

## LOST MAN CREEK



### Lost Man Creek.

Lost Man Creek headwaters in the Hunter Fryingpan Wilderness of the White River National Forest. Lush willow carrs characterize the valley floor and provide breeding habitat for Wilson's warblers, fox sparrows, Lincoln's sparrows and more. The willow carrs are sustained by overbanking flows during spring snowmelt and by soil moisture from upland snowmelt later in the season. A reservoir, dam and a diversion canal interrupt this natural flow before the stream reaches the Roaring Fork River. Above the reservoir a natural hydrologic regime sustains the stream-riparian ecosystem. Below the dam stream width and depth is decreased, and vegetation is encroaching into the stream channel with little habitat available for aquatic wildlife.

## Lost Man Creek

### 6.7 Lost Man Creek Segment 1: From confluence with Jack Creek to Roaring Fork river.

Number of reaches: 2

Length of segment: 3.2 km.

**General description:** Lost Man Creek headwaters in the Sawatch Mountains at about 12,450' and flows southward for about 8.8 km through a gently sloping glacially carved valley, and occasionally plunging down a rock wall, before reaching Lost Man Reservoir at about 10,600'. This assessment begins where Jack Creek has its confluence with Lost Man Creek at about 10,800'. A low gradient terrain allows the stream to meander widely allowing floodwaters to spread out across the valley, recharging the willow carrs that characterize the riparian zone. Surrounding uplands are a mosaic of spruce-fir forests, avalanche chutes dominated by willow, and rocky outcrops where krummholz islands of spruce and fir make a stand.

Beaver have recently (2003) dammed the mouth of the stream as it enters the reservoir greatly increasing open water and riparian zone width. Upstream of the reservoir human impacts are minimal; a recreation trail runs on the right bank but is outside of the riparian zone for most of its length. However, human impacts at the reservoir and to the stream below the reservoir are severe. Almost all of the water in the reservoir is diverted to the Front Range; only that water which leaks out of the bottom of the dam returns to the stream. Human recreational activity around the reservoir is heavy and has resulted in vegetation trampling and brought litter to the area.

Colorado Natural Heritage program has identified this area as a Potential Conservation Area because of the subalpine willow carr plant community that is, albeit common, in excellent condition here and because of the presence of Colorado cutthroat trout in the stream reaches above the reservoir. Since their report Canada lynx have been reintroduced into Colorado and now frequent the Lost Man drainage.

**Channel condition:** Above the reservoir the channel has its natural shape; sinuosity is high, there is no downcutting or lateral cutting, and there is very minimal vegetation alteration. Dewