of wildlife species and perform a disparate number of ecological functions, some of which are described above. These zones across the landscape often function as corridors for wildlife movement and dispersal between larger areas of habitat. Thus, keeping riparian zones intact helps protect biological diversity, allows animal movement, enhances gene flow and provides habitat to animals either outright or during periods of disturbance (Fischer and others, 2000). For example, the transition zone between the riparian zone along Tomichi Creek and the adjacent sagebrush steppe is important brood rearing habitat for Gunnison sage-grouse. Other species with historical, documented or suspected occurance along the Tomichi Creek riparian zones include river otters, yellow-billed cuckoos, boreal toads, and northern leopard frogs.

Riparian buffers also are significant because they offer a potential check against the effects of increased precipitation and runoff predicted by some models of climate change (IPCC). Overhead leaf canopy mechanically slows water velocity as it falls, thereby reducing the eroding capacity of the water and the ability of it to carry other particulates. Riparian vegetation absorbs greenhouse gases and store carbon in biomass and soil that may ameliorate or buffer against climate change. Managing for these functions will also provide a degree of resiliency within the aquatic and climatic system.

Overall, riparian systems have many values including benefits to: water quality and quantity; wildlife and biological diversity; and human quality of life. They reduce pollutants and trap sediment that improves water quality and through the interactions with groundwater they store and release water that supplies flow to the stream. The riparian vegetation also reduces the energy carried by flowing water thus decreasing the impacts of floods. The riparian zones

have been considered "keystone nodes" within the landscape where a disproportional amount of wildlife and other biological diversity is dependent upon them (Naiman and others, 2005). Human quality of life is greatly improved by riparian zones because humans use them for activities such as water based recreation and non-motorized transportation plus there are numerous social benefits of recreation in riparian zones such as hiking, running, hunting, skiing, walking and nature observation. In addition, these riparian zones also act as carbon sinks within the carbon cycle that may help with climate regulation. Therefore, riparian zones are critical to healthy streams, watersheds, and ecosystems as well as providing immeasurable benefits to allow humans to lead quality lives.

Introduction to Lower Tomichi Creek and Associated Riparian Areas

The study area encompasses riparian areas that are associated with the approximately 6.0 river miles of lower Tomichi Creek that lies between the northeast end of Tenderfoot Mountain and it's confluence with the Gunnison River. This reach of Tomichi Creek runs northeast to southwest and is situated in the low gradient river bottom that exists south of the City of Gunnison and the Gunnison County Airport. The Tomichi Creek drainage within the study area is comprised primarily of ranchlands that are established on alluvial plain in the upper five miles while the lower mile of stream is bounded to the south by a steep sagebrush steppe to the south with historical irrigated pasture and the Dos Rios Golf community to the north as it approaches the confluence with the Gunnison River. Although the study area is in close proximity to the City of Gunnison and various Gunnison County and Airport developments, the land is relatively undeveloped outside of agricultural use and generally free of structures (Figure 3; Map 1).

The terrain includes: drier, sagebrush hills that descend to the stream from the south in the lower (Segment 10) and upper reaches (Segment 1) of the study area in steeper undeveloped areas (Figure 3, Map 1), the ranchlands and associated irrigated pastures that are indicative of the Tomichi Creek Valley along with various developed landscapes that are associated with the City of Gunnison, Gunnison County Airport and Gunnison County developments and subdivisions. A complex irrigation system is established throughout the study area resulting in the existence of numerous human created water features including irrigation diversion and return features as well as distribution and return ditches. This extensive irrigation system has existed for over a hundred years in some areas and historically and currently supports important agricultural and community interests in the Gunnison Valley.

Many areas along the streambank have been subject to bank erosion and collapse into the stream. These eroded streambanks appear to be the result of continuous vegetation removal, open grazing and watering of livestock along the stream corridor. The study reach includes several bridges as well as non-bridged stream crossings that appear to be established and utilized seasonally by ranching equipment and livestock. The stream corridor in the study reach has been modified by human activity of varying intensities and is predominately used for hay production and livestock grazing throughout.

The reach of stream that runs approximately 1.0 mile southwest from the County Road 38 bridge (Gold Basin Road) has been included in a Conservation Area based development and has been subject to a private effort to restore wetlands and riparian areas associated with this section of Tomichi Creek (Segment 9, Map 1). Comparisons of current aerial imagery and aerial photography of the study area from 1952 (Figure 5) reveal that the stream reach throughout Segment 9 had been channelized historically. It is purported that this channelization was historically done in an effort to alleviate ice flows that backed up towards the Gold Basin Road bridge during winter months. One portion of the approximately 1.0 mile of channelized stream has recently been diverted and returned to its original channel resulting in rapid restoration of riparian area condition along the historic channel. This Conservation Area supports large areas of newly established and restored riparian areas that are functioning in good condition with a general upward trend. The apparent success of these restoration efforts provides a prime example of the potential success and benefits of riparian restoration efforts along this stretch of Tomichi Creek. The upward trend of riparian function in Segment 9 also provides riparian reference conditions for comparisons to conditions that exist in other riparian areas associated with Tomichi Creek. The mile of stream that exists below this Conservation Area/Subdivision runs through the Dos Rios Golf course and Community and steep minimally developed land to the south of the river.

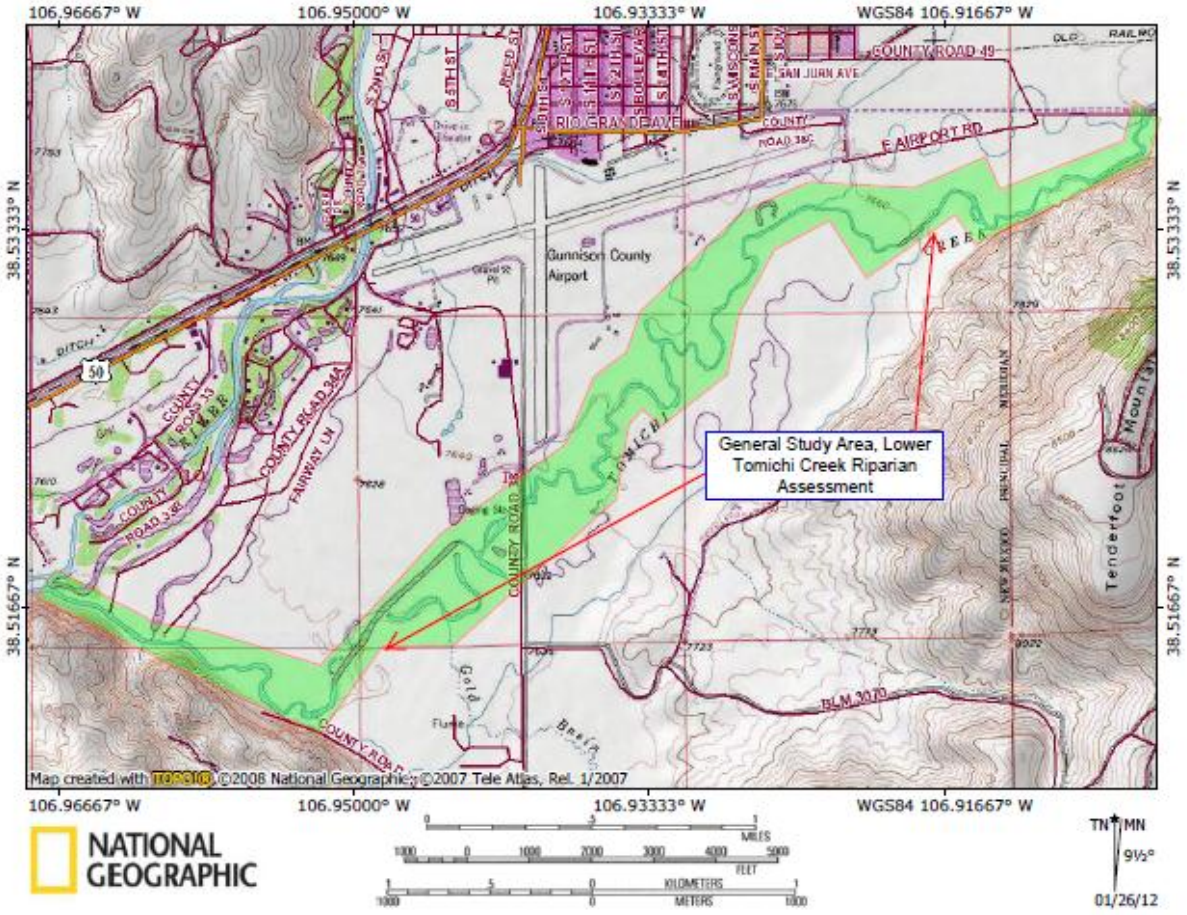


Figure 3. General Location of the Riparian Study Reach between Tenderfoot Mountain and the confluence with the Gunnison River.

Vegetation

Lower Tomichi Creek within the study reach supports a prevalence of Hydroriparian (water dependent) systems along the valley floor with some Mesoriparian and Xeroriparian systems existing along the banks where sagebrush steppes and dry upland hillslopes descend to the riverbank.

The largest tree species found in the riparian zones along Lower Tomichi Creek is the narrowleaf cottonwood (*Populous angustifolia*). Narrowleaf cottonwood is native to the Gunnison area and typically dominates the vegetative overstory strata in the lower Gunnison Valley stream corridors. Although some small stands of narrowleaf cottonwood exist along the upper reaches of the study area, these stands are limited and in most cases isolated. There is

also no evidence of recent recruitment of seedling narrowleaf cottonwoods. The limited, fragmented and nonexistence of these naturally occurring riparian areas along the upper segments of Lower Tomichi Creek (Segments 1-8, Map 1) results in the absence of very important riparian function components such as species diversity, species age class distribution, shading, streambank stability and the large woody debris that would be provided by cottonwood dominated riparian areas to the stream ecosystem. The absence of these cottonwood dominated complexes decreases the function of the existing riparian areas. The study reach that is below the Gold Basin Road bridge, however, supports large stands of narrowleaf cottonwood/alder complexes and may be an indication of historical conditions that existed along the Lower Tomichi Creek corridor. However, we are not aware of historical photos or documentation is available to confirm this at this time.

Although the continuous narrowleaf cottonwood groves that are common to lower Gunnison valleys is largely absent in the upper reaches of the study area, a shrub dominated riparian zone is present along most stream banks in the upper study reach. These areas are generally dominated by shrub species common to the Gunnison area such as thinleaf alder (*Alnus incan ssp.tenuifolia*), various willow (*Salix spp.*) species with an understory consisting of smaller shrubs and herbs. The understory is comprised of shrubs including Wood's rose (*Rosa woodsii*) as well as native herbs such as field mint (*Mentha arvense*) and false lupine (*Thermopsis rhombifolia*). The understory also includes wetland graminoids such as rushes (*Juncus spp.*) sedges (*Carex spp.*), along with a mix of pasture grasses and a variety of wetland forbs in the more saturated portions of the riparian areas. Knowledge of existing riparian plant species could help in future restoration, enhancement and management of the riparian areas along this stretch of Tomichi Creek. Figure 4 provides a list of riparian plant species that were observed during the 2011 study.

Common Name	Scientific Name
TREES	
Narrowleaf cottonwood	*Populous angustifolia*
Thin leaf alder	*Alnus incana ssp. tenuifolia*
Willow	*Salix sp.*
SHRUBS	
Geyer's willow	*Salix Geyeriana*
Sandbar willow	*Salix exigua*
Wood's rose	*Rosa woodsii*
Thin leaf alder	*Alnus incana ssp. tenuifolia*
HERBS	
Field mint	*Mentha arvense`*
False lupine	*Thermopsis rhombifolia*
Plantain	*Plantago major*
Willow herb	*Epilobium sp.*
Gray water smartweed	*Persicaria amphibia*
Nebraska sedge	*Carex nebrascensis*
Beaked sedge	*Carex utriculata*
Tufted hairgrass	*Deschampsia cespitosa*
Bluejoint reedgrass	*Calamogrostis canadensis*
Red top	*Agrostis alba*
Rush	*Juncus sp.*
Meadow foxtail	*Alopecurus pratensis*
Common mare's tail	*Hippuris vulgaris*

Figure 4. Riparian plant species observed during Tomichi Creek riparian assessment, 2011.

Tomichi Creek, in the upper reaches of the study area (Segments 1-8), is associated with a currently, highly fragmented and narrow riparian areas that are becoming more arid due to decrease in connection with the water table. These limited riparian areas provide small nodes of functional and functioning at risk riparian systems along this portion of the study reach. The lower segments of the study reach, excluding the north bank in the Dos Rios Golf Course area, are generally associated with larger, more robust riparian systems that are comprised of wider riparian areas that are providing higher quality riparian function (Map 1).

At a local scale, there are many wetland plants in the narrow riparian corridor that are not found in drier soils found upslope. As a result, and is typical of most other riparian areas, wildlife use of these areas is high which contributes to local biodiversity and high plant and animal productivity. In studies of Colorado riparian areas it has been found that 72% of all reptiles, 77% of all amphibian species, 80% of all mammals and 90% of all bird species that regularly occur in the southwestern states routinely utilize riparian areas for food, water, cover and migration routes. About 30 % of the local bird species use wetland and riparian areas exclusively. Wetland and riparian habitats also support a disproportionate number of species that are of special concern as the migrate to neotropical regions, have small continental populations, or are in decline (Brown, 1994). The riparian zones in this study are also important for essential functions such as dissipating flood energy and filtering sediment and pollution.

Soils

The Tomichi Creek riparian zone soils are comprised of alluvial deposits of silt, sand, gravel, cobbles and boulders within the alluvial river channel. When riparian areas extend outside of the alluvial channel, the vegetation is established on several soil types that are mapped and identified by the Natural Resource Conservation Service (NRCS). These soils and there characteristics are described below. Knowledge of the soils that are associated with particular riparian areas could aid in future management decisions regarding restoration, enhancement or conservation of valued riparian areas.

Soil moisture is the ultimate determinant of riparian vegetation type. Riparian vegetation occurs only where there is sufficient soil moisture. Soil moisture depends on natural stream flows and soil type. A natural hydrologic cycle including naturally high flooding flows with a slow decrease to average flows and then natural base flows determines the amount of soil moisture in riparian areas. Due to diversions and water management in the upper Tomichi Creek valley, the Tomichi Creek no longer has a natural flow regime resulting in riparian soils that may not be sufficiently flooded and saturated to support historic riparian vegetation patterns, including survival of seedlings.

Soils in natural riparian areas consist of stratified sediments of varying textures that are subject to intermittent flooding or a fluctuating water table that may reach the surface. The duration of soil wetness depends on the water levels of the adjacent water body.

The type of soil that is associated with riparian areas determines soil moisture potential that exists in that area. The physical characteristics and composition of a particular soil type affect soil functions including the absorption of water, the retention of water, run off of surface water, and the return of water back into the hydrologic system. Soils with high clay content have a greater ability to retain water, are poorly drained with high run-off of surface water while soils that are sandy or comprised of cobbles are typically well drained with high permeability and low available water capacity.

The identification and classification of soils that are supporting the riparian areas that exist along Tomichi Creek can aid in the assessment of factors including streambank stability, vegetation types that are associated with the different soils, and potential restoration efforts to impaired areas or those that are at risk.

According to the *Soil Survey of the Gunnison Area, Colorado parts of Gunnison, Hinsdale, Saguache Counties* and the National Resource Conservation Service (NRCS 2011) (Map 2), the lower Tomichi Creek channel is generally associated with two soil types between Tenderfoot Mountain and the confluence with the Gunnison River. The river channel and adjacent riparian areas lie generally within the low gradient ranchlands and pastures that exist along the stream. This pasture land is generally situated on two similar soil types identified as the Gas Creek and Irim loam. Both the Gas Creek (GaA, GaB) and Irim (IrA, IrB) loams are deep, poorly drained soils that are found on flood plains and low terraces with slopes of 0 to 5 percent that are adjacent to major streams and side drainageways. Both soils formed in recent alluvium of mixed origin. These soil types include a mat of partially decomposed organic material in the first 2-3 inches below the ground surface. These soils support grasslands and meadows comprised of timothy, redtop, tufted hairgrass, slender wheatgrass, rushes and sedges and are important for the production of native hay and pasture in the Gunnison Region. The Gas Creek and Irim Loams are subject to a fluctuating water table that is dependent on the water level in the adjacent water body. A characteristic that separates these soils from other soils that are associated with the river corridor is the fact that they are identified as *Hydric* by the NRCS. A Hydric soil is defined by the NRCS as "a soil that is formed under conditions of saturation, flooding or ponding long enough during the growing season to develop anaerobic (lacking oxygen) conditions in the upper part" (Federal Register, 1994). The concept of these soils includes soils that develop under sufficiently wet conditions to support the growth and regeneration of hydrophytic (water dependent) vegetation. The identification and location of the hydric soils may be valuable in restoration or conservation efforts to the riparian areas that

exist in the study area. Altered stream geomorphology may cause these areas to lose connection with the water table.

The lowest section of the stream runs through a soil classified as Alluvial land, occasionally flooded (Ao) soil type as Tomichi Creek enters the Gunnison River. This soil type is found on flood plains along streams and side drainageways. It consists of material recently deposited by streams. This soil type varies widely in texture and commonly has very cobbly or stony areas interspersed throughout. Due to its position adjacent to the river, this soil is subject to erosion from flooding and channel changes. Slopes are generally 0-5 percent. This alluvial soil type is suited to grazing, wildlife use and recreation. In most areas this soil supports an overstory of narrowleaf cottonwood (*Populus angustifolia*) with a shrub stratum comprised of willows with an understory of grasses, sedges and rushes. Alluvial land, occasionally flooded is a somewhat excessively drained soil with a very low available water capacity and a moderately high to very high capacity to transmit water.

The river corridor, flood plain and adjacent areas outside of the main channel are associated with several soil types of various characteristics and qualities within the study reach.

One rocky soil identified in association with the section of stream after it turns to the northwest in the lower study reach. The Stony rock land (St) is found in an area where steep rocky terrain descends directly to the banks of the river (Map 2). Stony rock land consists of exposed bedrock along with loose stones, boulders, and soils that are very shallow over bedrock. These soils are found on steep terrain (10 to 80 percent slope) and support sparse vegetation comprised of climatically adapted grasses shrubs, and forbs in the Upper Gunnison valley. This land type provides concealment and escape for wildlife.

Stream classification

The position of a stream in its landscape and watershed setting is a strong determinant of that stream's ability to develop and support significant riparian-wetland resources. Stream classification can provide a description of the stream's position in the landscape as well as the potential range of variability in bed composition, bank materials and parameters related to channel size, shape, and pattern (Prichard and others, 1998).

According to *Applied River Morphology* (Rosgen 1996), Tomichi Creek within the study reach is classified as a C4/C5 Stream Type. The C4/C5 Stream type is a slightly entrenched, meandering, gravel/sand dominated, riffle pool complex with a well-developed floodplain. The C4 stream type is found in U-shaped glacial valleys; valleys bordered by glacial and Holocene terraces; and in very broad, course alluvial typical of plains areas. The C5 stream is found in broad valleys and

plains areas with a history of riverine, lacustrine, glacial (outwash and glacio-fluvial), and eolian (wind driven) deposits. C4/C5 stream types have gentle gradients of less than 2%, display a high width depth ratio, and are slightly more sinuous with higher meander width ratios. The riffle pool sequence averages 5-7 bankfull channel widths in length. C4 stream banks are generally composed of unconsolidated, heterogeneous, non-cohesive, alluvial materials that are finer than the gravel dominated bed material. C5 streambanks are generally composed of sandy material, with streambeds exhibiting little difference in pavement and sub-pavement material composition. Consequently the C4/C5 stream type is susceptible to accelerated bank erosion. Rates of lateral adjustment are influenced and controlled by the presence and condition of riparian vegetation. Sediment supply is moderate to high, unless streambanks are in a very low erodability condition. The C4/C5 stream type is characterized by the presence of point bars and other depositional features and is very susceptible to shifts in both lateral and vertical stability caused by direct channel disturbance and changes in the flow and sediment regimes of the contributing watershed (Rosgen, 1996).

There is much evidence along this section of Tomichi Creek that a recent loss in riparian vegetation is leading to a change in geomorphology of the stream and a resulting decreased connection with the surface soils and the water table.

Riparian Assessment Methods

To preliminarily assess riparian condition and coverage of riparian areas within the study area, 2010 National Aerial Photography Program (NAPP) imagery was obtained for the lower Tomichi Creek corridor. The NAPP data archive contains high quality aerial photography that has been acquired dating back to 1980. This imagery was used for photo-interpretation in a Geographic Information System (GIS) to produce base maps as well as to manually interpret components such as land use, land cover, as well as river channel and adjacent land condition. The imagery was also used to approximate and quantify the percentage of riparian vegetative cover as well as make comparisons to previous years riparian cover through analysis of historical aerial imagery and to quantify ground cover occupied by impervious surfaces (houses, roads, etc.) to evaluate the percent of area occupied by vegetation, soil, geology and other natural cover features (Map 1).

We conducted a field survey of known and accessible riparian habitat along the study reach of Lower Tomichi Creek, Gunnison County, Colorado. The determined study reach includes Tomichi Creek from the northeast toe of Tenderfoot Mountain to the confluence with the Gunnison River. The reach has no major tributaries but is influenced by several small tributaries that are associated with of City of Gunnison storm water drainage and irrigation and drainage return features that enter Tomichi Creek within this reach.

The riparian and aquatic habitats included in this report were assessed using protocols similar to those in Chapter 5 in Barber and others (1999) (Appendix A); and Prichard and others (lotic waters 1998) (Appendix B). In using these and similar protocols, we assessed the watershed for characteristics such as: Epifaunal Substrate/Available Cover, Substrate Embeddedness, Velocity/Depth Regime, Sediment Deposition, Channel Flow Status, Channel Alteration, Bank Stability, Frequency of Riffles, Vegetative Protection, Width of Riparian Zone, Age-Diversity of Riparian Vegetation, Appropriate Riparian Soil Moisture Characteristics, Lateral and Vertical Stream Channel Stability, Dominant Riparian Vegetation Type, Watershed Contributions to Stream Degradation, Overall System Hydrology, Riparian Plant Vigor, and Presence of Known Noxious/Invasive Weeds. These individual criteria were noted on forms and functional scores were provided where applicable that range from a low of 0 to a high of 200. Additionally, to provide a separate and alternative analysis, riparian areas were scored using Proper Functioning Criteria (see Prichard an others 1998, 1999 for further definitions) into:

Proper Functioning Condition – when the riparian zone is achieving all of its potential and is performing all of the riparian functions

Functional – At Risk – when the riparian zones are impacted making them susceptible to degradation

Nonfunctional – are clearly not providing their main functions of reducing erosion, improving water quality and dissipating stream energy at high flows.

Prior to the field survey, the participants analyzed representative sites along Tomichi Creek together and calibrated ourselves to the metrics being used. When questions arose or critical designations were in question, we then consulted each other and analyzed the sites together. The Colorado Natural Heritage Program (2009) field tested Ecological Integrity Assessment protocol for Subalpine-Montane Riparian system that is similar to the ones we used and in a similar habitat. They found that the biological condition metrics used in the Ecological Integrity Assessment and most similar to the ones used in this study were “robust and reliable” indicators of riparian condition. Additionally, they found that overall “Ecological Integrity” scores proved reliable across users. This finding supports our use of calibrated observers in this study.

Based on the above criteria, the watershed segments were then analyzed, scored and characterized as to their “health” and functioning. These watershed segments were photodocumented, points were taken using Geographic Information System (GIS) software and maps were produced that illustrate the various watershed segments and their classification. Impaired areas were then prioritized for restoration based on issues such as the potential impacts of continued or future degradation, feasibility and degree of impairment.

Aerial photographs of this reach of the Gunnison River from 1952 (Figure 5), were digitized from prints obtained from the Gunnison Office of the Natural Resources Conservation Service (NRCS). Areas of riparian vegetation were analyzed with the 1952 aerial photographs to make comparisons of historical riparian vegetation and stream channel conditions. Additionally, soils maps (Map 2) were utilized to corroborate the historical distribution of riparian communities since specific soils develop under specific flood regimes.

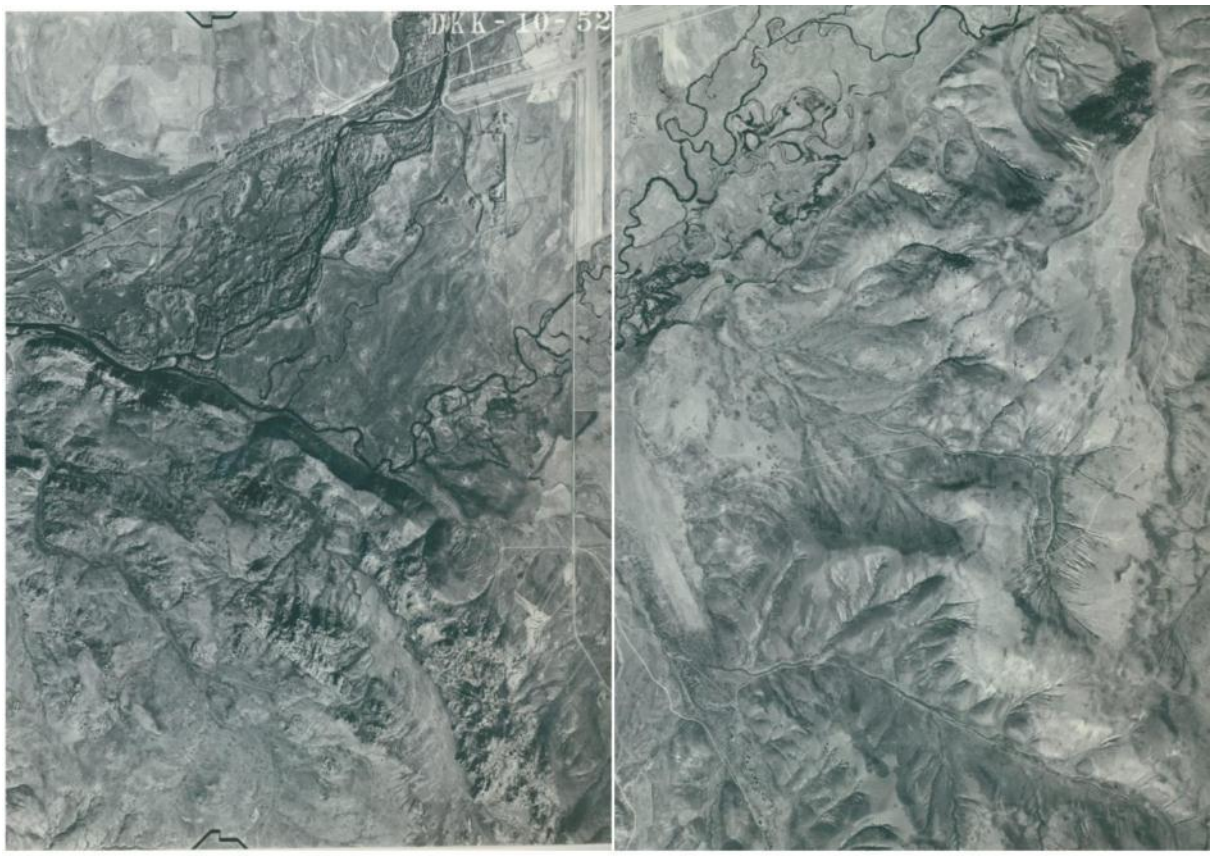


Figure 5. Aerial photographs of the lower Tomichi Creek (Gunnison County, CO) in the study reach from 1952. Photographs obtained from the Natural Resource Conservation Service, Gunnison, CO.

Additionally, the riparian Assessment Segments were classified as to the values of Water Quality, Flood Management, Microhabitat Regulation and Wildlife Habitat (Table 1).

The riparian characteristics desirable for Water Quality Protection were:

- Low slope in the riparian area (steep slopes require greater setbacks);
- High degree of vegetative cover to filter runoff;

- Vegetative cover on stream banks to prevent erosion.

The riparian characteristics desirable for Flood Management were:

- Flat areas adjacent to Lower Tomichi Creek that can store floodwaters;
- Woody vegetation in flood prone areas that slow flood flows;
- Lack of channelization and bank stabilization structures that increase water flow potentially increasing flood damage downstream.

The riparian characteristics desirable for Microclimate Regulation were:

- Riparian vegetation of sufficient height and cover to shade Lower Tomichi Creek during midday sun;
- Riparian vegetation of appropriate density to decrease evaporative winds;
- Woody riparian vegetation overhanging Lower Tomichi Creek.

The riparian characteristics desirable for Wildlife Habitat were:

- Abundant and diverse riparian vegetation;
- Minimal human disturbance.

Riparian Assessment Results

The following are riparian reaches (segments) that are associated with the lower Tomichi Creek channel and corridor within the study area. The assessment segments are defined based on existing irrigation diversion and return structures as well as similarity of conditions for analysis and are identified with alternating red and blue boundaries in the following 'segment overview' photographs and the attached Riparian Assessment Map (Map 1). These areas and their current condition are represented, numbered and color-coded on the Riparian Assessment Map and the results of our field discussion listed below follow these numbers and segments accordingly. Due to the scope and detail of the assessment, a digital Riparian Assessment Map (Map 1) is provided as a supplement to the Map 1 and is submitted with this report.

The "Assessment Segments" along Lower Tomichi Creek are numbered consecutively going downstream from the northeast toe of Tenderfoot Mountain (Segment 1) to the confluence with the Gunnison River (Segment 10). As illustrated in the legend of Map 1, unfragmented riparian areas identified as being in "Proper Functioning Condition" (PFC) are represented with green shading while isolated or fragmented/perforated yet functioning areas are represented with yellow-green shading. Streamside areas that are identified as "Functional at Risk" (FAR)

are represented with orange shading and areas that are identified as being "Non-functional" (NF) are represented with yellow linear demarcation (Map 1). The lower Tomichi Creek floodplain is represented by the sky-blue line that generally follows the river course and valley topography. The overview and maps also include the location of the irrigation diversion structures identified with orange circles as well as the location of irrigation return features that are identified as smaller purple circles (Map 1). In-stream crossings are denoted with two adjacent gray lines. A summary of all areas including the total area, stream length of reduced functioning, and riparian values are contained in Table 1. Habitat Assessment scores for each segment are provided in Table 3. The data forms utilized in habitat and riparian assessments for each segment are provided in Appendix A and B. Appendix C contains the field completed forms and Appendix D contains the aerial photographs that were used in the field to develop this assessment.

General Conditions

We found that the lower Tomichi Creek riparian zones vary in their Functioning Condition rating with the exception of the riparian zones that exist in Segment 9 which scores high. Many of the riparian segments upstream of Gold Basin were assessed as Functioning at Risk or Nonfunctional with very small and obscure nodes assessed as being in Proper Functioning Condition.

The general condition of functioning riparian zones appears to be experiencing a downward trend as the study reach travels from Segment 1 downstream to the Gold Basin Road bridge and Segment 8. A lack of diverse and robust riparian vegetation that distinguishes healthy riparian zones appears to be causing the general degradation of stream conditions in the segments above Gold Basin Road. The compromised riparian conditions appear to result in a lack of equilibrium in stream hydrology, a widening of the streambed and an increase of erosion and sediments that are contributed from upstream terrain and tributaries. Extensive loss of a stable streambank and erosion of existing banks is nearly ubiquitous throughout the upper reaches of the study area.

Riparian areas appear to be in an upward trend with a transition to larger, robust and diverse riparian zones in Segment 9. This documented upward trend is associated with the passive riparian and wetland restoration that has occurred in this reach. Riparian zones in Segment 10 may have reached potential due to confined conditions and development along the north bank.

Most of the "Functional at Risk" areas were generally found to be experiencing a downward trend with streambank conditions in degredation due to a lack of riparian vegetation and

resulting bank erosion and collapse. Numerous areas along the streambank have been subject to various agricultural impacts resulting in compromised riparian conditions existing along large reaches of streambank in the study area. Areas of impaired riparian zones are described in their individual sections below. Where lower Tomichi Creek riparian zones are in Proper Functioning Condition the areas generally support hydro-riparian vegetation of diverse composition and age class; have functional hydrology; and appropriate stream morphology. These areas include an overstory dominated by narrowleaf cottonwood (*Populous angustifolia*) and thin leaf alder (*Alnus tenuifolia*), with a shrub stratum that is dominated by willow (*Salix spp.*). The understory to this cottonwood/alder/willow complex is comprised of both upland and wetland grass species along with rushes (*Juncus spp.*) and sedges (*Carex spp.*) and a variety of wetland forbs in the more saturated portions of the riparian areas.

Also, the floodplain that is associated with the channel is marked by numerous abandoned stream meanders that often support wetland conditions with a dominance of wetland vegetation and the presence of a shallow depth to groundwater and wetland soils.

The Gunnison area received near record snowfall in the spring of 2011 resulting in late and subsequently heavy spring run-off flows in many of the local rivers and streams. According to the USGS stream gauging station 0911900 Tomichi Creek at Gunnison, CO, located at the Gold Basin Road bridge, stream flow during the investigation experienced a seasonal decrease from approximately 142 cfs at the beginning of the study period (16-Sept-2011) to approximately 70 cfs at the end of the study period October, 2011. Bankfull conditions existed near the 142 cfs streamflow while a noticeable exposure of substrate along the bank was observed during the lower stream flows (70 cfs) that occurred at the end of the study period (Figure 6).

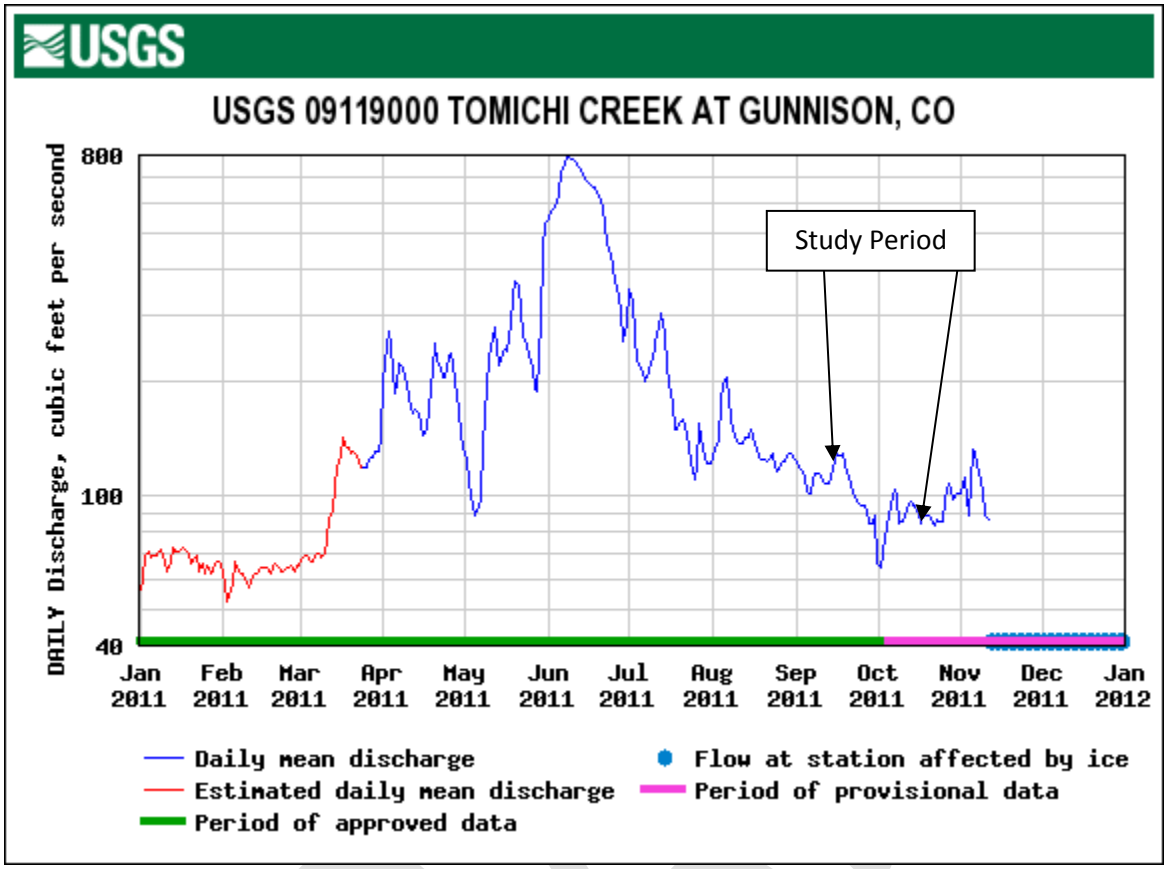


Figure 6. Recorded streamflow for Tomichi Creek during 2011 study period.

The following detailed descriptions and overview photos are provided to aid in locating, monitoring, and potential restoration of riparian segments within the study area.

All of the site photographs were taken in September and October of 2011.

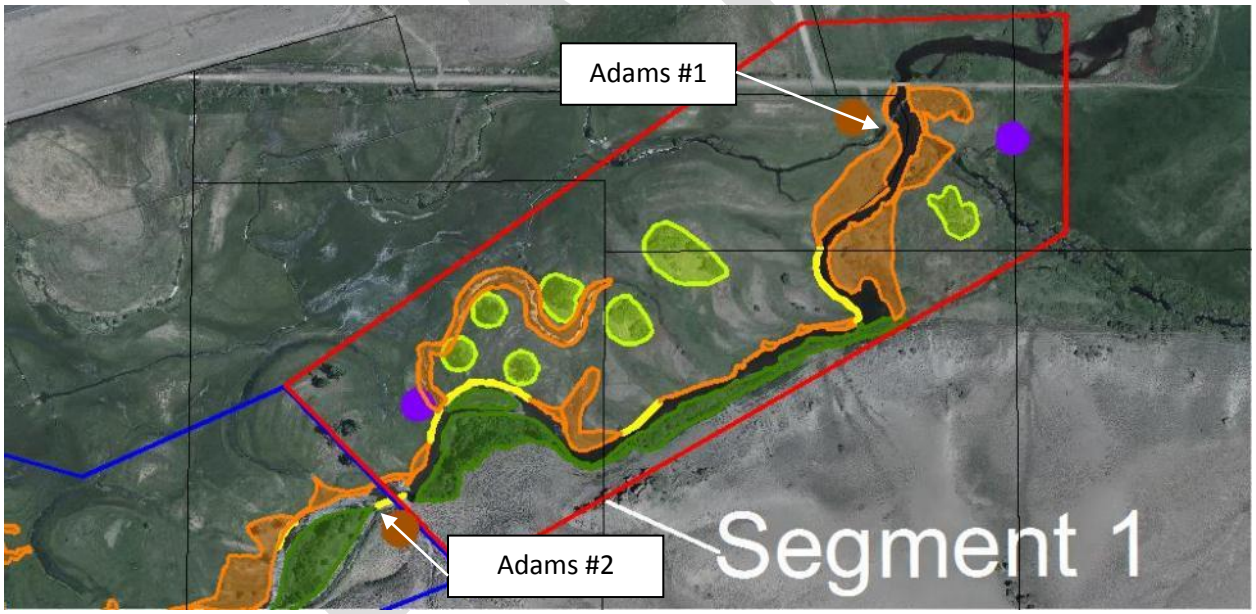
Gunnison River Riparian Segments

(Map 1)

Assessment Segment 1 (2650 Linear Feet (LF), 0.50 mi.): The northern boundary to this segment is the bridge located above Adams irrigation diversion # 1. The segment extends downstream to just above the Adams irrigation diversion #2. The habitat assessment score for Segment 1 is 146/200 (Table 3). Reduction in the habitat assessment score is due to some channel alteration near the bridge, mild substrate embeddedness as well as markedly low scores along the north bank in association with criteria such as bank instability, lack of vegetative cover and narrow riparian zone width (Appendix C). Approximately 40 percent of Segment 1 riparian areas are considered Functional- At Risk (FAR) with a downward trend while

60 percent of riparian areas are ranked as being in Proper Functioning Condition (PFC) although several riparian areas are isolated and disconnected from the marginal riparian area that exists along the stream course. The segment also includes approximately 840 linear feet of eroded streambank that is considered Nonfunctional (NF) due to a lack of little to no functional riparian vegetation (Table 1).

Segment 1 encompasses approximately 2650 linear feet of lower Tomichi Creek as it extends along the toe of Tenderfoot Mountain from a bridge that crosses the stream at the northern boundary of the study area to end just upstream of the Adams #2 irrigation diversion. This segment includes the Adams #1 irrigation diversion to the north and two irrigation drainage features that enter the stream from the south across from the Adams #1 diversion and the north near the southern boundary of segment. The northern streambank is adjacent to pasture land while the southern bank is bounded by a steep rocky hillslope that descends to the edge of the stream (Photograph 1). The steep bank located to the south of the channel naturally confines riparian vegetation with little extension of riparian areas beyond the edges of the southern streambank in this segment.



Overview 1. Aerial overview of Segment 1 (2010 NAPP imagery, Gunnison County).

The entire segment is situated on the Gas Creek sandy loam, 0 to 1 percent slopes. This poorly drained soil typically has a high moisture content and is conducive to the support of riparian and wetland vegetation when the proper conditions exist (Map 2).

The north bank in this segment is comprised of riparian area that is largely Functioning-At Risk with three sections of collapsed and eroded streambank that is in a nonfunctional condition due to vegetation removal (Photograph 2).

Photograph 1. Photograph taken September 16, 2011 looking downstream near the northern boundary of Segment 1. Note the absence of riparian vegetation along the northern bank (right) and resulting collapse of the eroded streambank into the stream channel. The more robust and intact riparian zone that exists along the south bank can be seen in along the toe of Tenderfoot Mountain in the background of photograph (Tomichi Creek Riparian Assessment, Gunnison County, CO)

The north bank is subject to active grazing and continuous entrance to the stream channel by domestic livestock. The compromised function along the north bank is the result of narrow, fragmented riparian zones that lacks varying age class and higher species diversity that is characteristic of healthy riparian zones. The lack of diversity appears to be due to the removal and hedging of vegetation by historical practices and domestic ungulates (Photographs 2 and 3).

The loss of this vegetation results in heavily eroded and failing streambanks. The segment includes several isolated cottonwood stands that appear to be remnants of riparian area that was historically associated with this stream segment (Overview 1). An abandoned stream meander that is located mid segment is identified as FAR riparian because the channel appears to be saturated and supports wetland/riparian characteristics (Overview 1). Although the feature is not part of the main channel riparian system, this swale is identified as part of the

riparian complex because the vegetation that grows within this swale feature is providing some riparian function to the main stream. With the exception of two "at risk" areas located at the upstream end of the segment, the geologically confined riparian areas along the south bank of Segment 1 are generally in Proper Functioning Condition. This southern bankconstitutes the entire 60% of riparian area in this stream segment that is identified as being in Proper Functioning Condition. The south bank in Segment 1 does not appear to be subject to active grazing as the terrain does not provide suitable grazing area for livestock and wildlife. The establishment of mature and immature narrowleaf cottonwood, alder and willow with an understory of riparian forbs and grasses provides adequate protection of the streambank, quality wildlife habitat, and an ongoing supply of large woody material along most of the southern streambank in this segment.

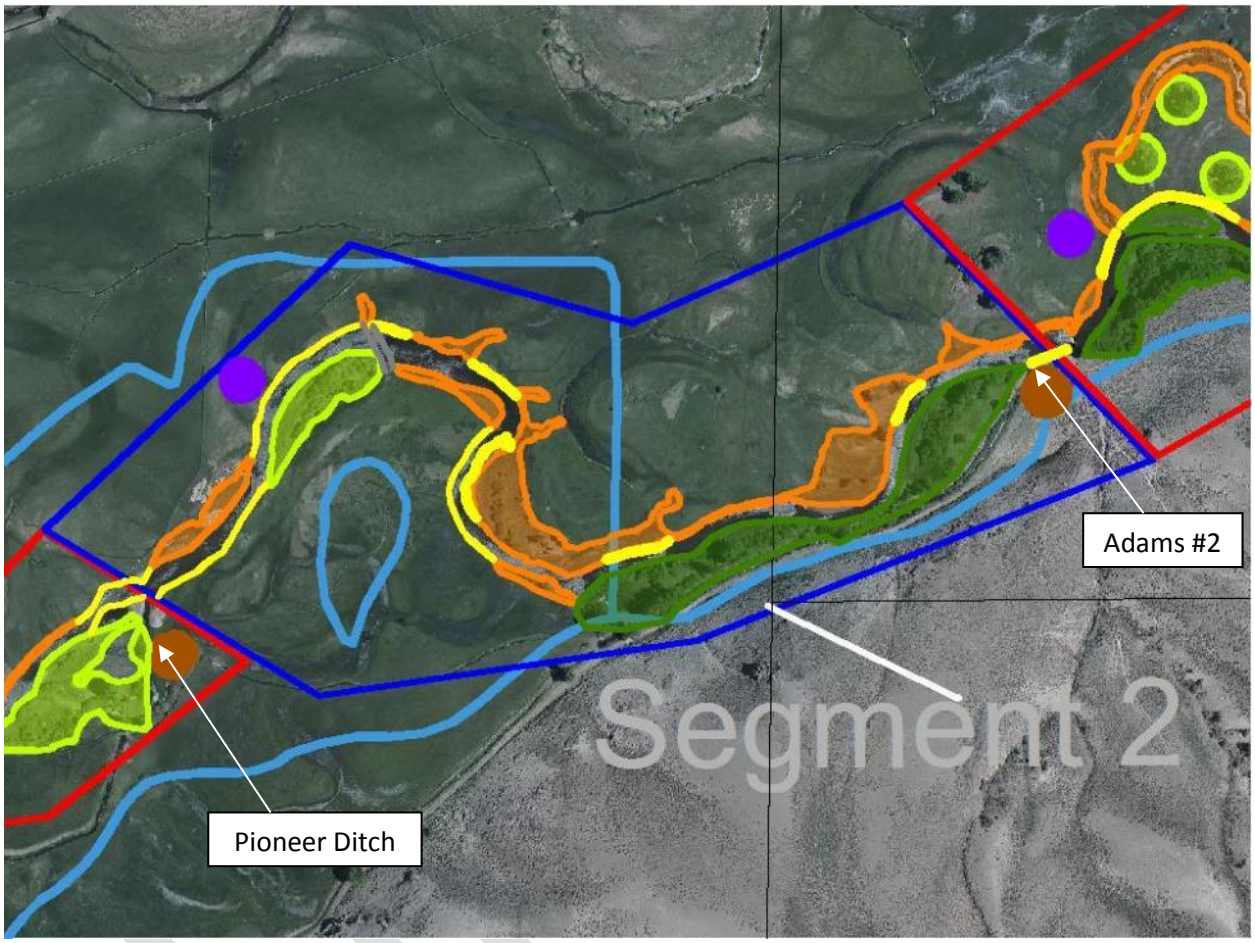
Due to terrain that does not support grazing areas, the south bank of Segment 1 generally supports a diverse composition and age class distribution of riparian vegetation that characterize healthy riparian zones. The north bank is exposed to grazing pressure that is too high in duration and intensity thus is only able to support riparian zones that are largely Functioning at Risk. The north bank includes three Nonfunctional areas along the streambank that are reducing the ecological functions and aesthetic qualities of riparian habitats in this area.

Currently, Segment 1 riparian functions such as Water Quality Protection, Flood Management and Wildlife Habitat are of medium value while Micro Climate Regulation is of low value. Potential for all functions within Segment 1 is high based on possible improvements in land management as well as enhancement and restoration of existing riparian zones (Table 2).

Assessment Segment 2 (3062 LF, 0.58 mi.): Adams #2 irrigation diversion downstream to just above the Pioneer irrigation diversion. The habitat assessment score for Segment 2 is 123/200 (Table 3). Reduction in the habitat assessment score is due to a; decrease in the velocity/depth regime, substrate embeddedness, greater sediment deposition and, similar to Segment 1, low scores, especially along the right bank, in association with bank stability, vegetative cover and riparian zone width (Appendix C). Approximately 48 percent of Segment 2 riparian areas are considered Functional at Risk with a downward trend while 51 percent of riparian areas are ranked as being in Proper Functioning Condition. The segment includes over 2000 linear feet of eroded streambank that is considered Nonfunctional due to a lack of any functional riparian vegetation and failing streambank.

As Segment 2 extends from the Adams irrigation diversion #2 (Photograph 4) downstream to above the Pioneer irrigation diversion, the stream channel begins to travel north away from the toe of Tenderfoot mountain. As the stream channel courses away from the toe of slope,

conditions along the south bank transition from the somewhat protected riparian areas along the base of the mountain to more grazing exposure and the pasture that is associated with the north bank. Segment 2 also includes one irrigation return that enters the stream from the north near the eastern segment boundary (Overview 2).



Overview 2. Aerial overview of Segment 2 (2010 NAPP imagery of Gunnison County).

The departure from the toe of Tenderfoot Mountain also marks a transition from the Gas Creek sandy loam, 0 to 1 percent to the Irim loam, 0 to 1 percent soil type. These hydric soils are of a similar composition and will support the growth of wetland and riparian vegetation when conditions allow.

Similar to Segment 1, the north bank in Segment 2 is comprised of riparian area that is largely Functioning at Risk and includes five separate sections, totaling approximately 2000 linear feet, of collapsed and eroded streambank that is in a Nonfunctional condition due to vegetation removal (Photograph 3, Table 1). Like Segment 1, the north bank is subject to active grazing and continuous entrance to the stream channel by livestock. The compromised function along the north bank is the result of narrow, fragmented riparian zones that lack riparian vegetation

with varying age class and species diversity. The lack of diversity appears to be due to the removal and hedging of vegetation by livestock and wildlife. The loss of vegetative diversity and coverage results in heavily eroded and failing streambank conditions (Photograph 7). The south bank in Segment 2 includes the Adams #2 irrigation diversion and a small stretch of streambank that is identified as Nonfunctional due to a lack of vegetation in association with the Adams #2 diversion structure (Photograph 4).

Photograph 4

Photograph 5

The above Photographs were taken September 16, 2011 looking southeast towards the Adams #2 diversion structure and southwest from just below the Adams # 2 diversion structure, respectively. Note the absence of riparian vegetation along the northern bank (left Photograph 4, right Photograph 5) and the presence of more robust properly functioning riparian vegetation along the southern bank at this location (left, Photograph 5) (Tomichi Creek Riparian Assessment, Gunnison County, CO).

Within the upper reaches of Segment 2, the south bank supports riparian zone similar to that of Segment 1 with the majority of properly functioning riparian area existing along the somewhat protected and confined toe of Tenderfoot Mountain (Photograph 5). As the channel moves into the pasture to the north of Tenderfoot Mountain, the south bank enters surroundings similar to those of the north bank. At this point the stream is subject to continuous grazing and livestock watering along both banks resulting in eroded conditions along the north and south banks (Photograph 6). Excluding a small, isolated riparian complex that is in Proper Functioning Condition, the riparian area along both the north and south banks is generally

Photograph 6

compromised to Functioning at Risk with extensive damage to streambanks in the eastern portion of Segment 2 (Overview 2).


Photograph 7

The compromised streambank along both banks also marks the point at which the stream begins to show signs of widening as a result of sloughing banks (Photograph 7). The consequence of this loss of functional streambank and widening of the channel is a significant decrease of in-stream habitat and stream shading, further impacting ecological conditions of Tomichi Creek in this area. One in-stream crossing within Segment 2 is located where the stream channel meanders from a northwest direction to a southwest course. Not only does this activity impact bank stability, vehicular in-stream crossings cause disturbance to the stream substrate and in-stream habitat (Overview 2, Photograph 8) although this impact is limited.


Photograph 8

Although Segment 2 supports two riparian areas identified as being in Proper Functioning Condition, these disconnected areas comprise only 50% of total riparian area for this segment. These small nodes include establishment of mature and immature narrowleaf cottonwood, alder and willow with an understory of riparian forbs and grasses. This vegetation helps to provide adequate protection of the streambank, quality wildlife habitat, and an ongoing supply of large woody material along associated portions of the southern streambank in this segment. The decrease in functioning riparian and increased presence of Functional at Risk and Nonfunctional riparian along with extensive stretches of failed streambank indicate the downward trend in riparian function as the stream courses to the west.

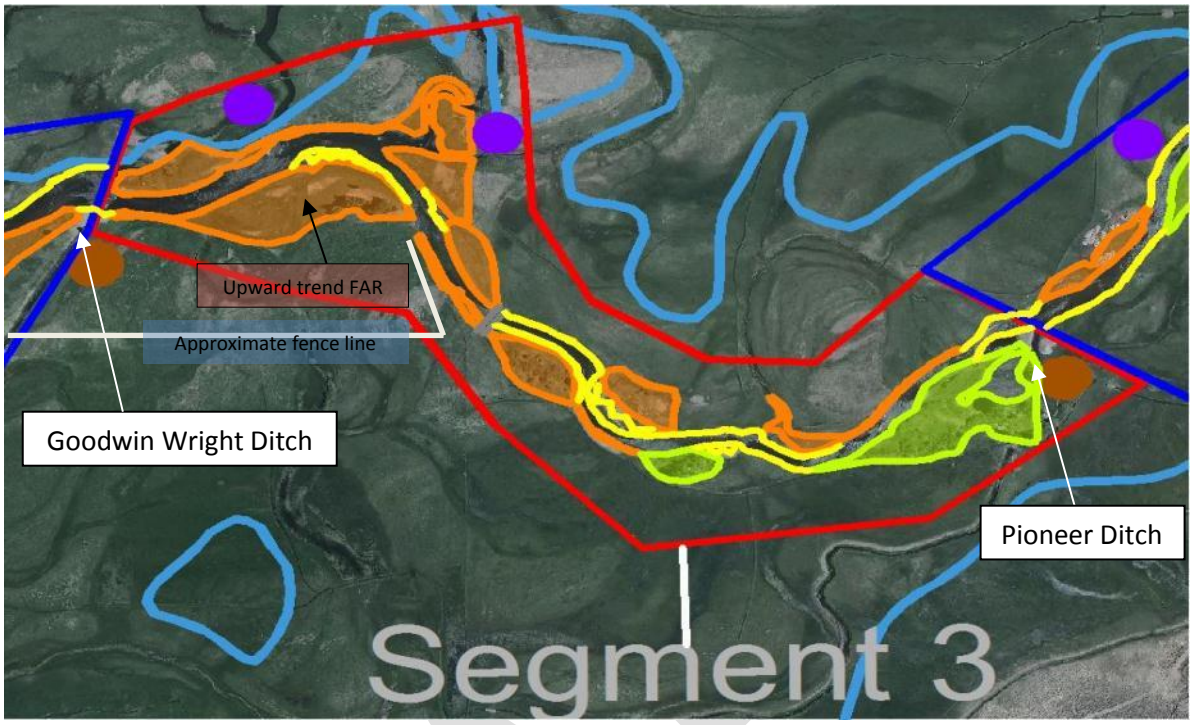
Current conditions in Segment 2 support riparian functions such as Water Quality Protection, Flood Management and Wildlife Habitat are of medium value while Micro Climate Regulation is of low value based on a deficiency of properly functioning riparian zones. Potential for all

functions within Segment 1 is high based on possible improvements in land management as well as enhancement and restoration of existing riparian zones (Table 2).

Assessment Segments 3 through 8 (14322 LF, 2.7 mi.): Segment 3 through 8 boundaries are established based on existing irrigation diversion and irrigation return features as well as Gold Basin Road. Segments 3 through 8 extend west from the just above the Pioneer irrigation diversion to the Gold Basin Road bridge (Map 1). Habitat Assessment Scores reveal the continuation of a downward trend in habitat quality and riparian function with downstream travel from the western boundary of Segment 2 to the Gold Basin Road bridge. Combined assessment scores for Segments 3 through 8 are all similar with an average score of about 112/200 (Table 3). The diminished scores from upstream segments are due to generally suboptimal to poor conditions for all stream habitat criteria but especially the parameters of Bank Stability, Vegetative Protection, and Riparian Vegetative Width (Appendix C). As has been common to this reach or lower Tomichi Creek, stream habitat quality is decreased largely due to the deficiency and absence of riparian vegetation and loss of quality riparian zones throughout the scope of these segments. The functional condition assessment of riparian areas throughout the Segments 3 through 8 is Functional at Risk with a downward trend (Table 1). Collectively, riparian areas determined as being in Proper Functioning Condition average approximately 25% with these areas determined as being fragmented and isolated. Riparian areas determined to be Functioning at Risk average 75%. These segments include a total of nearly a mile (5,140 linear feet) of Nonfunctional riparian zones associated with obvious bank sloughing and subsequent creek becoming wider and shallower.

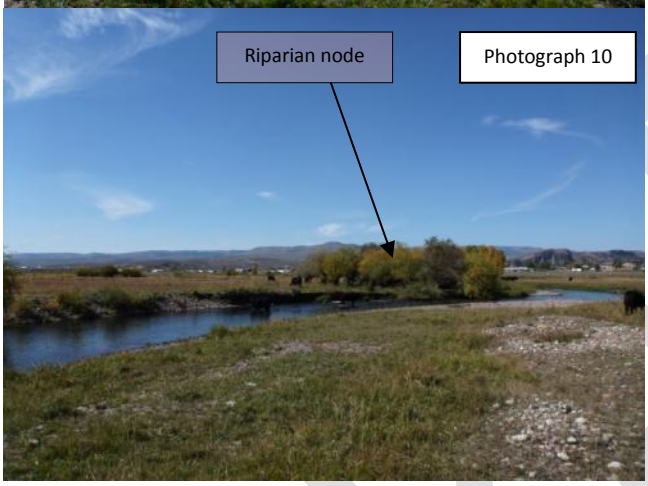
Segment 3 (2587 LF, 0.50mi)

Segment 3 extends from just above the Pioneer irrigation diversion downstream to the western boundary located upstream of the Goodwin Wright irrigation diversion (Overview 3). The segment is situated entirely on the Irim loam, 0 to 1 percent slope (Map 2).

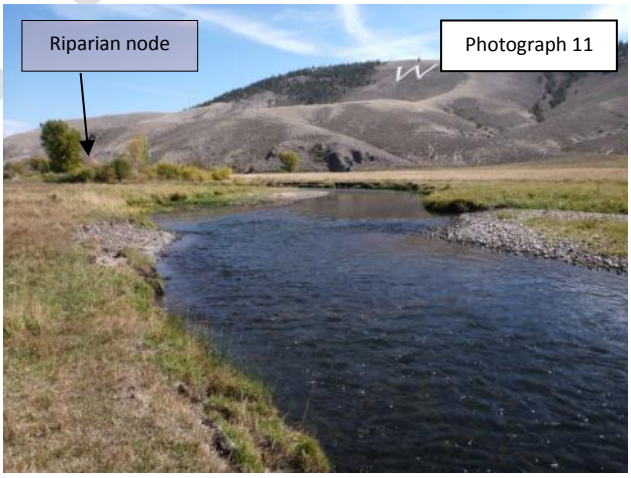


Overview 3. Aerial overview of Segment 3 (2010 NAPP imagery of Gunnison County).

The upstream boundary to Segment 3 is marked by the recent redesign and construction of the Pioneer irrigation diversion structure which supplies irrigation waters to much of the hay pasture that exists to the south of Tomichi Creek (Photograph 9). This diversion structure has been revamped in an effort to provide a more permanent diversion that does not require the maintenance that older, non-permanent structures of similar function necessitate. The north and south bank of the stream at this location are devoid of riparian vegetation in association with the newly constructed diversion leaving the banks in a Nonfunctional condition at the time of this assessment (Overview 3) however, this structure provides greater stability for long term recovery of riparian vegetation. Segment 3 also includes two drainage return features in the western portion. These features appear to collect and contribute drainage waters that originate north of the stream.



Segment 3 includes two small riparian areas that are identified as being fragmented Proper Functionin Condtion along the south bank in the eastern portion of the segment (Overview 3). These small areas provide an important node of functioning riparian zone that could be expanded upon with enhancement, restoration and modified land management along the creek (Photographs 10 and 11). Excluding these two locations, Segment 3 riparian condition continues to degrade with most riparian zones in a Functional at Risk status with extensive sloughing streambank in a Nonfunctional condition.



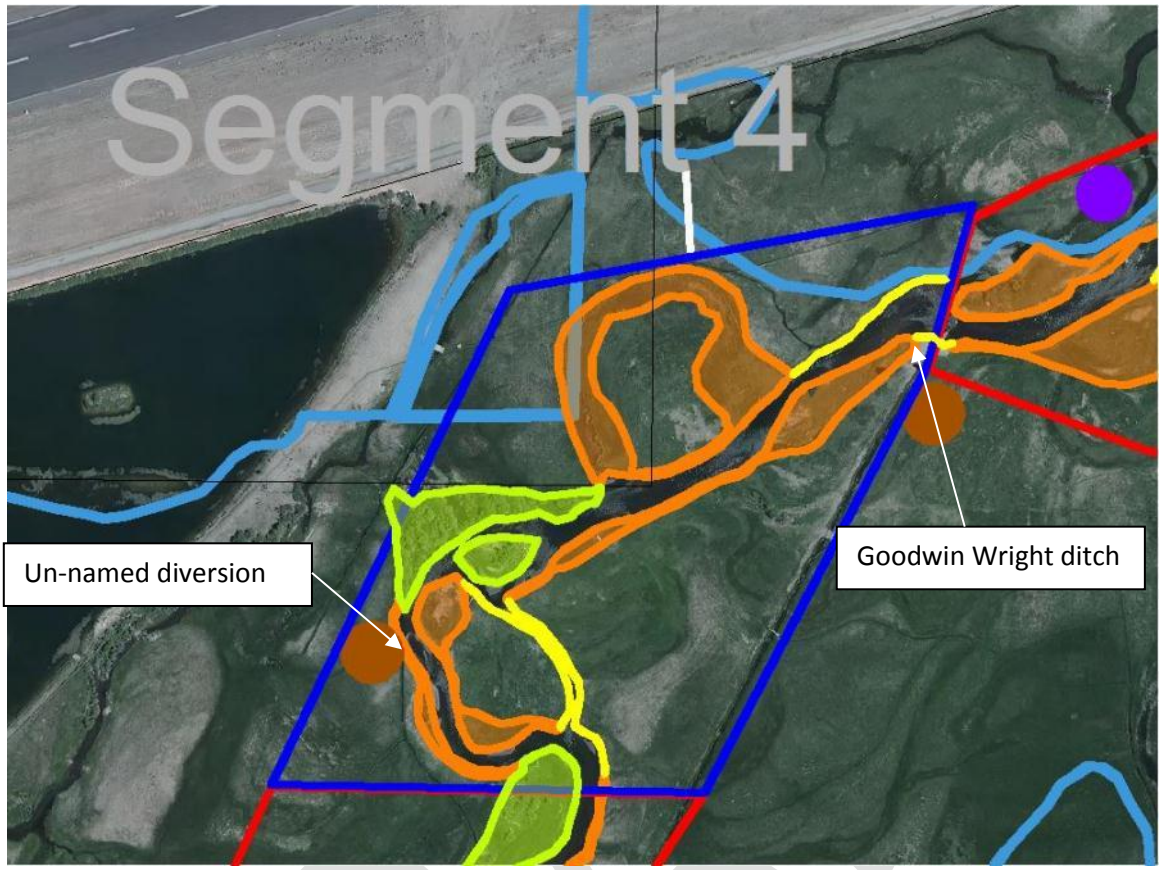
The stream continues to widen and riparian vegetation is limited to sedges and grasses and in some cases nonexistent along much of the stream channel. The lack of shade coupled with the continued widening of the stream channel result in more exposure to the sun and subsequent daily rise in water temperature. This lack of micro climate regulation can cause drastic diurnal variations in water temperature which can adversely affect many of the aquatic organisms that inhabit Tomichi Creek. These daily fluctuations are sometimes outside of an organism's ability to cope thus limiting success and often causing a shift in dominant species of plants, animals and insects that inhabit Tomichi Creek to more tolerant species. The shift to more tolerant dominant species can result in a loss of diversity that causes an imbalance to the stream ecology that brings about poor stream health. This can be reflected in a decline in measures of water quality.

An aspect of land management becomes apparent in association with some of the south bank riparian areas in Segment 3. In these areas, current fencing alignment and land use limits livestock from the continual grazing and watering that is common to lower Tomichi Creek (Overview 3). Although a lack of age class and species diversity still exists, the protection of riparian vegetation has resulted in an apparent state of recovery with more robust growth of existing plant species. This apparent recovery results in a transition from the documented downward trend of riparian condition becoming that of an upward trend as continued recovery in these areas will help in the revegetation of impacted point bars and streambanks that are associated with the increased vegetative cover.

Segment 3 currently supports the riparian functions of Water Quality Protection, Flood Management, Wildlife Habitat and Micro Climate Regulation of low value based on a deficiency of properly functioning riparian zones. Potential for all functions within Segment 1 is high based on possible improvements in land management as well as enhancement and restoration of existing riparian zones (Table 2).

Segment 4 (LF, 0.61 mi)

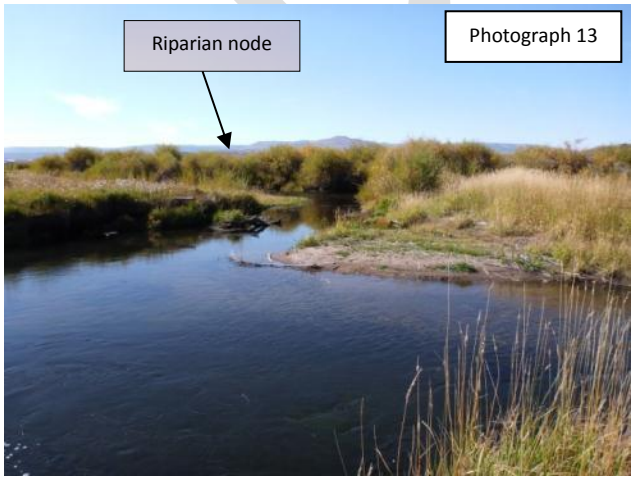
The upstream boundary to these segments begins just above the Goodwin Wright irrigation diversion with a downstream boundary established below the outlet of a recently formed braid to the main channel PFC riparian is limited to the north bank along a bend and an adjacent island that exists in the middle of the segment. The remainder of riparian area is classified as FAR or Nonfunctional based on a consistent lack of adequate vegetative cover (Overview 4).



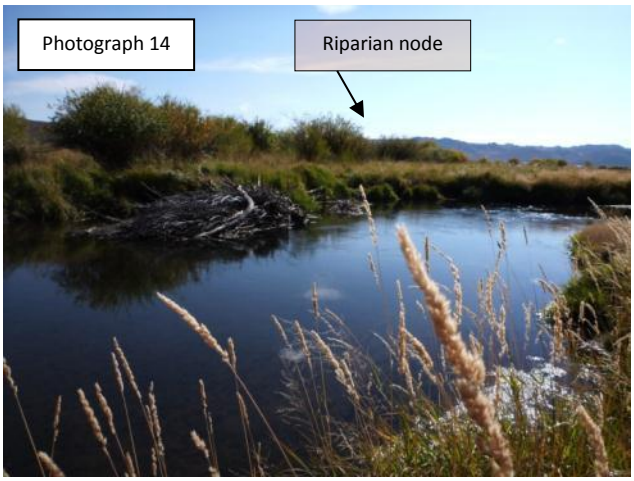
Overview 4. Aerial overview of Segment 4 (2010 NAPP imagery of Gunnison County).

Segment 4 marks a transition from the Irim loam, 0 to 1 percent slope to the Gas Creek sandy loam, 0 to 1 percent slope soil type (Map 2).

Segment 4 includes the Goodwin Wright irrigation diversion (Photograph 12) at the upstream limits of the segment and an un-named diversion near the downstream segment boundary.



Although this segment generally supports compromised riparian zone, it includes a minute riparian node comprised of an island and adjacent Proper Functioning Condition riparian area along the north bank. The



riparian vegetation in these locations is somewhat protected from intrusion of livestock by the stream as well as a property boundary to the north. The areas that are protected from grazing include more robust and diverse vegetation that is providing many of the functions inherent to riparian areas and contributing vital components of stream health such as wildlife habitat, stream shading and the woody debris seen in Photographs 13 and 14.

A recently created side channel exists just below the island in Segment 4 (Photograph 15). This naturally created channel is likely the result of heavy flows eroding the unprotected bank. As the bank began to fail, the stream vertically cut through the adjacent land to form a newly incised braid or stream channel that runs to the east of the current main channel to join the main channel to the south.

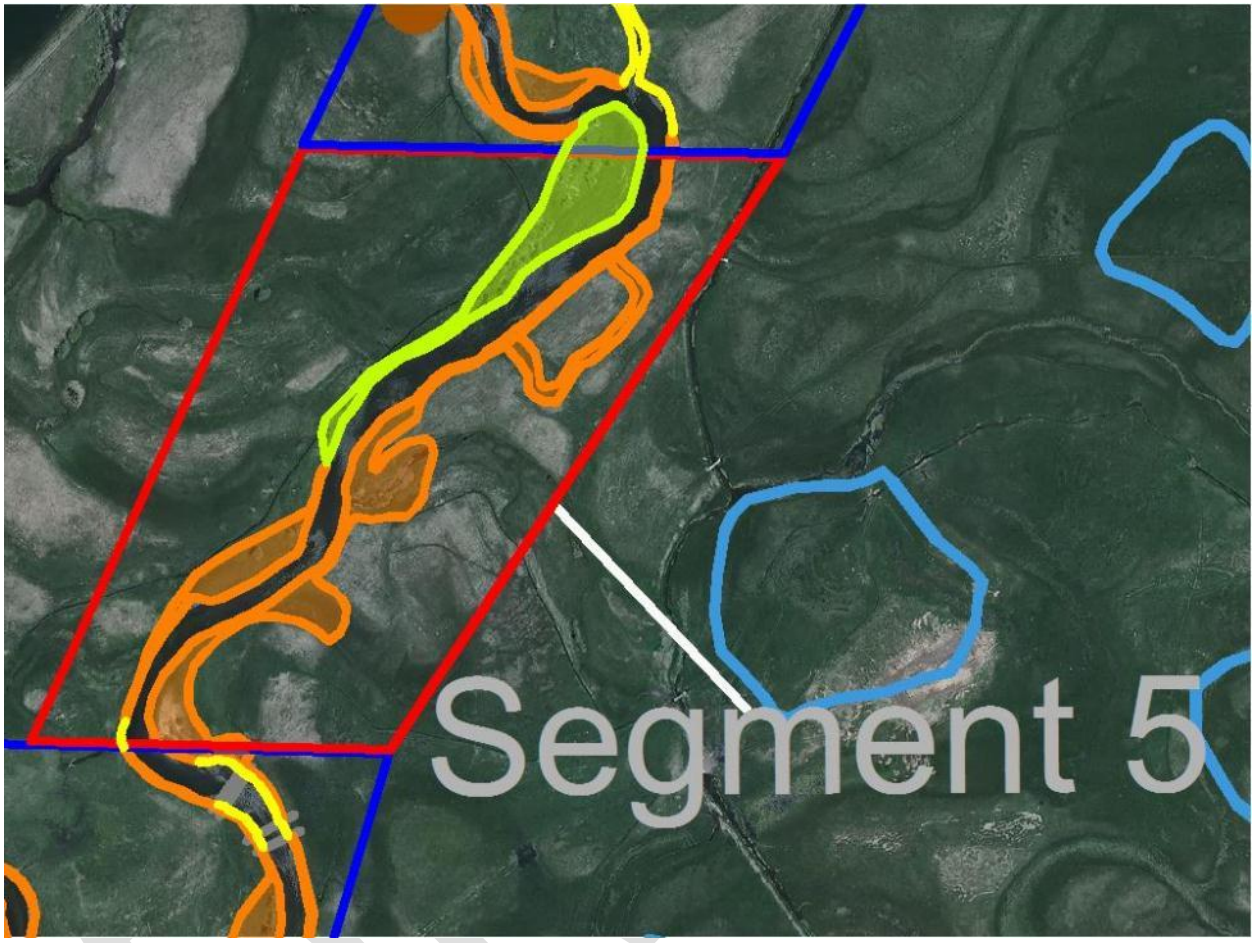
This type of circumstance indicates an imbalance to stream and ecosystem characteristics resulting namely from the lack of vegetation that is typical of this portion of the Tomichi Creek corridor. The new channel, established within the adjacent hay pasture provides very little in the way in riparian vegetation cover leaving the banks without adequate protection to dissipate high stream flow energy resulting in the inevitable erosion of additional stream bank as the channel attempts to achieve hydrologic balance in the landscape of this channel. Photograph 16 is taken looking at the beginning of the newly formed channel. This sloughing of the streambank and re-channelization will likely continue through various seasonal flow events until the stream attains a balance. These conditions will likely continue to degrade until hydrologic balance is obtained or restoration efforts to stabilize the streambank including the establishment of riparian vegetation along the stream.

Similar to Segment 1, an abandoned stream meander that is located mid segment is identified as Functional at Risk riparian because the channel appears to be saturated and supports wetland/riparian characteristics (Overview 4). Although the feature is not part of the main channel riparian system, this swale is identified as part of the riparian complex as the vegetation that grows within this swale feature is providing some riparian function while contributing riparian attributes to the stream when water and plant material from this feature are discharged and incorporated into the main stream. This swale may also aid in some flood abatement during high flow events and provide valuable wildlife habitat throughout the year.

Segment 4 riparian functions of Water Quality Protection, Flood Management, Wildlife Habitat and Micro Climate Regulation are of low value based on a deficiency of properly functioning riparian zones. Like the preceding segments, potential for all functions within Segment 4 is high based on possible improvements in land management as well as enhancement and restoration of existing riparian zones (Table 2).

Segment 5 (1407 LF, 0.27 mi)

Segment 5 begins just below the outlet of the newly created channel in Segment 4 to extend southwest to an abandoned diversion structure that is located on the west bank (Overview 5).



Overview 5. Aerial overview of Segment 5 (2010 NAPP imagery of Gunnison County).

Segment 5 includes a larger riparian node classified as fragmented PFC along the western bank. Excluding a short reach of NF streambank at the downstream boundary, the rest of the riparian zones are classified as FAR, however, these areas appear to be stable or experiencing a slight upward trend. Segment 5 represents a slight return to more balanced stream conditions than those experienced in Segments 3 and 4.

Photograph 17

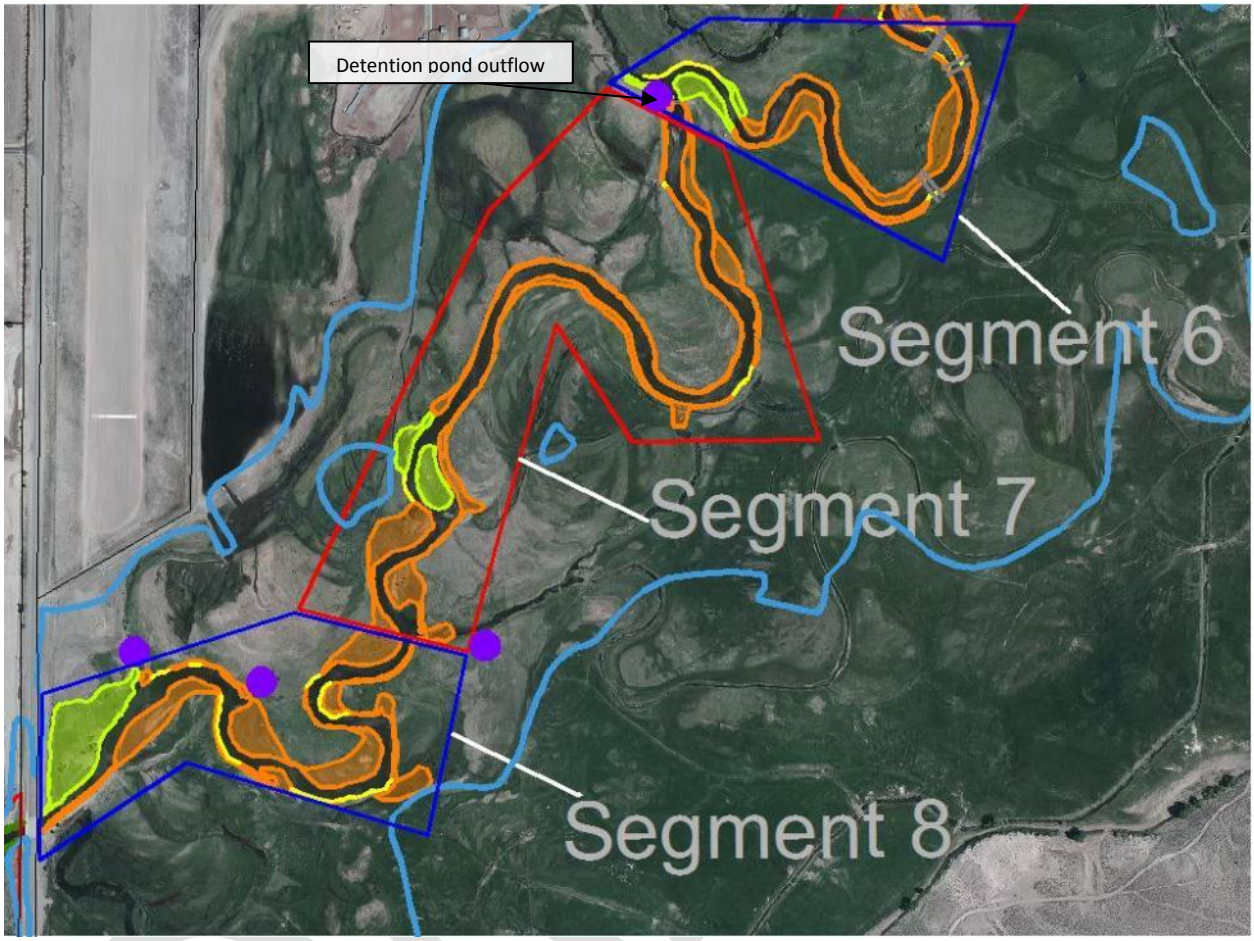
Although much of the riparian zone along both banks lacks the presence of diverse vegetation of varying age class, it is relatively intact and un-fragmented thus providing better riparian function to the stream ecosystem. The stream in Segment 5 continues to show signs of historic widening. A decrease in stream depth and increase in distance between riffles (riffle to run ratio) indicates this continued trend in channel morphology and potential stream degredation (Photograph 17). Like the segments upstream, these conditions will contribute to less stable water temperatures and less stable chemical and physical steam characteristics.

This and the segments downstream appear to be under the influence of different land use related to a shift to hay production rather than open grazing. A transition to hay production from the grazing that occurs upstream has reduced grazing and livestock impacts along the stream corridor. Limited grazing and livestock access to watering in the stream channel has allowed the vegetation along the streambanks to persist in a Functional at Risk state without the sloughing NonFunctional streambanks typical of upstream segments. Although the streambanks support limited establishment of riparian and wetland plant species, the pasture grasses that exist along the banks are robust and grow right to the stream edge. Even though these banks do not have the compliment of diverse species and age class distribution of riparian vegetation, the vegetative cover provided by the grasses appears to be contributing to improved bank stability in this segment.

The Riparian functions of Water Quality Protection, Flood Management, Wildlife Habitat and Micro Climate Regulation within Segment 5 are assessed at low value based on a deficiency of properly functioning riparian zones. Like the preceding segments, potential for all functions within Segment 5 is high based on possible improvements in land management as well as enhancement and restoration of existing riparian zones (Table 2).

Assessment Segments 6, 7 and 8 (8410 LF, 1.59 mi.)**:** Due to very similar stream habitat , riparian condition and landscape, Segments 6,7 and 8 are assessed collectively. Segments 6, 7 and 8 extend southwest from an upstream boundary of Segment 6 established just below the

abandon diversion structure that marks the end of Segment 5 to the downstream boundary of Segment 8 at Gold Basin Road (Overview 6).



Overview 6. Aerial overview of Segment 6, 7 and 8 (2010 NAPP imagery of Gunnison County).

Included within these segments are various in-stream crossings, an outflow channel from the detention ponds located to the north, and irrigation return ditches that drain the surrounding hay pasture. The segments are situated on the Gas Creek Sandy Loam, 0 to 1 percent slopes (Map 2)

Habitat Assessment scores average approximately 111/200 with low scores Bank Stability, Vegetative Protection and Riparian Zone width (Appendix C, Table 3). These segments support similar riparian condition with the majority of riparian areas classified as Functional at Risk excluding several very small pockets classified as fragmented Proper Functioning Condition riparian. The riparian areas are narrow and lack diversity in species and age class distribution of vegetation. The streambanks in Segments 6 and 7 and portions of Segment 8 appear to have acquired minimal stabilization. This stabilization appears to be related to the land being utilized for hay production as opposed to grazing. The pastures that are utilized for growing hay are

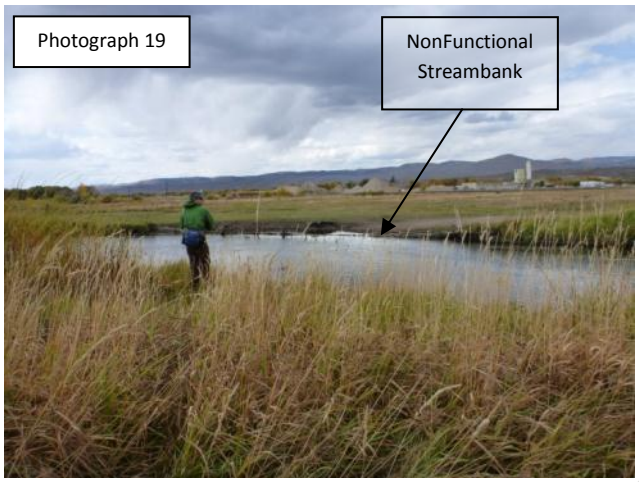
often protected from grazing with fence alignment which excludes grazing for a period of time during the growing season to allow hay production to reach potential. Similar to Segments 4 and 5, the seasonal exclusion of livestock from the streambank permits grasses and vegetation to reach growing season potential. The increased production has enabled pasture grasses to grow down to the stream edge thus providing some vegetative cover and slight increase in ability to withstand higher flows where these grasses are established. These areas exhibit sloughing but to a lesser extent than those without the cover of the grasses (Photograph 18). In many cases, the pastures that are adjacent to the stream in these segments are harvested right to the edge of the stream leaving very little protective buffer between the pasture and streambank (left bank Photograph 18). This mowing directly along the streambank may limit the establishment of potential riparian zones.

Photograph 18

Photograph 19

Although this type of vegetation lacks much of the characteristics of healthy riparian zones and subsequent ecological functions, it provides a minimal buffer to direct hydrologic impacts to the bank that are not present where this vegetation is removed or non-existent. When impacts to the bank and vegetation are minimized, the banks show the ability to support the growth of more robust vegetation resulting in better cover of vulnerable areas (Photograph 19).

The downstream section of Segment 8, however, appears to be subject to more streamside riparian impact resulting from grazing pressure and streamside access of livestock with a departure from the hay production back to a grazing influence. This section of Segment 8 includes numerous NonFunctional riparian and sloughing streambanks resulting from streamside access to livestock (Photograph 19).



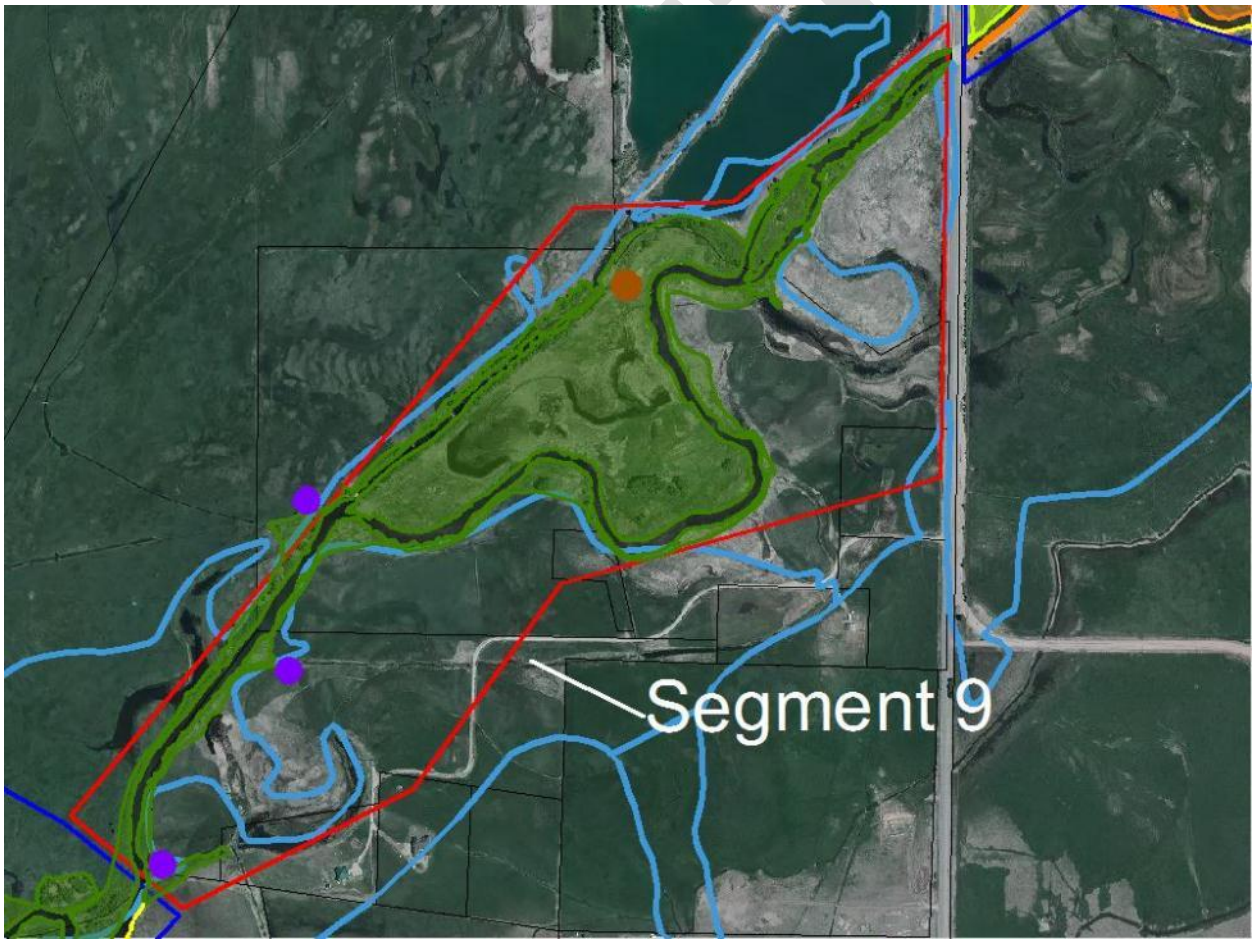
The stream channel in these segments continues to show signs of widening. Not only has the stream become shallower and less confined by healthy riparian area, continued widening of the channel is revealed in a homogenous streambed. A healthy stream will generally be comprised of flow regimes such as slow deep, slow shallow, fast deep and fast shallow. Due to persistent channel widening, the flow regimes in these segments are generally limited to three or less of the regime types necessary to provide a balanced Velocity/Depth ratio (Photograph 20).

Although riparian areas within Segments 6, 7 and 8 are in a generally compromised condition, differences in land use have provided some protection of various streambank and riparian areas. The vegetative cover in the areas sheltered from livestock in the upper portion of segments 6, 7 and 8 is providing slightly increased bank stability. The minimally improved condition aids in slowing the downward trend in riparian condition that is observed with downstream travel from the upper segments. A return to more grazing access to the stream in the lower reaches of segment 8 results in degraded conditions and NonFunctional riparian areas as the stream approaches Gold Basin Road.

Although riparian functions remain of low value in these segments, evidence of slight improvement to riparian condition due to subtle changes in land use are apparent. The slightly improved stability indicates the potential influence land use management has on this stream system. Like the preceding segments, potential for increased functional value within Segments

6, 7 and 8 is high based on possible improvements or modifications to land management as well as enhancement and restoration of existing riparian zones (Table 2).

Assessment Segment 9 (6193 Lf, 1.17 mi.)**:** Segment 9 extends from the Gold Basin Road bridge southwest to a property boundary and a bend in the river channel that transitions the stream to a more westerly course as it nears the confluence with the Gunnison River. Segment 9 is comprised of large, intact riparian areas that are determined as being in Proper Functioning Condition. The segment includes one irrigation diversion and 3 irrigation return features. The area includes several abandoned stream oxbows within the mapped floodplain that support wetland conditions that comprise lateral wetlands that are associated with the stream corridor (Overview 7).



Overview 7. Aerial overview of Segment 9 (2010 NAPP imagery of Gunnison County).

This segment shows a marked increase from the lower habitat assessment scores of upstream segments with an assessment score of 183/200. The rise in habitat quality is related to improvements in all assessment criteria (Appendix C, Table 3). Notably, dramatic improvement and enlargement of vegetative cover along both banks has increased scores from poor to an

optimal rating for criteria such as Channel Flow Status, bank stability, Vegetative Protection, Riparian Zone Width and Velocity Depth Regime. Unlike segments upstream, this segment has no eroded or sloughing banks. Approximately 100 percent of Segment 9 riparian areas are considered Proper Functioning Condtion with an upward trend as the passive restoration and decrease in grazing appears to continue to improve conditions in this segment (Table 1).

Segment 9 is situated within the property boundaries of the *Tomichi Creek Preserve*. This property is part of a Conservation Development that includes a permanent 74 acre Conservation Easement that is established in cooperation with the NRCS with a goal of restoring the stream and associated riparian and wetland complexes. This conservation easement protects the riparian corridor that exists on the property. The property has also experienced relatively recent conservation efforts that include passive restoration of riparian and wetland areas throughout the property, the construction of several levees and water structures to enhance wildlife habitat along with the restoration of portions of a previously straightened stream channel to a historically sinuous configuration (Figure 5).


Photograph 21


Photograph 22

Although the restoration efforts which include the established Conservation Easement and a shift in agricultural use from that of overland grazing to an emphasis in hay production are relatively recent and of short duration, the effects on the existing riparian corridor are impressive especially in light of the riparian conditions that exist in the segments upstream of this area. Although some stream-banks lack the larger shrubs and trees that are vital to healthy riparian zones, riparian areas along both banks appear to be recovering with robust riparian vegetation such as sedges and wetland grasses established to the Ordinary High Water Mark (OHWM) of the stream channel.

This vegetation is providing the beginnings of healthy riparian function and an associated attainment of hydrologic equilibrium and a more balanced stream morphology that is limited in the previous segments. Photograph 21 is taken October 5, 2011 looking north at a portion of the re-established channel. Flows

within this historic channel are relatively, however they have already brought about the restoration of riparian vegetation that is acting to narrow the stream, shade in-stream habitat and create a better riffle/run ratio (Photograph 22). Some areas along the restored channel are beginning to support plantings and some recruitment of the narrowleaf cottonwood trees that typically dominate the tree strata in Lower Gunnison Valley riparian zones (Photograph 23).

Photograph 23

Photograph 24

The re-establishment of cottonwoods within the riparian areas along Tomichi Creek would greatly enhance riparian function and help to supply riparian functions such as bank stability, shading and contributions of large woody material to the stream ecosystem. The recovery of riparian vegetation is also apparent in the re-vegetation of point bars throughout the segment. Another benefit that is associated with improved riparian condition is the re-vegetation of point bars throughout the segment. The ability of point bars to become re-vegetated after high flow events that scour the area adds to

the resilience and balance in the stream system.

Photograph 25

Photographs 25 and 26 exhibit the revegetation of point bars in Segment 9. Small willow recruits are becoming established along the point bar in Photograph 25 with the lush growth of reed canary grass up to 3 to 4 feet in hieght established along the bank in Photograph 26. Other areas associated with the restored stream channel and the historical channel within the segment support riaprian that is an upward trend due to the decrease in grazing pressure and passive restoration that has taken place in this segment. In these areas willows, alder and some cottonwood are being restored as important components of these riparian zones.

Photograph 26


Photograph 27


Photograph 28

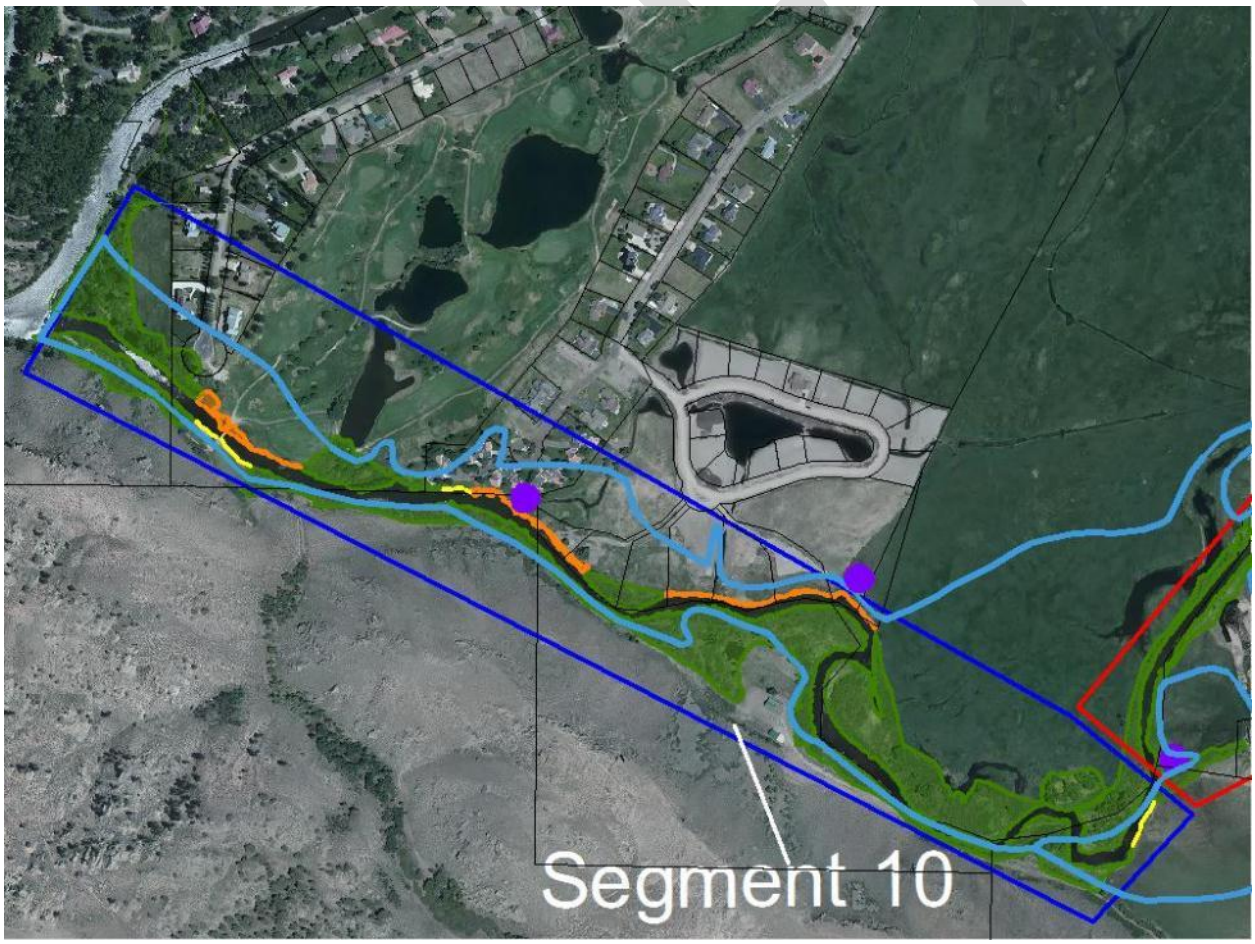
Where this restoration has occurred, riparian areas exhibit marked improvements in quality and function and reveal the potential improvements and recovery that modifications to land management and conservation of stream corridors can bring to valuable riparian zones along Tomichi Creek. Photographs 27 and 28 document healthy riparian areas in this segment that include the components of diverse species and age class of riparian vegetation that provide cover and stability to streambanks. The vegetative cover and stability provide the foundation to support continued improvements to stream health and balance throughout the segment.

Segment 9 also includes large emergent wetlands that are associated with what appear to be abandoned oxbows of Tomichi Creek (Photograph 29). These conserved wetland are also contributing to the quality of aquatic resources and wildlife habitat that exists in this segment.


Photograph 29

Segment 9 riparian functions of Water Quality Protection, Flood Management are of medium to medium high value while values for Wildlife Habitat and Micro Climate Regulation are of high value based on the upward trend of riparian condition that appears to be occurring currently. If the observed upward trend of riparian condition continues, the passive restoration, enhancement and recovery of riparian areas will likely bring all of the riparian function in Segment 9 to that of high value (Table 2).

Segment 10 (5531 LF, 1.04 mi.)*:* Segment 10 extends west from the bend in the stream that marks the western boundary of the Tomichi Creek Preserve to the Confluence with the Gunnison River.Dos. This segment has two irrigation return features and no irrigation diversion structures. Segment 10 includes intact riparian areas along the northern and southern banks in the upper portion of the segment that are determined as being in PFC. Excluding an area that is adjacent to a golf course green feature, riparian areas remain generally intact along the confined and relatively undeveloped southern bank in the lower portion of the segment. Riparian areas along the northern bank include hay pasture, residences within Dos Rios communities and small portions of the Dos Rios Golf Course (Overview 8). Stream Habitat Assessment score for Segment 10 is 175/200 with optimal conditions being met in several criteria (Appendix C, Table 3). Although the riparian area does not exhibit the upward trend of the adjoining Segment 9, the light development and lower impact along the entire southern bank and the upper northern bank contributes to higher habitat assessment and Proper Functioning Condition riparian values for this reach of Tomichi Creek.



Overview 7. Aerial overview of Segment 10 (2010 NAPP imagery of Gunnison County).

Approximately 98% of riparian areas are rated as being in Proper Functioning Condition while 2.0% are considered Functional at Risk within Segment 10. The larger, intact riparian areas that currently exist in this segment provide valuable riparian function to this reach of Tomichi Creek as well as the Gunnison River located just downstream. 526 Linear feet of streambank are identified as NonFunctional in association with unprotected and sloughing banks or banks that are armored with rip rap in the Dos Rios Golf Course area.

Soils associated with the northern bank in Segment 10 are generally the Gas Creek sandy loam, 0 to 1 percent slopes (GaA) in the upper portions of the segment with a transition to the Alluvial occasionally flooded soil type(Ao) as the stream approaches the Gunnison River. The southern bank is comprised of upland soil referred to as the Stony rock land (ST) Soil type in the upper portions of the segment with the transition to the Alluvial land occasionally flooded near the Gunnison River (Map 2).

Segment 10 supports a majority of proper functioning riparian areas along the relatively protected southern bank. Like Segments 1 and 2, the steep hillside confines and limits grazing and development along this bank providing some protection of the riparian areas. Development associated with the golf course and various developments has impacted the riparian areas that exist along the northern bank restricting the characteristics of healthy riparian zones in the lower portions of the northern bank.

The riparian functions of Water Quality Protection, Flood Management, Wildlife Habitat and Micro Climate Regulation are currently of medium value. Potential for increase to these values is limited in Segment 10 due to development along the stream, particularly the northern bank (Table 2).

Summary and Recommendations

There are approximately 6 river miles of Tomichi Creek from the base of Tenderfoot Mountain to its confluence with the Gunnison River which are assessed in this report. Of this, approximately 65% of the Tomichi Creek riparian corridor is in Proper Functioning Condition which is a measure of having a riparian community that continues to function yet also allows for human land use. However, 8,510 linear feet of bank (about 27%) were rated as nonfunctional with almost all of this occurring in segments above Gold Basin Road. Even though the study zone was predominantly functioning, based on a GIS analysis of aerial photographs riparian forests aerial coverage has been almost eliminated in segments above Gold Basin Road. In addition to riparian community loss, about 9% of the remaining riparian community has been degraded through perforation. Much of this degradation upstream of

Gold Basin Road has led to a degradation of instream aquatic habitat and a shift to a wider and shallower stream with much less shading and instream habitat structure.

Immediately downstream of Gold Basin Road is a segment that has undergone near passive restoration with the entire 28.52 acres being in Proper Functioning Condition. This segment serves as an example at what near passive restoration can achieve in about a 10 year restoration period. Most of the NonFunctional and Functioning at Risk segments are managed by the County of Gunnison, the Gunnison-Crested Butte Regional Airport or Western State Colorado University. These sections are also immediately downstream from property that was recently acquired by the Colorado Parks and Wildlife and is now the Tomichi Creek State Wildlife Area.

Ultimately, riparian communities and human activity are often not congruent, but through thoughtful, scientifically based management, the conflict between use and ecosystem function may not be inevitable. Thus we recommend a planned, science based land use management between the entities managing land upstream of Gold Basin Road. These include the County of Gunnison, the Gunnison-Crested Butte Regional Airport and Western State Colorado University. These entities could cooperate in joint management plan with the Colorado Parks and Wildlife who manage the Tomichi Creek State Wildlife Area to create a consistent and effective management zone. This management should address appropriate riparian buffers of Tomichi Creek and riparian zone including the appropriate intensity and duration of livestock grazing in these zones as well as appropriate hay production. These efforts should also consider the livelihoods and input from the lessees of the property. However, these areas are in need of immediate revegetation and restoration with willows, thinleaf alders, and narrowleaf cottonwoods and restoration should mimic the restoration that occurred below Gold Basin Road.

Short to medium term removal of grazing and haying in a 25 foot minimum buffer is recommended. There are, however, many studies (see Fischer and others, 2000 for a list) that indicate that the 25 foot setback, is inadequate at protecting water quality and riparian values. For the sole protection of water quality, studies indicate from 4 meters to 30 meters and the Planner's Guide to Wetland Buffers for Local Governments (Environmental Law Institute 2008) indicates 20 to 175 feet is necessary with corrections for land use intensity, wetland category and slope adjustment. Most land use in this area is compatible with riparian protection so a minimum buffer width should be adequate.

Additionally, the redesign and reconstruction of diversion structures should be considered to reduce impact to riparian zones while also providing a reliable water source to irrigators. There is also some evidence of a declining water table in some areas of lower Tomichi Creek.

Maintaining stream flows, if possible, in lower Tomichi Creek will help with the maintenance of riparian areas, improve water quality and support the instream aquatic habitat.

A focused effort should be instigated to protect functional areas and restore function to impaired areas where possible to maximize the riparian values of water storage, water quality protection, flood management, microclimate regulation and wildlife habitat. Proper overall management both longitudinally and laterally from the river, will help maintain functional and structural diversity making the system resilient to perturbations. These areas should contain appropriate riparian vegetation that is diverse in types, age-structure and function.

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References

Baker, M.B., Jr., P.F. Ffolliott, L.F. DeBano, D.G. Neary. eds. 2004. Riparian Areas of the Southwestern United States: Hydrology, Ecology and Management. Lewis Publishers. Boca Raton, FL. 408 pp.

Barbour, M.T., J. Gerritsen, B.D. Snyder, and J.B. Stribling.1999. Rapid Bioassessment Protocols for Use in Streams and Wadeable Rivers: Periphyton, Benthic Macroinvertebrates and Fish, Second Edition. EPA 841-B-99-002. U.S. Environmental Protection Agency; Office of Water; Washington, D.C. (*especially* Chapter 5. Habitat Assessment and Physicochemical Parameters.)

Baron, J.S., N.L. Poff, P.L. Angermeier, C.N. Dahm, P.H. Gleick, N.G. Hariston, Jr., R.B. Jackson, C.A. Johnston, B.D. Richter, and A.D. Steinman. 2003. Sustaining Healthy Freshwater Ecosystems. Issues in Ecology, Winter 2003, 16 pages.

Braatne, Rood and Heilman. 1996. Life History, Ecology and Conservation of Riparian Cottonwoods in North America. *In* Stettler, R.F., Bradshaw, H.D., Jr., Heilman, P.E., and Hinckley, T.M. 1996. Biology of *Populus* and its implications for management and conservation. NRC Research Press, Ottawa, Ontario, Canada. 539 pp.

Brown, D. E. 1994. *Biotic communities of the Southwestern United States and northwestern Mexico.* University of Utah Press, Salt Lake City, 342 pp.

Colorado Natural Heritage Program. 2009. Field Testing of the Subalpine-Montane Riparian Shrublands Ecological Integrity Assessment (EIA) in the Blue River Watershed, Colorado. 67 pages.

Cooper, D.J. 1993. Wetlands of the Crested Butte Region: Mapping, Functional Evaluation and Hydrologic Regime. Report to Town of Crested Butte, Colorado and Environmental Protection Agency, Region VIII. 65 pages plus appendices.

Environmental Law Institute. 2008. Planner's Guide to Wetland Buffers for Local Governements. 29 pages. Downloadable from www.eli.org

Federal Register. July 13, 1994. Changes in Hydric soils of the United States. Washington D.C. (Definition of Hydric Soils).

Fischer, R.A., C.O. Martin and J.C. Fischenich. 2000. Improving Riparian Buffers Strips and Corridors for Water Quality and Wildlife. International Conference on Riparian Ecology and Management in Multi-Land Use Watersheds. American Water Resources Association. 7 pages.

Goodwin, C. N., C.P. Hawkins and J.L. Kershner. 1997. Riparian restoration in the Western United States: Overview and Perspective. Restoration Ecology: 5(4s), 4-14.

Huggenberger, P., E. Hoehn, R. Beschta, and W. Woessner. 1998. Abiotic aspects of channels and floodplains in riparian ecology. Freshwater Biology, 3:407-425.

Hunter, William R. and Spears, Clayton F. 1963. Soil Survey of the Gunnison Area, Colorado. United States Department of Agriculture, forest and Soil Conservation Service.

Lichvar, R.W. and J.S. Wakeley, ed. 2004. Review of Ordinary High Water Mark indicators for delineatingarid streams in the southwestern United States. ERDC/CRREL TR-04-1. Hanover, NH. US Army Engineer Research abd Development Center, Cold Regions Research and Engineering Laboratory.

Loheide, S. and S.M. Gorelick. 2005. A High-Resolution Evapotranspiration Mapping Algorithm (ETMA) with Hydroecological Applications at Riparian Restoration Sites, Remote Sensing of Environment, Vol. 98, p. 182-200, doi:10.1016/j.rse.2005.07.003.

Loheide, S.P. and S.M. Gorelick. 2006. Quantifying stream-aquifer interactions through analysis of remotely sensed thermographic profiles and in-situ temperature records, Environmental Science & Technology, 40, p. 3336-3341

Naiman, R.J., H. Decamps and M.E. McClain. 2005. Riparia: Ecology, Conservation, and Management of Streamside Communities. Elsevier, New York, New York, USA. 448 pages.

Polis, G.A., M.E. Power, and G.R. Huxel (eds.) 2004. Food Webs at the Landscape Scale. The University of Chicago Press, Chicago, IL, USA. 548 pages.

Prichard, D., J. Anderson, C. Correll, J. Fogg, K. Gebhardt, R. Krapf, S. Leonard, B. Mitchell and J. Staats. 1998. Riparian Area Management: A User Guide to Assessing Proper Functioning Condition and the Supporting Science for Lotic Areas. U.S. Bureau of Land Management, U.S. Forest Service and Natural Resource Conservation Service. Technical Reference 1737-15. 136 pages.

Prichard, D., F. Berg, S. Leonard, W. Hagenbuck, M. Manning, R. Krapf, C. Noble, R. Leonard, and J. Staats. 1999. Riparian Area Management: A User Guide to Assessing Proper Functioning Condition and the Supporting Science for Lentic Areas. U.S. Bureau of Land Management, U.S. Forest Service and Natural Resource Conservation Service. Technical Reference 1737-16. 109 pages.

Rickard, T.A. 1903. Across the San Juan Mountains. The Engineering and Mining Journal, New York. 115 pages.

Rosgen, D.L. 1994. A classification of natural rivers. *Catena* 22:169-199.

Rosgen, D. 1996. Applied River Morphology, 2nd edition. Wildland Hydrology. 390 pages.

Saunders, W.C. and K.D. Fausch. 2010. Effects of riparian grazing on terrestrial invertebrate inputs that feed trout in central Rocky Mountain streams. Final Report to the NRCS, USFS, WY Game and Fish Department and BLM. 209 pp.

Tague, C., S Vlaentine and M. Kotchen. 2008. Effect of geomorphic channel restoration on streamflow and groundwater in a snowmelt-dominated watershed. Water Resources Research 44, W10415.

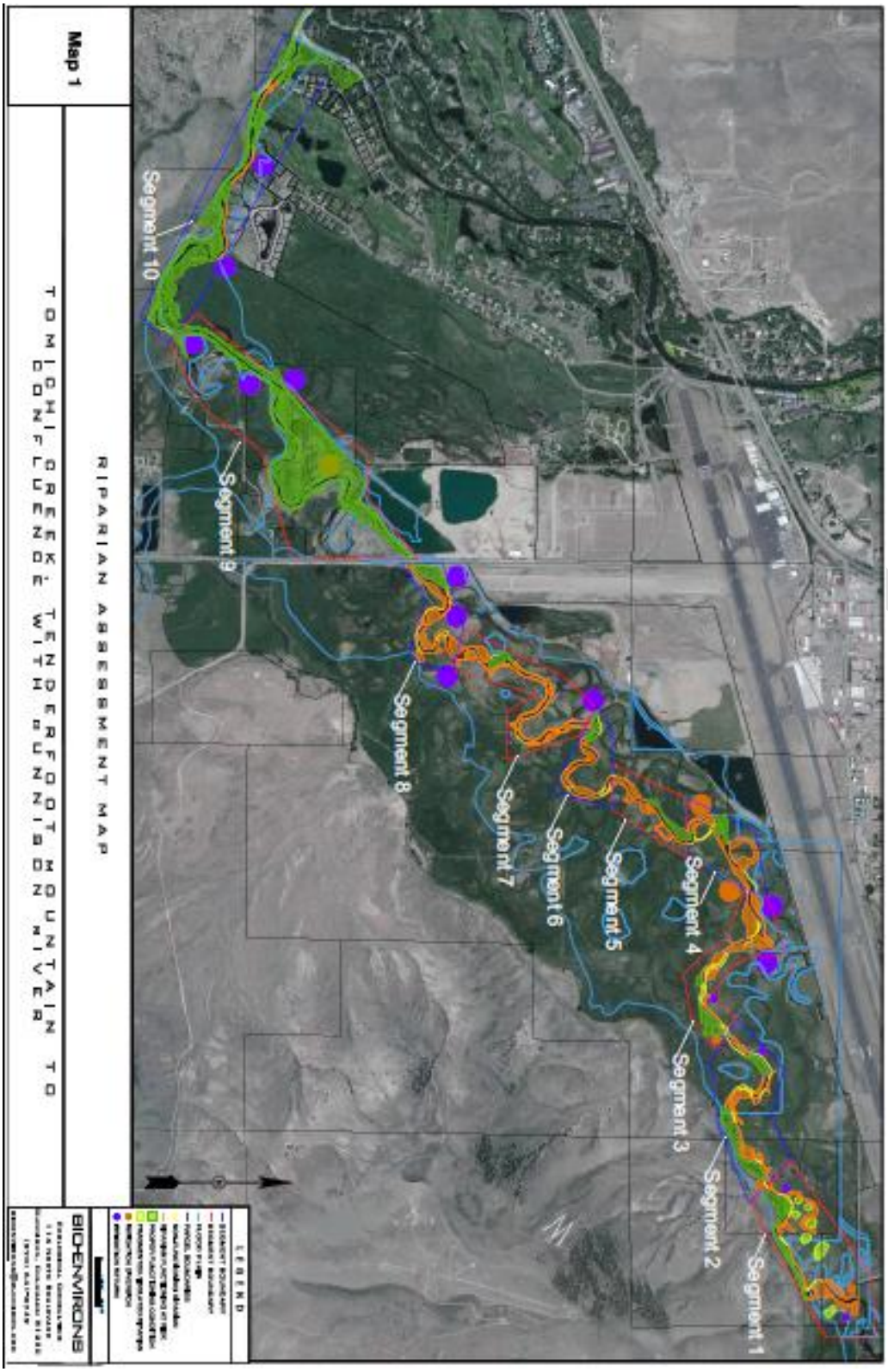
United States. NRCS Web Soil Survey- Soil Map – Gunnison Area, Colorado. United States Department of Agriculture, Forest Service and Soil Conservation Service. 2 Jan, 2011 http://websoilsurvey.nrcs.usda.gov/app/WebSoilSurvey.aspx

United States Department of Agriculture, Natural Resources conservation Service. 2010. Field Indicators of Hydric Soils in the United States, Version 7.0. G.W. Hurt, P.M. Whited, and R.F Pringle (editors). USDA-NRCS, in cooperation with the National Committee for Hydric Soils.

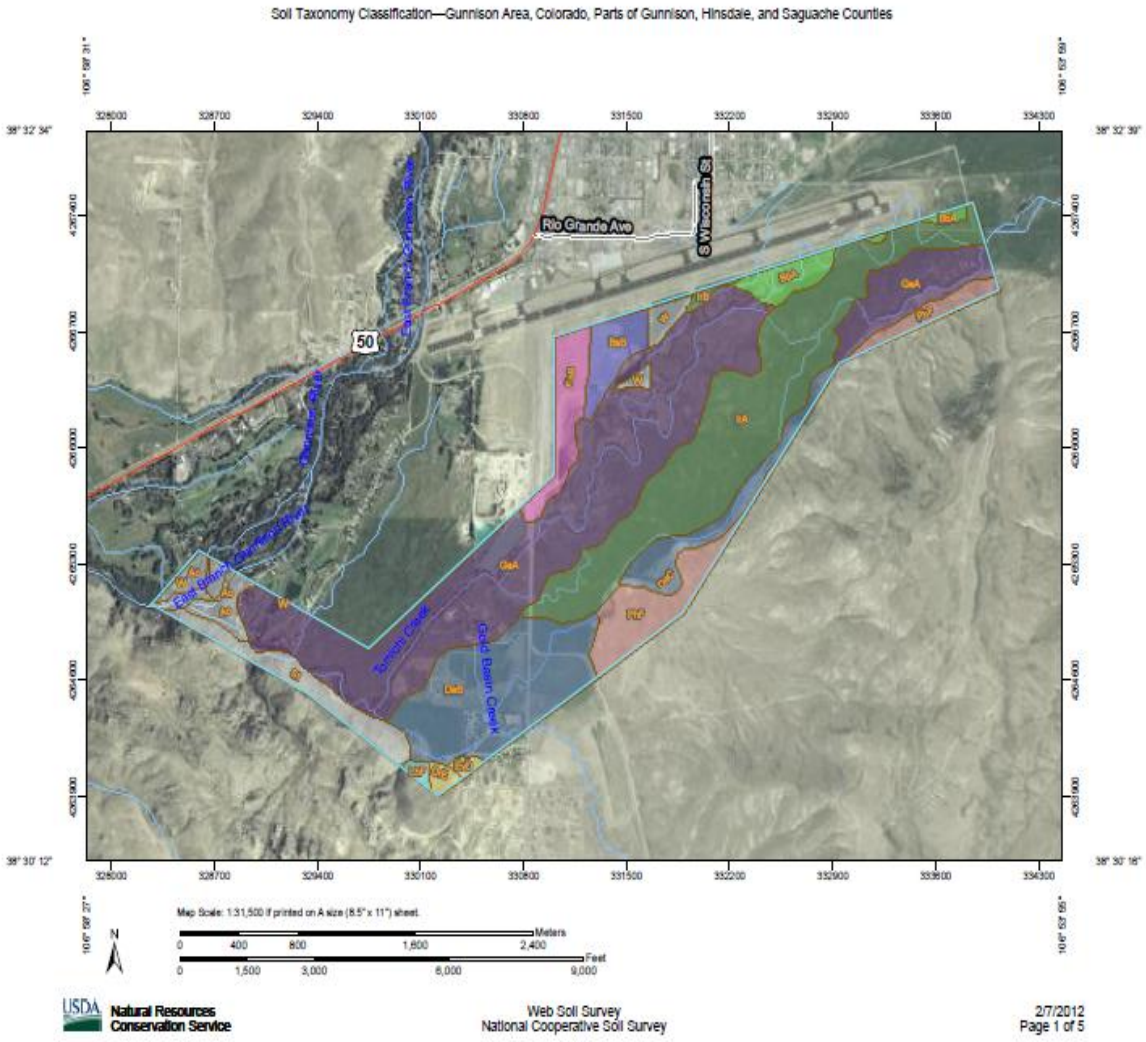
Wipfli, M.S. 1997. Terrestrial invertebrates as salmonid prey and nitrogen sources in streams: contrasting old-growth and young-growth riparian forests in southeastern Alaska, USA. Canadian Journal of Fisheries and Aquatic Sciences. 54: 1259-1269.

Worrall, J. 2009. Dieback and Mortality of *Alnus* in the Southern Rocky Mountains, USA. Plant Disease. 93(3): 293-298.

Maps



Map 1. 2011 Riparian Assessment Map of the lower Tomichi Creek from Tenderfoot Mountain to the confluence with the Gunnison River.



Map 2. NRCS Soil map, Tomichi Creek from Tenderfoot Mountain to the confluence with the Gunnison River (Gunnison County, CO.)

Tables

Table 1. Summary of Proper Functioning Criteria of lower Tomichi Creek from the northeast toe of Tenderfoot Mountain to the confluence with the Gunnison River, Gunnison County, Colorado (2011).

Assessment Segment	Segment Length (miles/Linear feet)	Non-Functioning (approx. linear feet)	Functioning at Risk (Acreage)	Proper Functioning Condition(Acreage)	Proper Functioning Condition-fragmented (Acreage)	Total Riparian Area(Acreage)
1	0.50/2650’	839’	3.11	2.19	2.23	7.5
2	0.58/3062’	2006’	2.78	3.01	_	5.79
3	0.50/2590’	1967’	3.64	-	1.48	5.12
4	0.34/1806’	1175’	2.6	-	0.38	2.98
5	0.27/1407’	50’	1.63	-	0.96	2.59
6	0.44/2316’	657’	1.32	-	0.4	1.72
7	0.66/3490	279’	2.76	-	0.57	3.33
8	0.50/2604	1011’	3.22	-	1.5	4.72
9	1.17/6193	_	_	28.52	_	28.52
10	1.04/5531	526’	0.34	14.87	0.4	15.61
Total	6.0/31,449	8510’	21.41	54.28	7.92	83.61

Table 2. Summary of relative riparian functioning values of lower Tomichi Creek from the northeast toe of Tenderfoot Mountain to the confluence with the Gunnison River, Gunnison County, Colorado (2011).

Assessment Segment	Water Quality Protection	Water Quality Protection Potential	Flood Manage-ment	Flood Manage-ment Potential	Micro-climate Regulation	Micro-climate Regulation Potential	Wildlife Habitat	Wildlife Habitat Potential
1	Medium	High	Medium	High	Low	High	Medium	High
2	Medium	High	Low-Medium	High	Low	High	Medium	High
3	Low	High	Low	High	Low	High	Low	High
4	Low	High	Low	High	Low	High	Low	High
5	Low	High	Low	High	Low	High	Low	High
6	Low	High	Low	High	Low	High	Low	High
7	Low	High	Low	High	Low	High	Low	High
8	Low	High	Low	High	Low	High	Low	High
9	Medium	High	Medium-High	High	High	High	High	High
10	Medium	Medium	Medium	Low	Medium	Medium	Medium	Medium

Segment #	Habitat Assessment Score
1	**146**
2	**123**
3	**106**
4	**116**
5	**116**
6	**118**
7	**108**
8	**108**
9	**183**
10	**175**

Table 3. Habitat Assessment Scores for lower Tomichi Creek Riparian assessment. Taken form Habitat Assessment Field Data Sheet

Appendices

Appendix A. Data sheets from Barber and others, 1999 used in assessment segment analysis for flowing water sections.

HABITAT ASSESSMENT FIELD DATA SHEET—HIGH GRADIENT STREAMS (FRONT)

STREAM NAME	LOCATION
STATION # _____ RIVERMILE _____	STREAM CLASS
LAT _____ LONG _____	RIVER BASIN
STORET #	AGENCY
INVESTIGATORS	
FORM COMPLETED BY	DATE _____ TIME _____ AM PM / REASON FOR SURVEY

Parameters to be evaluated in sampling reach

Habitat Parameter	Condition Category: Optimal	Suboptimal	Marginal	Poor
1. Epifaunal Substrate/ Available Cover	Greater than 70% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient).	40-70% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale).	20-40% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 20% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
2. Embeddedness	Gravel, cobble, and boulder particles are 0-25% surrounded by fine sediment. Layering of cobble provides diversity of niche space.	Gravel, cobble, and boulder particles are 25-50% surrounded by fine sediment.	Gravel, cobble, and boulder particles are 50-75% surrounded by fine sediment.	Gravel, cobble, and boulder particles are more than 75% surrounded by fine sediment.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
3. Velocity/Depth Regime	All four velocity/depth regimes present (slow-deep, slow-shallow, fast-deep, fast-shallow). (Slow is <0.3 m/s, deep is >0.5 m.)	Only 3 of the 4 regimes present (if fast-shallow is missing, score lower than if missing other regimes).	Only 2 of the 4 habitat regimes present (if fast-shallow or slow-shallow are missing, score low).	Dominated by 1 velocity/ depth regime (usually slow-deep).
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
4. Sediment Deposition	Little or no enlargement of islands or point bars and less than 5% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 5-30% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 30-50% of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; more than 50% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
5. Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills >75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0

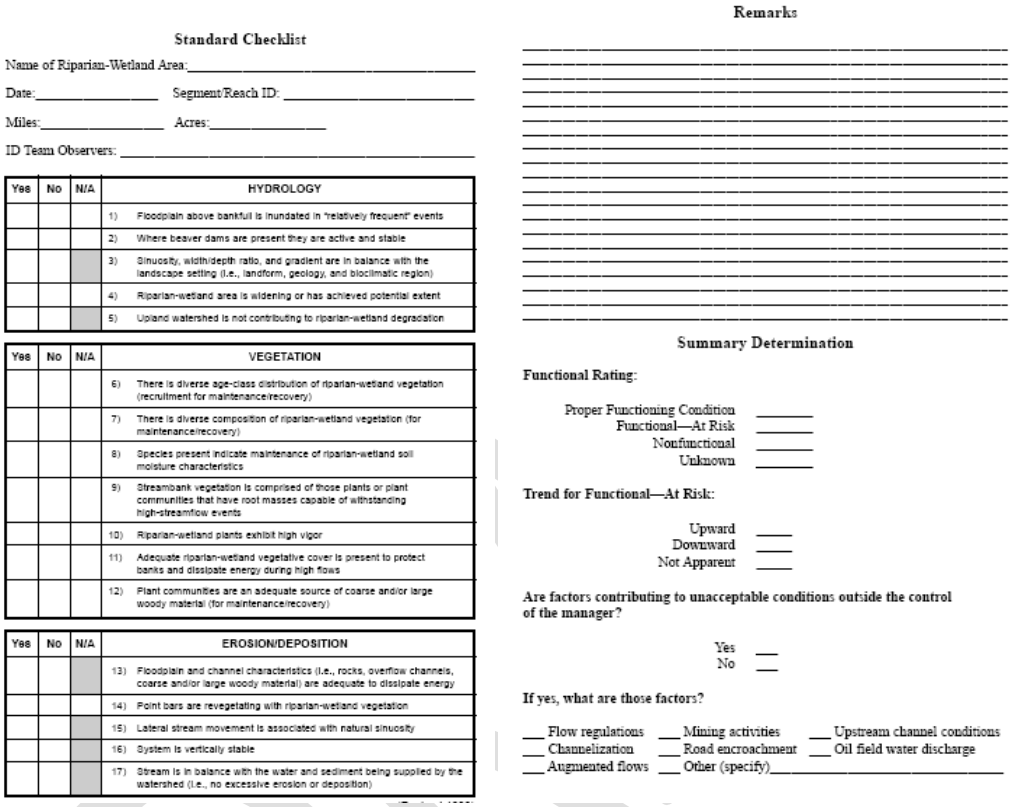
HABITAT ASSESSMENT FIELD DATA SHEET—HIGH GRADIENT STREAMS (BACK)

Parameters to be evaluated broader than sampling reach

Habitat Parameter	Condition Category: Optimal	Suboptimal	Marginal	Poor
6. Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr) may be present, but recent channelization is not present.	Channelization may be extensive; embankments or shoring structures present on both banks, and 40 to 80% of stream reach channelized and disrupted.	Banks shored with gabion or concrete, over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
7. Frequency of Riffles (or bends)	Occurrence of riffles relatively frequent; ratio of distance between riffles divided by width of the stream <7:1 (generally 5 to 7); variety of habitat is key. In streams where riffles are continuous, placement of boulders or other large, natural obstruction is important.	Occurrence of riffles infrequent; distance between riffles divided by the width of the stream is between 7 to 15.	Occasional riffle or bend; bottom contours provide some habitat; distance between riffles divided by the width of the stream is between 15 to 25.	Generally all flat water or shallow riffles; poor habitat; distance between riffles divided by the width of the stream is a ratio of >25.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
8. Bank Stability (score each bank) Note: determine left or right side by facing downstream.	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.
SCORE ___ (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0
9. Vegetative Protection (score each bank)	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
SCORE ___ (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0
10. Riparian Vegetative Zone Width (score each bank riparian zone)	Width of riparian zone >18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone.	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6-12 meters; human activities have impacted zone a great deal.	Width of riparian zone <6 meters; little or no riparian vegetation due to human activities.
SCORE ___ (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0

Total Score _____

Appendix B. Data sheets from Richard and others, 1998 used in assessment segment analysis for flowing water sections.



Standard Checklist

Name of Riparian-Wetland Area:_____

Date:_____ Segment/Reach ID: _____

Miles:_____ Acres:_____

ID Team Observers: _____

Yes	No	N/A	HYDROLOGY
			1) Floodplain above bankfull is inundated in "relatively frequent" events
			2) Where beaver dams are present they are active and stable
			3) Sinuosity, width/depth ratio, and gradient are in balance with the landscape setting (i.e., landform, geology, and bioclimatic region)
			4) Riparian-wetland area is widening or has achieved potential extent
			5) Upland watershed is not contributing to riparian-wetland degradation

Yes	No	N/A	VEGETATION
			6) There is diverse age-class distribution of riparian-wetland vegetation (recruitment for maintenance/recovery)
			7) There is diverse composition of riparian-wetland vegetation (for maintenance/recovery)
			8) Species present indicate maintenance of riparian-wetland soil moisture characteristics
			9) Streambank vegetation is comprised of those plants or plant communities that have root masses capable of withstanding high-streamflow events
			10) Riparian-wetland plants exhibit high vigor
			11) Adequate riparian-wetland vegetative cover is present to protect banks and dissipate energy during high flows
			12) Plant communities are an adequate source of coarse and/or large woody material (for maintenance/recovery)

Yes	No	N/A	EROSION/DEPOSITION
			13) Floodplain and channel characteristics (i.e., rocks, overflow channels, coarse and/or large woody material) are adequate to dissipate energy
			14) Point bars are revegetating with riparian-wetland vegetation
			15) Lateral stream movement is associated with natural sinuosity
			16) System is vertically stable
			17) Stream is in balance with the water and sediment being supplied by the watershed (i.e., no excessive erosion or deposition)

Remarks

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Summary Determination

Functional Rating:

Proper Functioning Condition _____
Functional—At Risk _____
Nonfunctional _____
Unknown _____

Trend for Functional—At Risk:

Upward ____
Downward ____
Not Apparent ____

Are factors contributing to unacceptable conditions outside the control of the manager?

Yes ___
No ___

If yes, what are those factors?

___ Flow regulations ___ Mining activities ___ Upstream channel conditions
___ Channelization ___ Road encroachment ___ Oil field water discharge
___ Augmented flows ___ Other (specify)_____

Appendix C. Completed data sheets from Richard and others, 1998 and Barber and others, 1999 used in assessment segment analysis for flowing water sections of the lower Tomichi Creek.

Standard Checklist

Name of Riparian-Wetland Area: Tomichi Creek

Date: 16-Sept-2011 Segment/Reach ID: #1

2650ft Miles: 0.50 Acres: 7.53 ac FAR = 3.11 PFC = 2.19 Rectx = 2.23 NF = 839 LF

ID Team Observers: T.L, K.A.

Yes	No	N/A	HYDROLOGY	
X			1)	Floodplain above bankfull is inundated in "relatively frequent" events
		NA	2)	Where beaver dams are present they are active and stable
X			3)	Sinuosity, width/depth ratio, and gradient are in balance with the landscape setting (i.e., landform, geology, and bioclimatic region)
	X		4)	Riparian-wetland area is widening or has achieved potential extent
			5)	Upland watershed is not contributing to riparian-wetland degradation

Yes	No	N/A	VEGETATION	
	X		6)	There is diverse age-class distribution of riparian-wetland vegetation (recruitment for maintenance/recovery)
	X		7)	There is diverse composition of riparian-wetland vegetation (for maintenance/recovery)
X			8)	Species present indicate maintenance of riparian-wetland soil moisture characteristics
X			9)	Streambank vegetation is comprised of those plants or plant communities that have root masses capable of withstanding high-streamflow events
	X		10)	Riparian-wetland plants exhibit high vigor
	X		11)	Adequate riparian-wetland vegetative cover is present to protect banks and dissipate energy during high flows
	X		12)	Plant communities are an adequate source of coarse and/or large woody material (for maintenance/recovery)

Yes	No	N/A	EROSION/DEPOSITION	
X			13)	Floodplain and channel characteristics (i.e., rocks, overflow channels, coarse and/or large woody material) are adequate to dissipate energy
X			14)	Point bars are revegetating with riparian-wetland vegetation
	X		15)	Lateral stream movement is associated with natural sinuosity Potential
	X		16)	System is vertically stable
X			17)	Stream is in balance with the water and sediment being supplied by the watershed (i.e., no excessive erosion or deposition)

(Revised 1998)

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Remarks

- Left Bank in good condition Slightly Confined By Geo
Left Bank and Stable Good Veg Diversity
Left Bank access limited By topo and Therefore Protected

Right Degraded -
- Grazing
- Hooked Veg
- Eroded
- No protection from Livestock
- Lack vegetated Diversity and Use Structure

Summary Determination

Functional Rating:

Proper Functioning Condition	____
Functional—At Risk	X
Nonfunctional	____
Unknown	____

Trend for Functional—At Risk:

Upward	____
Downward	X
Not Apparent	____

Are factors contributing to unacceptable conditions outside the control of the manager?

Yes	____
No	X

If yes, what are those factors?

___ Flow regulations	___ Mining activities	___ Upstream channel conditions
___ Channelization	___ Road encroachment	___ Oil field water discharge
___ Augmented flows	___ Other (specify)_____	

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HABITAT ASSESSMENT FIELD DATA SHEET—HIGH GRADIENT STREAMS (FRONT)

STREAM NAME Tomichi Creek	LOCATION Segment #1	
STATION # 1 RIVERMILE	STREAM CLASS	
LAT 38.5366 LONG -106.9065	RIVER BASIN Gunnison	
STORET #	AGENCY UGRWCD	
INVESTIGATORS T.L, KA		
FORM COMPLETED BY T. Lapella, K. Alexander	DATE 16-Sept-2011 TIME 13:00	REASON FOR SURVEY Riparian assessment

142 cfs ⇒ Bankfull

Parameters to be evaluated in sampling reach

Habitat Parameter	Condition Category: Optimal	Suboptimal	Marginal	Poor
1. Epifaunal Substrate/ Available Cover	Greater than 70% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient).	40-70% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale).	20-40% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 20% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
SCORE	20 19 18 17 16	(15) 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
2. Embeddedness	Gravel, cobble, and boulder particles are 0-25% surrounded by fine sediment. Layering of cobble provides diversity of niche space.	Gravel, cobble, and boulder particles are 25-50% surrounded by fine sediment.	Gravel, cobble, and boulder particles are 50-75% surrounded by fine sediment.	Gravel, cobble, and boulder particles are more than 75% surrounded by fine sediment.
SCORE	20 19 18 17 16	15 14 (13) 12 11	10 9 8 7 6	5 4 3 2 1 0
3. Velocity/Depth Regime	All four velocity/depth regimes present (slow-deep, slow-shallow, fast-deep, fast-shallow). (Slow is < 0.3 m/s, deep is > 0.5 m.)	Only 3 of the 4 regimes present (if fast-shallow is missing, score lower than if missing other regimes).	Only 2 of the 4 habitat regimes present (if fast-shallow or slow-shallow are missing, score low).	Dominated by 1 velocity/ depth regime (usually slow-deep).
SCORE	20 19 18 (17) 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
4. Sediment Deposition	Little or no enlargement of islands or point bars and less than 5% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 5-30% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 30-50% of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; more than 50% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
SCORE	20 19 18 17 16	(15) 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
5. Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills >75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
SCORE	20 19 (18) 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0

↓ Irrigation off for Haying → Bankfull conditions

HABITAT ASSESSMENT FIELD DATA SHEET—HIGH GRADIENT STREAMS (BACK)

Parameters to be evaluated broader than sampling reach

Habitat Parameter	Condition Category: Optimal	Suboptimal	Marginal	Poor
6. Channel Alteration Irrigation Diversions meanders prevented-Reduced -controlled	Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr) may be present, but recent channelization is not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.
SCORE	20 19 18 17 16	15 14 (13 circled) 12 11	10 9 8 7 6	5 4 3 2 1 0
7. Frequency of Riffles (or bends)	Occurrence of riffles relatively frequent; ratio of distance between riffles divided by width of the stream <7:1 (generally 5 to 7); variety of habitat is key. In streams where riffles are continuous, placement of boulders or other large, natural obstruction is important.	Occurrence of riffles infrequent; distance between riffles divided by the width of the stream is between 7 to 15.	Occasional riffle or bend; bottom contours provide some habitat; distance between riffles divided by the width of the stream is between 15 to 25.	Generally all flat water or shallow riffles; poor habitat; distance between riffles divided by the width of the stream is a ratio of >25.
SCORE	20 19 (18 circled) 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
8. Bank Stability (score each bank) Note: determine left or right side by facing downstream.	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.
SCORE ___ (LB)	Left Bank 10 (9 circled)	8 7 6	5 4 3	2 1 0
SCORE ___ (RB)	Right Bank 10 9	8 7 (6 circled)	5 4 3	2 1 0
9. Vegetative Protection (score each bank)	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
SCORE ___ (LB)	Left Bank 10 (9 circled)	8 7 6	5 4 3	2 1 0 low agricultural input Confined by Geo
SCORE (RB)	Right Bank 10 9	8 7 6	5 (4 circled) 3	2 1 0 High Agriculture
10. Riparian Vegetative Zone Width (score each bank riparian zone)	Width of riparian zone >18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone.	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6-12 meters; human activities have impacted zone a great deal.	Width of riparian zone <6 meters: little or no riparian vegetation due to human activities.
SCORE ___ (LB)	Left Bank 10 9	8 (7 circled) 6	5 4 3	2 1 0 Geologic confined
SCORE (RB)	Right Bank 10 9	8 7 6	5 4 3	(2 circled) 1 0

loss of vegetation from grazing some bare areas

Total Score 146

A-8 *Appendix A-1: Habitat Assessment and Physicochemical Characterization Field Data Sheets - Form 2*

Standard Checklist

Name of Riparian-Wetland Area: Tomichi Creek

Date: 21-Sept-2011 Segment/Reach ID: Segment #2

3062 ft Miles: 0.58 Acres: 3.79 ac

EAR = 2.78
PFC = 2.19
NF = 2006 LF

ID Team Observers: KA, TL

Yes	No	N/A		HYDROLOGY
X			1)	Floodplain above bankfull is inundated in "relatively frequent" events
		N/A	2)	Where beaver dams are present they are active and stable
X			3)	Sinuosity, width/depth ratio, and gradient are in balance with the landscape setting (i.e., landform, geology, and bioclimatic region)
	X	X	4)	Riparian-wetland area is widening or has achieved potential extent
*			5)	Upland watershed is not contributing to riparian-wetland degradation

Yes	No	N/A		VEGETATION
	X		6)	There is diverse age-class distribution of riparian-wetland vegetation (recruitment for maintenance/recovery)
	X		7)	There is diverse composition of riparian-wetland vegetation (for maintenance/recovery)
X			8)	Species present indicate maintenance of riparian-wetland soil moisture characteristics
X			9)	Streambank vegetation is comprised of those plants or plant communities that have root masses capable of withstanding high-streamflow events
	X		10)	Riparian-wetland plants exhibit high vigor
	X		11)	Adequate riparian-wetland vegetative cover is present to protect banks and dissipate energy during high flows
	X		12)	Plant communities are an adequate source of coarse and/or large woody material (for maintenance/recovery)

Patches of stream not maint. aired

Yes	No	N/A		EROSION/DEPOSITION
X			13)	Floodplain and channel characteristics (i.e., rocks, overflow channels, coarse and/or large woody material) are adequate to dissipate energy
	X		14)	Point bars are revegetating with riparian-wetland vegetation
X			15)	Lateral stream movement is associated with natural sinuosity
X			16)	System is vertically stable
*	X		17)	Stream is in balance with the water and sediment being supplied by the watershed (i.e., no excessive erosion or deposition)

(Revised 1998)

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Remarks

upper section
Left Bank — Good in Portions
lower - Degraded/Impaired Areas of Dams
Geo - confined upper

Right Bank — willows.
Grazing - Hedged veg - Mushroomed Shrubs
Highly eroded bank in some areas
Sloughing of Riparian into stream.
Stream Widening - loss of instream Habitat.
Lack of shrub and tree Strata

51% PFC
49% FAR

Summary Determination

Functional Rating:

Proper Functioning Condition	____
Functional—At Risk	X
Nonfunctional	____ Sections of Non Functional
Unknown	____

Trend for Functional—At Risk:

Upward	____
Downward	X
Not Apparent	____

Are factors contributing to unacceptable conditions outside the control of the manager?

Yes	____
No	X

If yes, what are those factors?

___ Flow regulations	___ Mining activities	___ Upstream channel conditions
___ Channelization	___ Road encroachment	___ Oil field water discharge
___ Augmented flows	___ Other (specify)_____	

HABITAT ASSESSMENT FIELD DATA SHEET—HIGH GRADIENT STREAMS (FRONT)

STREAM NAME Tomichi Creek	LOCATION Segment #2	
STATION # _____ RIVERMILE _____	STREAM CLASS C-3	
LAT 38.5344 LONG -106.9145	RIVER BASIN Gunnison	
STORET #	AGENCY UGRWCD	
INVESTIGATORS KA, TL		
FORM COMPLETED BY TL	DATE 21-Sept-2011 TIME 14:52 AM PM	REASON FOR SURVEY Riparian Assoc.

Parameters to be evaluated in sampling reach

Habitat Parameter	Condition Category: Optimal	Suboptimal	Marginal	Poor
1. Epifaunal Substrate/ Available Cover	Greater than 70% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient).	40-70% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale).	20-40% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 20% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
SCORE 13	20 19 18 17 16	15 14 (13) 12 11	10 9 8 7 6	5 4 3 2 1 0
2. Embeddedness	Gravel, cobble, and boulder particles are 0-25% surrounded by fine sediment. Layering of cobble provides diversity of niche space.	Gravel, cobble, and boulder particles are 25-50% surrounded by fine sediment.	Gravel, cobble, and boulder particles are 50-75% surrounded by fine sediment.	Gravel, cobble, and boulder particles are more than 75% surrounded by fine sediment.
SCORE 13	20 19 18 17 16	15 14 (13) 12 11	10 9 8 7 6	5 4 3 2 1 0
3. Velocity/Depth Regime	All four velocity/depth regimes present (slow-deep, slow-shallow, fast-deep, fast-shallow). (Slow is < 0.3 m/s, deep is > 0.5 m.)	Only 3 of the 4 regimes present (if fast-shallow is missing, score lower than if missing other regimes).	Only 2 of the 4 habitat regimes present (if fast-shallow or slow-shallow are missing, score low).	Dominated by 1 velocity/ depth regime (usually slow-deep).
SCORE 10	20 19 18 17 16	15 14 13 12 11	(10) 9 8 7 6	5 4 3 2 1 0
4. Sediment Deposition	Little or no enlargement of islands or point bars and less than 5% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 5-30% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 30-50% of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; more than 50% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
SCORE 13	20 19 18 17 16	15 14 (13) 12 11	10 9 8 7 6	5 4 3 2 1 0
5. Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills >75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
SCORE 17	20 19 18 (17) 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0

Irrigation terminates Br Hayes
Plus in stream

HABITAT ASSESSMENT FIELD DATA SHEET—HIGH GRADIENT STREAMS (BACK)

Parameters to be evaluated broader than sampling reach

Habitat Parameter	Condition Category: Optimal	Suboptimal	Marginal	Poor
6. Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr) may be present, but recent channelization is not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.
SCORE 16	20 19 18 17 (16)	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
7. Frequency of Riffles (or bends)	Occurrence of riffles relatively frequent; ratio of distance between riffles divided by width of the stream <7:1 (generally 5 to 7); variety of habitat is key. In streams where riffles are continuous, placement of boulders or other large, natural obstruction is important.	Occurrence of riffles infrequent; distance between riffles divided by the width of the stream is between 7 to 15.	Occasional riffle or bend; bottom contours provide some habitat; distance between riffles divided by the width of the stream is between 15 to 25.	Generally all flat water or shallow riffles; poor habitat; distance between riffles divided by the width of the stream is a ratio of >25.
SCORE 17	20 19 18 (17) 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
8. Bank Stability (score each bank) Note: determine left or right side by facing downstream.	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.
SCORE 6 (LB)	Left Bank 10 9	8 7 (6)	5 4 3	2 1 0
SCORE 2 (RB)	Right Bank 10 9	8 7 6	5 4 3	(2) 1 0
9. Vegetative Protection (score each bank)	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
SCORE 6 (LB)	Left Bank 10 9	8 7 (6)	5 4 3	2 1 0
SCORE 3 (RB)	Right Bank 10 9	8 7 6	5 4 (3)	2 1 0
10. Riparian Vegetative Zone Width (score each bank riparian zone)	Width of riparian zone >18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone.	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6-12 meters; human activities have impacted zone a great deal.	Width of riparian zone <6 meters: little or no riparian vegetation due to human activities.
SCORE 5 (LB)	Left Bank 10 9	8 7 6	(5) 4 3	2 1 0
SCORE 2 (RB)	Right Bank 10 9	8 7 6	5 4 3	(2) 1 0

Irrig. Diversions

year round grazing

Total Score 123

Standard Checklist

Name of Riparian-Wetland Area: Tomichi Creek

Date: 28-Sept-2011 Segment/Reach ID: Segment #3

FAR = 3.64
PFC = 1.48
NF = 1976 LF

* Miles: 0.50, 2587 LF Acres: 5.12 ac

ID Team Observers: KA, TL

Yes	No	N/A	HYDROLOGY
X			1) Floodplain above bankfull is inundated in "relatively frequent" events
		N/A	2) Where beaver dams are present they are active and stable
X			3) Sinuosity, width/depth ratio, and gradient are in balance with the landscape setting (i.e., landform, geology, and bioclimatic region)
	X		4) Riparian-wetland area is widening or has achieved potential extent
*			5) Upland watershed is not contributing to riparian-wetland degradation

Yes	No	N/A	VEGETATION
	X		6) There is diverse age-class distribution of riparian-wetland vegetation (recruitment for maintenance/recovery)
	X		7) There is diverse composition of riparian-wetland vegetation (for maintenance/recovery)
X			8) Species present indicate maintenance of riparian-wetland soil moisture characteristics
X			9) Streambank vegetation is comprised of those plants or plant communities that have root masses capable of withstanding high-streamflow events
	X		10) Riparian-wetland plants exhibit high vigor
	X		11) Adequate riparian-wetland vegetative cover is present to protect banks and dissipate energy during high flows
X			12) Plant communities are an adequate source of coarse and/or large woody material (for maintenance/recovery)

Yes	No	N/A	EROSION/DEPOSITION
X			13) Floodplain and channel characteristics (i.e., rocks, overflow channels, coarse and/or large woody material) are adequate to dissipate energy
X			14) Point bars are revegetating with riparian-wetland vegetation
X			15) Lateral stream movement is associated with natural sinuosity
	X		16) System is vertically stable
*			17) Stream is in balance with the water and sediment being supplied by the watershed (i.e., no excessive erosion or deposition)

(Revised 1998)

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Remarks

Stream is widening
- Bank Erosion causing widening

- Appears that different grazing practices at identified Reach. Less grazing with Fence
- Better Regeneration and revegetation of Exposed Areas

May be good Break segment at Reach due to grazing difference?

Cattle prevalent upstream of IO Reach

Summary Determination

Functional Rating:

Proper Functioning Condition	___
Functional—At Risk	X
Nonfunctional	___
Unknown	___

Trend for Functional—At Risk:

Upward	___ → upward Downstream of Fence
Downward	X
Not Apparent	___

Are factors contributing to unacceptable conditions outside the control of the manager?

Yes	___
No	X

If yes, what are those factors?

___ Flow regulations	___ Mining activities	___ Upstream channel conditions
___ Channelization	___ Road encroachment	___ Oil field water discharge
___ Augmented flows	___ Other (specify)_____	

Standard Checklist

Name of Riparian-Wetland Area: Tomichi Creek

Date: 28-Sept-2011 Segment/Reach ID: Segment #5 + 4

4 = 0.34 mi, 1806 LF 4 = 2.98

Miles: 5 = 0.27 mi, 1407 LF Acres: 5 = 2.59

4 FAR = 2.16 PFC = 0.38 NF = 1175 LF

5 FAR 1.63 PFC 0.96 NF = 50'

ID Team Observers: KA, TL

Yes	No	N/A	HYDROLOGY
X			1) Floodplain above bankfull is inundated in "relatively frequent" events
		NA	2) Where beaver dams are present they are active and stable
X			3) Sinuosity, width/depth ratio, and gradient are in balance with the landscape setting (i.e., landform, geology, and bioclimatic region)
	X		4) Riparian-wetland area is widening or has achieved potential extent
			5) Upland watershed is not contributing to riparian-wetland degradation

Yes	No	N/A	VEGETATION	
	X		6) There is diverse age-class distribution of riparian-wetland vegetation (recruitment for maintenance/recovery)	
	X		7) There is diverse composition of riparian-wetland vegetation (for maintenance/recovery)	
X			8) Species present indicate maintenance of riparian-wetland soil moisture characteristics	
X			9) Streambank vegetation is comprised of those plants or plant communities that have root masses capable of withstanding high-streamflow events	not on new channel
X			10) Riparian-wetland plants exhibit high vigor	
	X		11) Adequate riparian-wetland vegetative cover is present to protect banks and dissipate energy during high flows	new channel
	X		12) Plant communities are an adequate source of coarse and/or large woody material (for maintenance/recovery)	

Yes	No	N/A	EROSION/DEPOSITION
X			13) Floodplain and channel characteristics (i.e., rocks, overflow channels, coarse and/or large woody material) are adequate to dissipate energy
X			14) Point bars are revegetating with riparian-wetland vegetation
	X		15) Lateral stream movement is associated with natural sinuosity
X			16) System is vertically stable
			17) Stream is in balance with the water and sediment being supplied by the watershed (i.e., no excessive erosion or deposition)

(Revised 1998)

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Remarks

~~Left Bank~~ bed
~~Channel~~ Stream downstream of new channel has widened.
- Blown out Area at Island.
- ~~Both~~ Banks Below new channel is recent ~~Above~~ but does not have Equilibrium new channel formation

Summary Determination

Functional Rating:

Proper Functioning Condition	___
Functional—At Risk	X
Nonfunctional	___
Unknown	___

Trend for Functional—At Risk:

Upward	___ → Some areas below new channel upward
Downward	X
Not Apparent	___

Are factors contributing to unacceptable conditions outside the control of the manager?

Yes	___
No	X

If yes, what are those factors?

___ Flow regulations ___ Mining activities ___ Upstream channel conditions
___ Channelization ___ Road encroachment ___ Oil field water discharge
___ Augmented flows ___ Other (specify)_____

HABITAT ASSESSMENT FIELD DATA SHEET—HIGH GRADIENT STREAMS (FRONT)

STREAM NAME Tomichi Creek	LOCATION Segment #5 + 9
STATION #_____ RIVERMILE_____	STREAM CLASS
LAT_____ LONG_____	RIVER BASIN Gunnison
STORET #	AGENCY UBRUCD
INVESTIGATORS RH TL	
FORM COMPLETED BY	DATE 28-Sept-2011 TIME _____ AM PM / REASON FOR SURVEY Stream Asses

L: 38.5332, -106.9269
S: 38.5304, -106.9289

Extend on Aerial → 90 CFS

Parameters to be evaluated in sampling reach	Habitat Parameter	Condition Category: Optimal	Suboptimal	Marginal	Poor
	1. Epifaunal Substrate/ Available Cover	Greater than 70% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient).	40-70% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale).	20-40% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 20% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
	SCORE	20 19 18 17 16	15 14 (13) 12 11	10 9 8 7 6	5 4 3 2 1 0
	2. Embeddedness	Gravel, cobble, and boulder particles are 0-25% surrounded by fine sediment. Layering of cobble provides diversity of niche space.	Gravel, cobble, and boulder particles are 25-50% surrounded by fine sediment.	Gravel, cobble, and boulder particles are 50-75% surrounded by fine sediment.	Gravel, cobble, and boulder particles are more than 75% surrounded by fine sediment.
	SCORE	20 19 18 17 16	15 14 (13) 12 11	10 9 8 7 6	5 4 3 2 1 0
	3. Velocity/Depth Regime	All four velocity/depth regimes present (slow-deep, slow-shallow, fast-deep, fast-shallow). (Slow is < 0.3 m/s, deep is > 0.5 m.)	Only 3 of the 4 regimes present (if fast-shallow is missing, score lower than if missing other regimes).	Only 2 of the 4 habitat regimes present (if fast-shallow or slow-shallow are missing, score low).	Dominated by 1 velocity/ depth regime (usually slow-deep).
	SCORE	20 19 18 17 16	15 14 (13) 12 11	10 9 8 7 6	5 4 3 2 1 0
	4. Sediment Deposition	Little or no enlargement of islands or point bars and less than 5% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 5-30% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 30-50% of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; more than 50% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
	SCORE	20 19 18 17 16	15 14 (13) 12 11	10 9 8 7 6	5 4 3 2 1 0
	5. Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills >75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
	SCORE	20 19 18 17 (16)	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0

new channel not colonized

HABITAT ASSESSMENT FIELD DATA SHEET—HIGH GRADIENT STREAMS (BACK)

Parameters to be evaluated broader than sampling reach

Habitat Parameter	Condition Category: Optimal	Suboptimal	Marginal	Poor
6. Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr) may be present, but recent channelization is not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.
SCORE	20 19 18 (17) 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
7. Frequency of Riffles (or bends)	Occurrence of riffles relatively frequent; ratio of distance between riffles divided by width of the stream <7:1 (generally 5 to 7); variety of habitat is key. In streams where riffles are continuous, placement of boulders or other large, natural obstruction is important.	Occurrence of riffles infrequent; distance between riffles divided by the width of the stream is between 7 to 15.	Occasional riffle or bend; bottom contours provide some habitat; distance between riffles divided by the width of the stream is between 15 to 25.	Generally all flat water or shallow riffles; poor habitat; distance between riffles divided by the width of the stream is a ratio of >25.
SCORE	20 19 18 17 16	15 14 (13) 12 11	10 9 8 7 6	5 4 3 2 1 0
8. Bank Stability (score each bank) Note: determine left or right side by facing downstream.	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.
SCORE 2 (LB)	Left Bank 10 9	8 7 6	5 4 3	(2) 1 0
SCORE 4 (RB)	Right Bank 10 9	8 7 6	5 (4) 3	2 1 0
9. Vegetative Protection (score each bank)	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
SCORE 2 (LB)	Left Bank 10 9	8 7 6	5 4 3	(2) 1 0
SCORE 4 (RB)	Right Bank 10 9	8 7 6	5 (4) 3	2 1 0
10. Riparian Vegetative Zone Width (score each bank riparian zone)	Width of riparian zone >18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone.	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6-12 meters; human activities have impacted zone a great deal.	Width of riparian zone <6 meters: little or no riparian vegetation due to human activities.
SCORE 2 (LB)	Left Bank 10 9	8 7 6	5 4 3	(2) 1 0
SCORE 4 (RB)	Right Bank 10 9	8 7 6	5 (4) 3	2 1 0

Okay except Diversion Area

Right Bank Better

Some fence exclusion left Bank

Right Bank Better

One good RFC area on RB

Total Score 116

48

103 CFS

Standard Checklist

Name of Riparian-Wetland Area: Tomichi Creek

Date: 26-Sept-2011 Segment/Reach ID: Segment #6

FAR = 1.32
PFC = 0.4
NF = 1657 LF

X Miles: 0.44mi, 2316LF Acres: 1.72

ID Team Observers: KA, TL

Yes	No	N/A	HYDROLOGY
X			1) Floodplain above bankfull is inundated in "relatively frequent" events
		NA	2) Where beaver dams are present they are active and stable
	X		3) Sinuosity, width/depth ratio, and gradient are in balance with the landscape setting (i.e., landform, geology, and bioclimatic region)
X			4) Riparian-wetland area is widening or has achieved potential extent
X			5) Upland watershed is not contributing to riparian-wetland degradation

Too wide

Yes	No	N/A	VEGETATION
	X		6) There is diverse age-class distribution of riparian-wetland vegetation (recruitment for maintenance/recovery)
	X		7) There is diverse composition of riparian-wetland vegetation (for maintenance/recovery)
X			8) Species present indicate maintenance of riparian-wetland soil moisture characteristics
X			9) Streambank vegetation is comprised of those plants or plant communities that have root masses capable of withstanding high-streamflow events
X			10) Riparian-wetland plants exhibit high vigor
	X		11) Adequate riparian-wetland vegetative cover is present to protect banks and dissipate energy during high flows
X			12) Plant communities are an adequate source of coarse and/or large woody material (for maintenance/recovery)

Yes	No	N/A	EROSION/DEPOSITION
	X		13) Floodplain and channel characteristics (i.e., rocks, overflow channels, coarse and/or large woody material) are adequate to dissipate energy
X			14) Point bars are revegetating with riparian-wetland vegetation
X			15) Lateral stream movement is associated with natural sinuosity
X			16) System is vertically stable
X			17) Stream is in balance with the water and sediment being supplied by the watershed (i.e., no excessive erosion or deposition)

(Revised 1998)

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Remarks

Stream appears to be widening
Stream bed homogenous flow type
Riparian veg appears to be widening
- Grazing Management
- minimal evidence of riparian grazing
- Some areas excluded with fencing.
- Graze practices may be different
- Small willow prevalent along Banks w/a few large willow present
- Point bars minimal vegetated
- no medium age class willows

Stream level at green line at 103 CFS Flow

Summary Determination

Functional Rating:

Proper Functioning Condition	___
Functional—At Risk	X
Nonfunctional	___
Unknown	___

Trend for Functional—At Risk:

Upward	X
Downward	___
Not Apparent	___

Are factors contributing to unacceptable conditions outside the control of the manager?

Yes	___
No	X

If yes, what are those factors?

___ Flow regulations ___ Mining activities ___ Upstream channel conditions
___ Channelization ___ Road encroachment ___ Oil field water discharge
___ Augmented flows ___ Other (specify)___

64

HABITAT ASSESSMENT FIELD DATA SHEET—HIGH GRADIENT STREAMS (FRONT)

STREAM NAME Tomichi Creek		LOCATION Tomich creek segment #6	
STATION # #6	RIVERMILE	STREAM CLASS	
LAT 38.5284	LONG -106.9303	RIVER BASIN Gunnison	
STORET #		AGENCY UGRWCD	
INVESTIGATORS KA, TL			
FORM COMPLETED BY TL		DATE 26-Sept-2011 TIME 15:17 AM PM	REASON FOR SURVEY Riparian Assess.

103 CFS

Parameters to be evaluated in sampling reach

Habitat Parameter	Condition Category: Optimal	Suboptimal	Marginal	Poor
1. Epifaunal Substrate/ Available Cover	Greater than 70% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient).	40-70% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale).	20-40% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 20% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
SCORE	20 19 18 17 16	15 14 13 (12) 11	10 9 8 7 6	5 4 3 2 1 0
2. Embeddedness	Gravel, cobble, and boulder particles are 0-25% surrounded by fine sediment. Layering of cobble provides diversity of niche space.	Gravel, cobble, and boulder particles are 25-50% surrounded by fine sediment.	Gravel, cobble, and boulder particles are 50-75% surrounded by fine sediment.	Gravel, cobble, and boulder particles are more than 75% surrounded by fine sediment.
SCORE	20 19 18 17 16	15 14 13 (12) 11	10 9 8 7 6	5 4 3 2 1 0
3. Velocity/Depth Regime	All four velocity/depth regimes present (slow-deep, slow-shallow, fast-deep, fast-shallow). (Slow is < 0.3 m/s, deep is > 0.5 m.)	Only 3 of the 4 regimes present (if fast-shallow is missing, score lower than if missing other regimes).	Only 2 of the 4 habitat regimes present (if fast-shallow or slow-shallow are missing, score low).	Dominated by 1 velocity/ depth regime (usually slow-deep).
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 (3) 2 1 0
4. Sediment Deposition	Little or no enlargement of islands or point bars and less than 5% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 5-30% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 30-50% of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; more than 50% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
SCORE	20 19 18 17 16	15 (14) 13 12 11	10 9 8 7 6	5 4 3 2 1 0
5. Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills >75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
SCORE	20 19 18 (17) 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0

Smooth flow lack Diversity of flow ty

Friction off

Rapid Bioassessment Protocols For Use in Streams and Wadeable Rivers: Periphyton, Benthic Macroinvertebrates, and Fish, Second Edition - Form 2 A-7

HABITAT ASSESSMENT FIELD DATA SHEET—HIGH GRADIENT STREAMS (BACK)

Parameters to be evaluated broader than sampling reach

Habitat Parameter	Condition Category: Optimal	Suboptimal	Marginal	Poor
6. Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr) may be present, but recent channelization is not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.
SCORE	20 19 18 17 16	15 14 (13) 12 11	10 9 8 7 6	5 4 3 2 1 0
7. Frequency of Riffles (or bends)	Occurrence of riffles relatively frequent; ratio of distance between riffles divided by width of the stream <7:1 (generally 5 to 7); variety of habitat is key. In streams where riffles are continuous, placement of boulders or other large, natural obstruction is important.	Occurrence of riffles infrequent; distance between riffles divided by the width of the stream is between 7 to 15.	Occasional riffle or bend; bottom contours provide some habitat; distance between riffles divided by the width of the stream is between 15 to 25.	Generally all flat water or shallow riffles; poor habitat; distance between riffles divided by the width of the stream is a ratio of >25.
SCORE	20 19 18 17 16	15 14 (13) 12 11	10 9 8 7 6	5 4 3 2 1 0
8. Bank Stability (score each bank) Note: determine left or right side by facing downstream.	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.
SCORE 7 (LB) Left Bank	10 9	8 (7) 6	5 4 3	2 1 0
SCORE 7 (RB) Right Bank	10 9	8 (7) 6	5 4 3	2 1 0
9. Vegetative Protection (score each bank)	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
SCORE 7 (LB) Left Bank	10 9	8 (7) 6	5 4 3	2 1 0
SCORE 7 (RB) Right Bank	10 9	8 (7) 6	5 4 3	2 1 0
10. Riparian Vegetative Zone Width (score each bank riparian zone)	Width of riparian zone >18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone.	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6-12 meters; human activities have impacted zone a great deal.	Width of riparian zone <6 meters: little or no riparian vegetation due to human activities.
SCORE 3 (LB) Left Bank	10 9	8 7 6	5 4 (3)	2 1 0
SCORE 3 (RB) Right Bank	10 9	8 7 6	5 4 (3)	2 1 0

Total Score 118

Standard Checklist

Name of Riparian-Wetland Area: Tomichi Creek

Date: 3-Oct-2011 (7 = 10.66mi, 3490 LF) Segment/Reach ID: 7+8 (7 = 3.33)

Miles: Bk = 0.50mi, 2604LF Acres: 8 = 4.72

7: RAR = 2.76, PFC = .57, NF 279LF — 8: RAR 3.22, PFC 1.5, NF 1011 LF

ID Team Observers: KA, TL

78 CFS

Yes	No	N/A	HYDROLOGY
X			1) Floodplain above bankfull is inundated in "relatively frequent" events
		N/A	2) Where beaver dams are present they are active and stable
X			3) Sinuosity, width/depth ratio, and gradient are in balance with the landscape setting (i.e., landform, geology, and bioclimatic region)
	X		4) Riparian-wetland area is widening or has achieved potential extent
			5) Upland watershed is not contributing to riparian-wetland degradation

Yes	No	N/A	VEGETATION
	X		6) There is diverse age-class distribution of riparian-wetland vegetation (recruitment for maintenance/recovery)
X			7) There is diverse composition of riparian-wetland vegetation (for maintenance/recovery)
X			8) Species present indicate maintenance of riparian-wetland soil moisture characteristics
X			9) Streambank vegetation is comprised of those plants or plant communities that have root masses capable of withstanding high-streamflow events
X			10) Riparian-wetland plants exhibit high vigor
	X		11) Adequate riparian-wetland vegetative cover is present to protect banks and dissipate energy during high flows
	X		12) Plant communities are an adequate source of coarse and/or large woody material (for maintenance/recovery)

Yes	No	N/A	EROSION/DEPOSITION
	X		13) Floodplain and channel characteristics (i.e., rocks, overflow channels, coarse and/or large woody material) are adequate to dissipate energy
	X		14) Point bars are revegetating with riparian-wetland vegetation
X			15) Lateral stream movement is associated with natural sinuosity
	X		16) System is vertically stable
			17) Stream is in balance with the water and sediment being supplied by the watershed (i.e., no excessive erosion or deposition)

(Revised 1998)

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Remarks

- Stream continues to widen
* Evidence of old channelization where meandy Bend are cut
- Small pockets of PFC
- Narrow Riparian especially Along Hwy Pasture
- Flows seasonally decreasing
- Some Stream bank protected by Fencing
- Noticeable difference in veg.
- Many areas of Agricultural and Natural wetlands in pastures Extensive
- Collapsing Banks
- Irrigate off and most Slough and Adjacent wetlands Prairie up.

Summary Determination

Functional Rating:

Proper Functioning Condition	
Functional—At Risk	X
Nonfunctional	
Unknown	

Trend for Functional—At Risk:

7 Isolated

Upward	- Where protected from Grazing
Downward	X
Not Apparent	

Are factors contributing to unacceptable conditions outside the control of the manager?

Yes	
No	X

If yes, what are those factors?

___ Flow regulations	___ Mining activities	___ Upstream channel conditions
___ Channelization	___ Road encroachment	___ Oil field water discharge
___ Augmented flows	___ Other (specify)_____	

HABITAT ASSESSMENT FIELD DATA SHEET—HIGH GRADIENT STREAMS (FRONT)

STREAM NAME Tomichi	LOCATION Segment #7+8 Bridge to Bridge		
STATION # _____ RIVERMILE _____	STREAM CLASS C3		
LAT 38.5223 LONG -106.9370	RIVER BASIN Gunnison		
STORET #	AGENCY UGRWCD		
INVESTIGATORS KA, TL			
FORM COMPLETED BY TL	DATE 3-Oct-2011 TIME 15:26 AM PM	REASON FOR SURVEY Stream Assess	

78 CFS

Parameters to be evaluated in sampling reach

Habitat Parameter	Condition Category			
	Optimal	Suboptimal	Marginal	Poor
1. Epifaunal Substrate/ Available Cover	Greater than 70% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient).	40-70% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale).	20-40% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 20% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
SCORE	20 19 18 17 16	15 14 13 (12) 11	10 9 8 7 6	5 4 3 2 1 0
2. Embeddedness	Gravel, cobble, and boulder particles are 0-25% surrounded by fine sediment. Layering of cobble provides diversity of niche space.	Gravel, cobble, and boulder particles are 25-50% surrounded by fine sediment.	Gravel, cobble, and boulder particles are 50-75% surrounded by fine sediment.	Gravel, cobble, and boulder particles are more than 75% surrounded by fine sediment.
SCORE	20 19 18 17 16	15 14 13 (12) 11	10 9 8 7 6	5 4 3 2 1 0
3. Velocity/Depth Regime	All four velocity/depth regimes present (slow-deep, slow-shallow, fast-deep, fast-shallow). (Slow is < 0.3 m/s, deep is > 0.5 m.)	Only 3 of the 4 regimes present (if fast-shallow is missing, score lower than if missing other regimes).	Only 2 of the 4 habitat regimes present (if fast-shallow or slow-shallow are missing, score low).	Dominated by 1 velocity/ depth regime (usually slow-deep).
SCORE	20 19 18 17 16	15 14 13 (12) 11	10 9 8 7 6	5 4 3 2 1 0
4. Sediment Deposition	Little or no enlargement of islands or point bars and less than 5% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 5-30% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 30-50% of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; more than 50% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
SCORE	20 19 18 17 16	15 14 13 12 (11)	10 9 8 7 6	5 4 3 2 1 0
5. Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills >75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
SCORE	20 19 18 17 16	15 14 (13) 12 11	10 9 8 7 6	5 4 3 2 1 0

60 flows decrease seasonally

HABITAT ASSESSMENT FIELD DATA SHEET—HIGH GRADIENT STREAMS (BACK)

Parameters to be evaluated broader than sampling reach

Habitat Parameter	Condition Category: Optimal	Condition Category: Suboptimal	Condition Category: Marginal	Condition Category: Poor
6. Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr) may be present, but recent channelization is not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.
SCORE	20 19 18 17 16	15 14 13 (12) 11	10 9 8 7 6	5 4 3 2 1 0
7. Frequency of Riffles (or bends)	Occurrence of riffles relatively frequent; ratio of distance between riffles divided by width of the stream <7:1 (generally 5 to 7); variety of habitat is key. In streams where riffles are continuous, placement of boulders or other large, natural obstruction is important.	Occurrence of riffles infrequent; distance between riffles divided by the width of the stream is between 7 to 15..	Occasional riffle or bend; bottom contours provide some habitat; distance between riffles divided by the width of the stream is between 15 to 25.	Generally all flat water or shallow riffles; poor habitat; distance between riffles divided by the width of the stream is a ratio of >25.
SCORE	20 19 18 17 (16)	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
8. Bank Stability (score each bank) Note: determine left or right side by facing downstream.	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.
SCORE 4 (LB)	Left Bank 10 9	8 7 6	5 (4) 3	2 1 0
SCORE 4 (RB)	Right Bank 10 9	8 7 6	5 (4) 3	2 1 0
9. Vegetative Protection (score each bank)	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
SCORE ___ (LB)	Left Bank 10 9	8 7 6	(5) 4 3	2 1 0
SCORE ___ (RB)	Right Bank 10 9	8 7 6	(5) 4 3	2 1 0
10. Riparian Vegetative Zone Width (score each bank riparian zone)	Width of riparian zone >18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone.	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6-12 meters; human activities have impacted zone a great deal.	Width of riparian zone <6 meters: little or no riparian vegetation due to human activities.
SCORE ___ (LB)	Left Bank 10 9	8 7 6	5 4 3	2 (1) 0
SCORE ___ (RB)	Right Bank 10 9	8 7 6	5 4 3	2 (1) 0

Shallow and wider Riffle more Abundant Than normal

Total Score 108

A-8 *Appendix A-1: Habitat Assessment and Physicochemical Characterization Field Data Sheets - Form 2*

Standard Checklist

Name of Riparian-Wetland Area: Tomichi Creek

Date: 10-Oct-2011 Segment/Reach ID: Segment ~~#~~ 9

* Miles: 1.17mi, 6193 LF Acres: 28.52 — PFC

ID Team Observers: RA, TL

98 CFS

Yes	No	N/A	HYDROLOGY
X			1) Floodplain above bankfull is inundated in "relatively frequent" events
X			2) Where beaver dams are present they are active and stable
X			3) Sinuosity, width/depth ratio, and gradient are in balance with the landscape setting (i.e., landform, geology, and bioclimatic region)
X			4) Riparian-wetland area is widening or has achieved potential extent
*			5) Upland watershed is not contributing to riparian-wetland degradation

Yes	No	N/A	VEGETATION
X			6) There is diverse age-class distribution of riparian-wetland vegetation (recruitment for maintenance/recovery)
X			7) There is diverse composition of riparian-wetland vegetation (for maintenance/recovery)
X			8) Species present indicate maintenance of riparian-wetland soil moisture characteristics
X			9) Streambank vegetation is comprised of those plants or plant communities that have root masses capable of withstanding high-streamflow events
X			10) Riparian-wetland plants exhibit high vigor
X			11) Adequate riparian-wetland vegetative cover is present to protect banks and dissipate energy during high flows
X			12) Plant communities are an adequate source of coarse and/or large woody material (for maintenance/recovery)

Yes	No	N/A	EROSION/DEPOSITION
X			13) Floodplain and channel characteristics (i.e., rocks, overflow channels, coarse and/or large woody material) are adequate to dissipate energy
X			14) Point bars are revegetating with riparian-wetland vegetation
X			15) Lateral stream movement is associated with natural sinuosity
X			16) System is vertically stable
X			17) Stream is in balance with the water and sediment being supplied by the watershed (i.e., no excessive erosion or deposition)

(Revised 1998)

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Remarks

Upward trend throughout due to non-grazing Practices
Good example of Riparian restoration
- Channel Switch
Cottonwoods potential to return to Banks
Restored channel Banks recovering w/some Shrub tree recruitment + starts.
Finally, some LWD in stream bed
Channel narrowing / stream becoming deeper in narrowed area
Willow recovering from historic livestock Browsing
- Restored old channel
- Fine Dam Formation Below Gold Basin Road

Summary Determination

Functional Rating:

Proper Functioning Condition	X
Functional—At Risk	
Nonfunctional	
Unknown	

Trend for Functional—At Risk:

Upward	X
Downward	
Not Apparent	

Are factors contributing to unacceptable conditions outside the control of the manager?

Yes	
No	X

If yes, what are those factors?

___ Flow regulations	___ Mining activities	___ Upstream channel conditions
___ Channelization	___ Road encroachment	___ Oil field water discharge
___ Augmented flows	___ Other (specify)_____	

HABITAT ASSESSMENT FIELD DATA SHEET—HIGH GRADIENT STREAMS (FRONT)

STREAM NAME Tomichi Creek		LOCATION Segment ~~Reach~~ #9	
STATION # _____ RIVERMILE _____		STREAM CLASS	
* LAT 38.5174 LONG -106.9947		RIVER BASIN Gunnison	
STORET #		AGENCY UCRWCD	
INVESTIGATORS KA, TL			
FORM COMPLETED BY TL	DATE 10-Oct-2011 TIME 1404 AM PM	REASON FOR SURVEY Stream Assess.	

98 cfs

Parameters to be evaluated in sampling reach

Habitat Parameter	Condition Category: Optimal	Suboptimal	Marginal	Poor
1. Epifaunal Substrate/ Available Cover	Greater than 70% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient).	40-70% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale).	20-40% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 20% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
SCORE	20 19 (18) 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
2. Embeddedness	Gravel, cobble, and boulder particles are 0-25% surrounded by fine sediment. Layering of cobble provides diversity of niche space.	Gravel, cobble, and boulder particles are 25-50% surrounded by fine sediment.	Gravel, cobble, and boulder particles are 50-75% surrounded by fine sediment.	Gravel, cobble, and boulder particles are more than 75% surrounded by fine sediment.
SCORE	20 19 18 17 (16)	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
3. Velocity/Depth Regime	All four velocity/depth regimes present (slow-deep, slow-shallow, fast-deep, fast-shallow). (Slow is < 0.3 m/s, deep is > 0.5 m.)	Only 3 of the 4 regimes present (if fast-shallow is missing, score lower than if missing other regimes).	Only 2 of the 4 habitat regimes present (if fast-shallow or slow-shallow are missing, score low).	Dominated by 1 velocity/ depth regime (usually slow-deep).
SCORE	20 19 (18) 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
4. Sediment Deposition	Little or no enlargement of islands or point bars and less than 5% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 5-30% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 30-50% of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; more than 50% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
SCORE	20 19 18 17 16	(15) 14 (13) 12 11	10 9 8 7 6	5 4 3 2 1 0
5. Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills >75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
SCORE	20 19 (18) 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0

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HABITAT ASSESSMENT FIELD DATA SHEET—HIGH GRADIENT STREAMS (BACK)

Parameters to be evaluated broader than sampling reach

Habitat Parameter	Condition Category: Optimal	Suboptimal	Marginal	Poor
6. Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr) may be present, but recent channelization is not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.
SCORE	20 19 18 17 16	(15) 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
7. Frequency of Riffles (or bends)	Occurrence of riffles relatively frequent; ratio of distance between riffles divided by width of the stream <7:1 (generally 5 to 7); variety of habitat is key. In streams where riffles are continuous, placement of boulders or other large, natural obstruction is important.	Occurrence of riffles infrequent; distance between riffles divided by the width of the stream is between 7 to 15.	Occasional riffle or bend; bottom contours provide some habitat; distance between riffles divided by the width of the stream is between 15 to 25.	Generally all flat water or shallow riffles; poor habitat; distance between riffles divided by the width of the stream is a ratio of >25.
SCORE	20 19 18 17 16	(15) 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
8. Bank Stability (score each bank) Note: determine left or right side by facing downstream.	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.
SCORE ___ (LB)	Left Bank (10) 9	8 7 6	5 4 3	2 1 0
SCORE ___ (RB)	Right Bank (10) 9	8 7 6	5 4 3	2 1 0
9. Vegetative Protection (score each bank)	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
SCORE ___ (LB)	Left Bank (10) 9	8 7 6	5 4 3	2 1 0
SCORE ___ (RB)	Right Bank (10) 9	8 7 6	5 4 3	2 1 0
10. Riparian Vegetative Zone Width (score each bank riparian zone)	Width of riparian zone >18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone.	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6-12 meters; human activities have impacted zone a great deal.	Width of riparian zone <6 meters: little or no riparian vegetation due to human activities.
SCORE ___ (LB)	Left Bank 10 9	(8) 7 6	5 4 3	2 1 0
SCORE ___ (RB)	Right Bank 10 (9)	8 7 6	5 4 3	2 1 0

no channel restored

89

Total Score 183

Standard Checklist

Name of Riparian-Wetland Area: Tomichi Creek

Date: 10 oct 2011 Segment/Reach ID: Segment 10 FAR 2.0% 0.4 APC 98% 14.87 NF 52% LF

Miles: 104 mi, 5531LF Acres:

ID Team Observers: KA, TL

95cfs

Yes	No	N/A	HYDROLOGY
X			1) Floodplain above bankfull is inundated in "relatively frequent" events
		N/A	2) Where beaver dams are present they are active and stable
X			3) Sinuosity, width/depth ratio, and gradient are in balance with the landscape setting (i.e., landform, geology, and bioclimatic region)
	X		4) Riparian-wetland area is widening or has achieved potential extent
			5) Upland watershed is not contributing to riparian-wetland degradation

Yes	No	N/A	VEGETATION
X			6) There is diverse age-class distribution of riparian-wetland vegetation (recruitment for maintenance/recovery)
X			7) There is diverse composition of riparian-wetland vegetation (for maintenance/recovery)
X			8) Species present indicate maintenance of riparian-wetland soil moisture characteristics
X			9) Streambank vegetation is comprised of those plants or plant communities that have root masses capable of withstanding high-streamflow events
X			10) Riparian-wetland plants exhibit high vigor
X			11) Adequate riparian-wetland vegetative cover is present to protect banks and dissipate energy during high flows
X			12) Plant communities are an adequate source of coarse and/or large woody material (for maintenance/recovery)

Yes	No	N/A	EROSION/DEPOSITION
X			13) Floodplain and channel characteristics (i.e., rocks, overflow channels, coarse and/or large woody material) are adequate to dissipate energy
X			14) Point bars are revegetating with riparian-wetland vegetation
X			15) Lateral stream movement is associated with natural sinuosity
X			16) System is vertically stable
			17) Stream is in balance with the water and sediment being supplied by the watershed (i.e., no excessive erosion or deposition)

(Revised 1998)

Remarks

South Bank

Sim Areas Confined By Geology

- Golf course and associated Dev. Impact North bank near Hwy, Course, Development.

Potential for Sim restoration at new development

- Incentive for bank restoration w/ new Development No loss w/ LUR

Summary Determination

Functional Rating:

Proper Functioning Condition	X
Functional—At Risk	Patches
Nonfunctional	
Unknown	

Trend for Functional—At Risk:

Upward	
Downward	
Not Apparent	X

Are factors contributing to unacceptable conditions outside the control of the manager?

Yes	
No	X

If yes, what are those factors?

___ Flow regulations	___ Mining activities	___ Upstream channel conditions
___ Channelization	___ Road encroachment	___ Oil field water discharge
___ Augmented flows	___ Other (specify)_____	

HABITAT ASSESSMENT FIELD DATA SHEET—HIGH GRADIENT STREAMS (FRONT)

STREAM NAME Tomichi Creek	LOCATION Segment #2 10	
STATION # _____ RIVERMILE _____	STREAM CLASS	
LAT 38.5143 LONG -106.9570	RIVER BASIN Gunnison	
STORET #	AGENCY URRWCD	
INVESTIGATORS KA, TL		
FORM COMPLETED BY TL	DATE 10 Oct 2011 TIME 14:11 AM PM	REASON FOR SURVEY Stream Assess

95 cfs

Parameters to be evaluated in sampling reach

Habitat Parameter	Condition Category: Optimal	Suboptimal	Marginal	Poor
1. Epifaunal Substrate/ Available Cover	Greater than 70% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient).	40-70% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale).	20-40% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 20% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
SCORE	20 19 (18) 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
2. Embeddedness	Gravel, cobble, and boulder particles are 0-25% surrounded by fine sediment. Layering of cobble provides diversity of niche space.	Gravel, cobble, and boulder particles are 25-50% surrounded by fine sediment.	Gravel, cobble, and boulder particles are 50-75% surrounded by fine sediment.	Gravel, cobble, and boulder particles are more than 75% surrounded by fine sediment.
SCORE	20 19 (18) 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
3. Velocity/Depth Regime	All four velocity/depth regimes present (slow-deep, slow-shallow, fast-deep, fast-shallow). (Slow is < 0.3 m/s, deep is > 0.5 m.)	Only 3 of the 4 regimes present (if fast-shallow is missing, score lower than if missing other regimes).	Only 2 of the 4 habitat regimes present (if fast-shallow or slow-shallow are missing, score low).	Dominated by 1 velocity/ depth regime (usually slow-deep).
SCORE	20 19 18 17 16	15 (14) 13 12 11	10 9 8 7 6	5 4 3 2 1 0
4. Sediment Deposition	Little or no enlargement of islands or point bars and less than 5% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 5-30% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 30-50% of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; more than 50% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
SCORE	20 19 (18) 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
5. Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills >75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
SCORE	20 19 (18) 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0

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HABITAT ASSESSMENT FIELD DATA SHEET—HIGH GRADIENT STREAMS (BACK)

Parameters to be evaluated broader than sampling reach

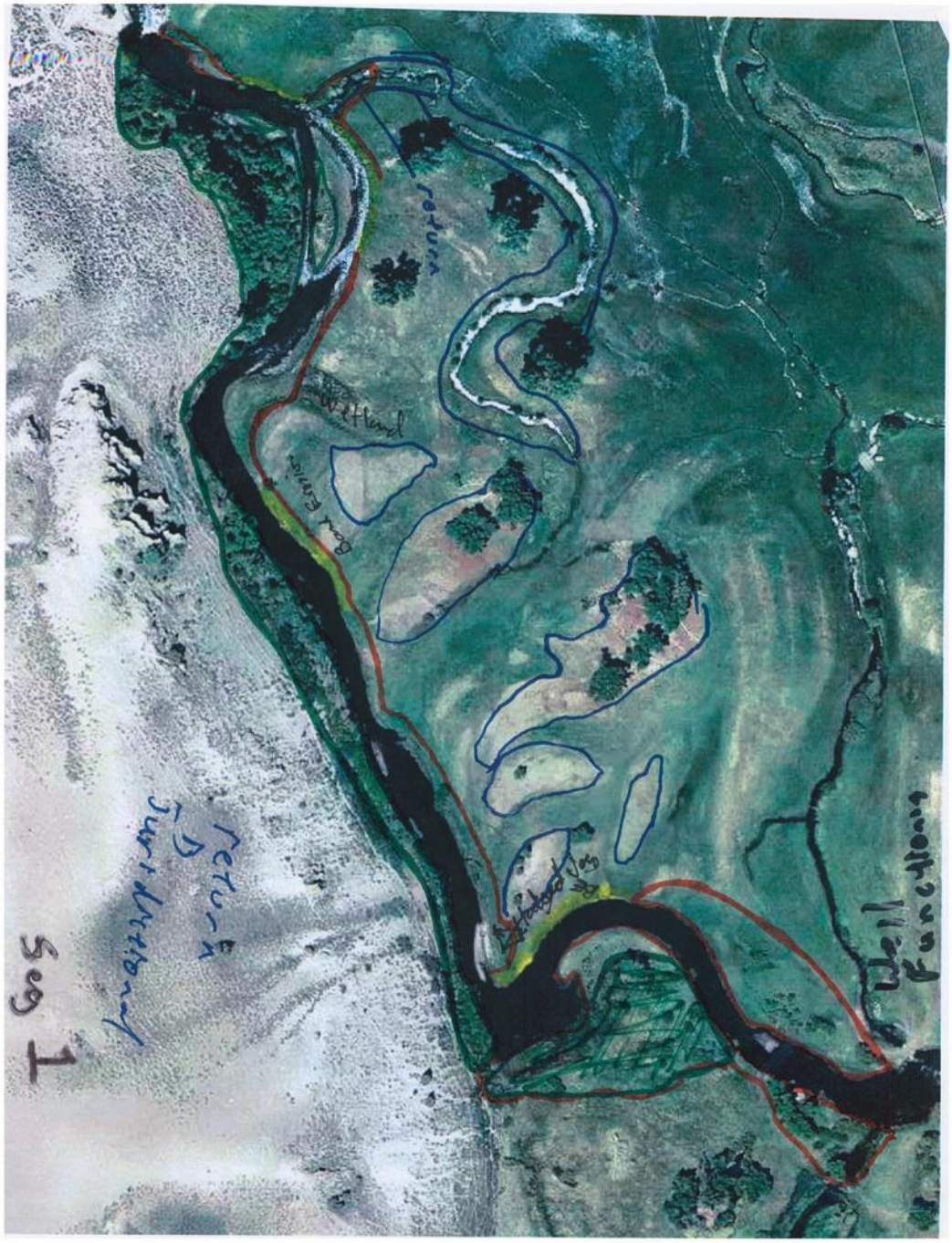
Habitat Parameter	Condition Category: Optimal	Suboptimal	Marginal	Poor
6. Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr) may be present, but recent channelization is not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.
SCORE	20 19 18 (17) 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
7. Frequency of Riffles (or bends)	Occurrence of riffles relatively frequent; ratio of distance between riffles divided by width of the stream <7:1 (generally 5 to 7); variety of habitat is key. In streams where riffles are continuous, placement of boulders or other large, natural obstruction is important.	Occurrence of riffles infrequent; distance between riffles divided by the width of the stream is between 7 to 15.	Occasional riffle or bend; bottom contours provide some habitat; distance between riffles divided by the width of the stream is between 15 to 25.	Generally all flat water or shallow riffles; poor habitat; distance between riffles divided by the width of the stream is a ratio of >25.
SCORE	20 19 18 17 16	15 14 (13) 12 11	10 9 8 7 6	5 4 3 2 1 0
8. Bank Stability (score each bank) Note: determine left or right side by facing downstream.	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.
SCORE ___ (LB)	Left Bank 10 9	(8) 7 6	5 4 3	2 1 0
SCORE ___ (RB)	Right Bank 10 9	(8) 7 6	5 4 3	2 1 0
9. Vegetative Protection (score each bank)	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
SCORE ___ (LB)	Left Bank 10 (9)	(8) 7 6	5 4 3	2 1 0
SCORE ___ (RB)	Right Bank 10 9	8 (7) 6	5 4 3	2 1 0
10. Riparian Vegetative Zone Width (score each bank riparian zone)	Width of riparian zone >18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone.	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6-12 meters; human activities have impacted zone a great deal.	Width of riparian zone <6 meters: little or no riparian vegetation due to human activities.
SCORE ___ (LB)	Left Bank (10) 9	8 7 6	5 4 3	2 1 0
SCORE ___ (RB)	Right Bank 10 9	8 (7) 6	5 4 3	2 1 0

Areas Around Golf now new lower course

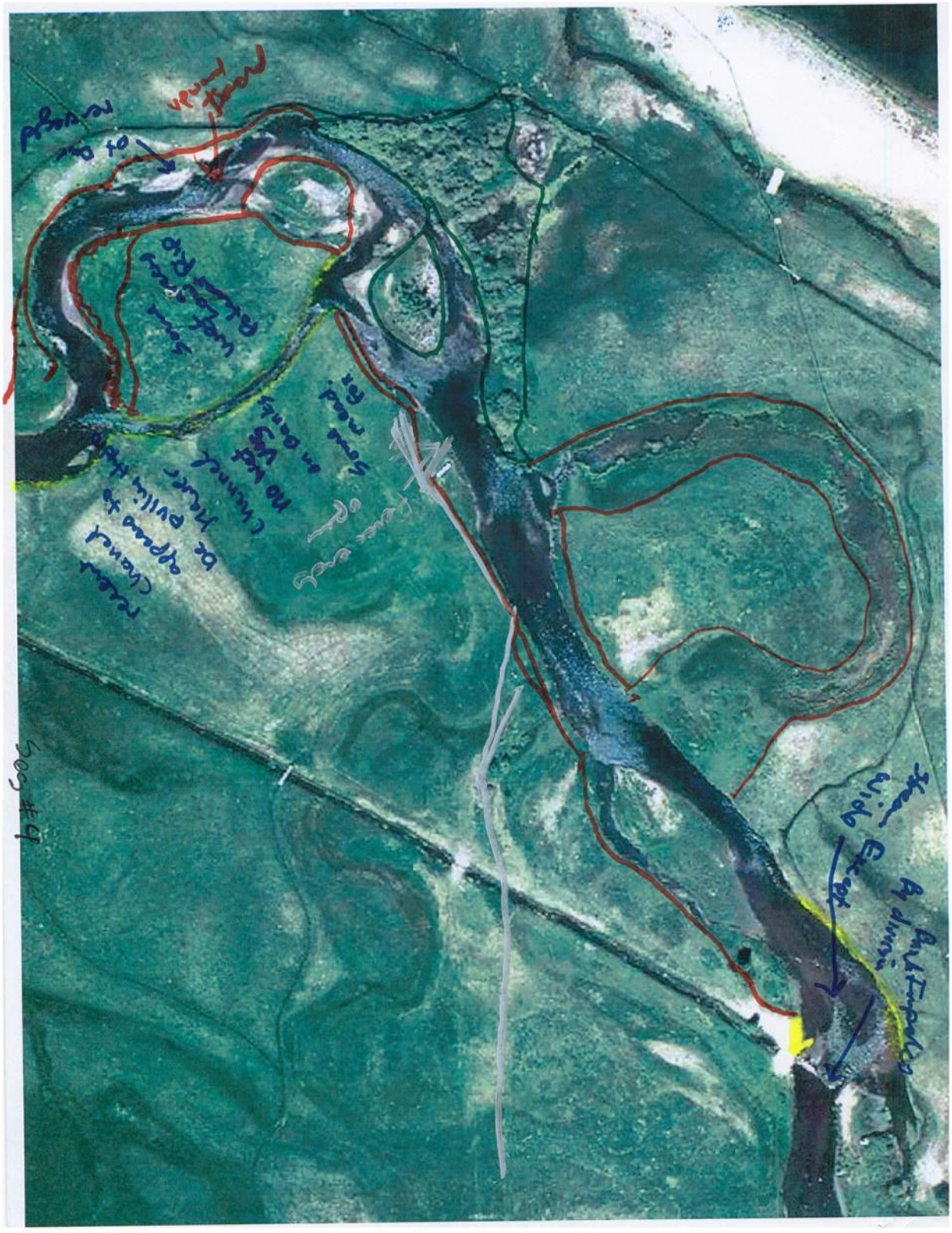
79

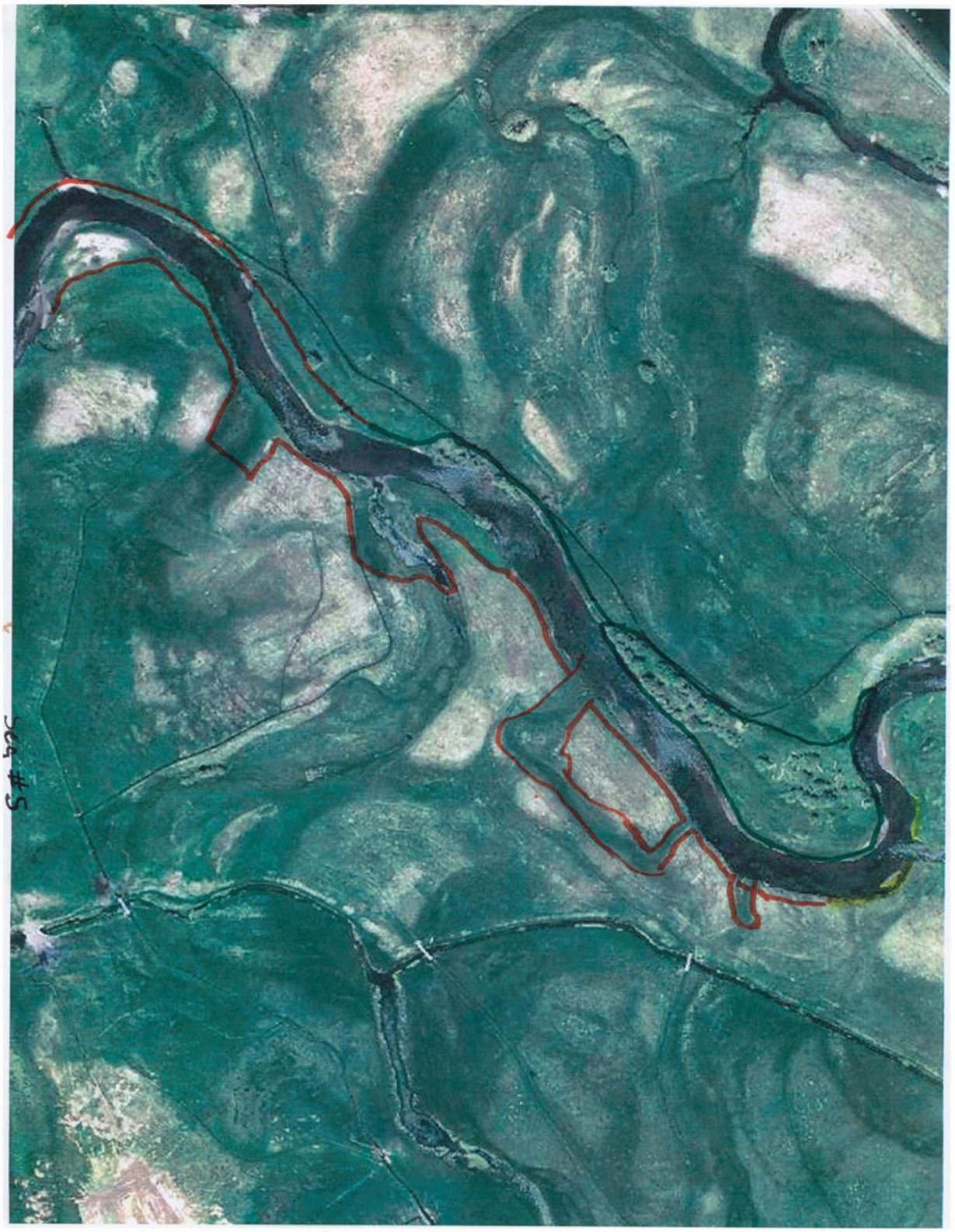
Total Score 175

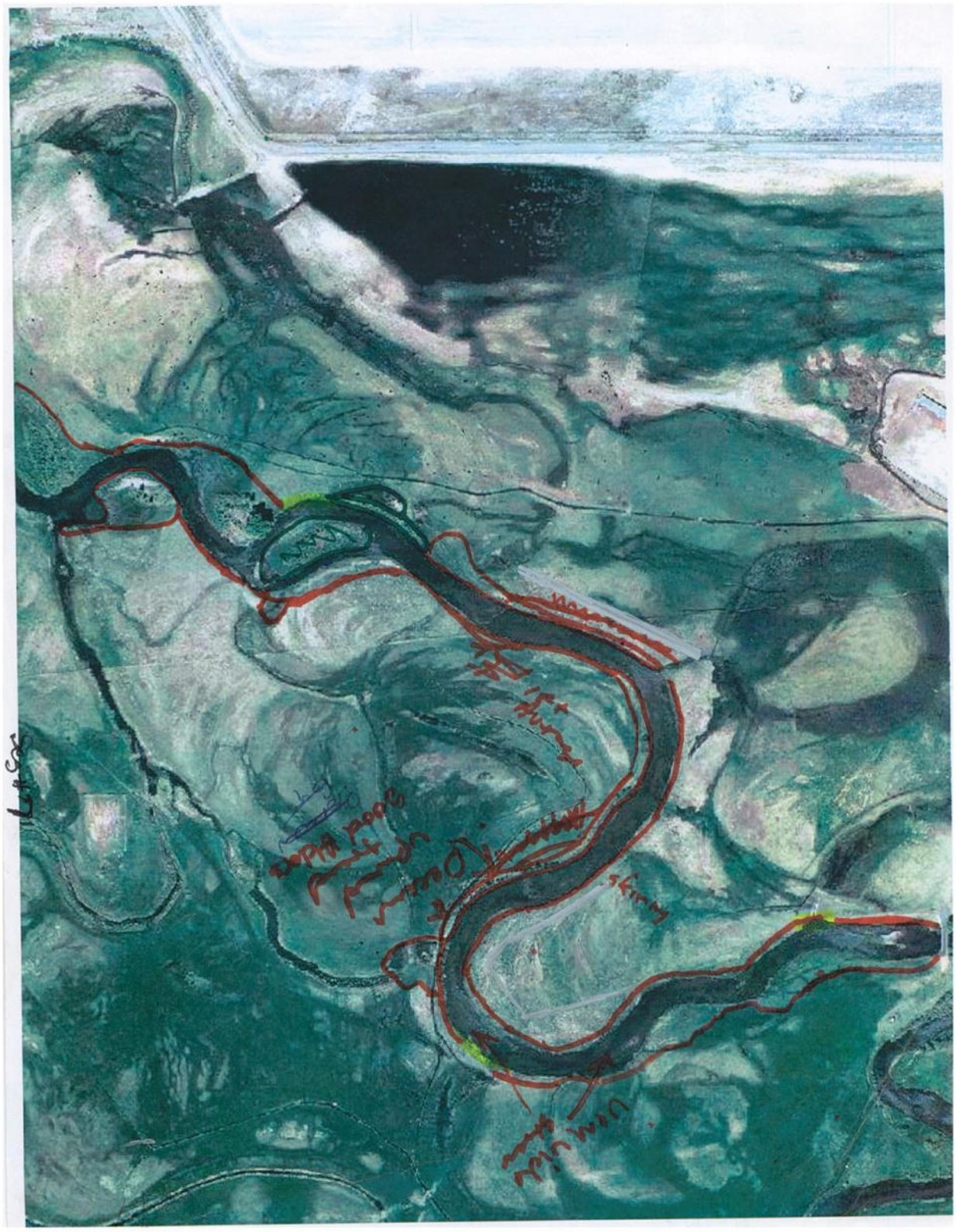
Appendix D. Aerial maps used in assessment segment analysis for lower Tomichi Creek, Gunnison County, CO in September 2011.




Partially reversed
pt. Bar








extra-wide channel?


no Rip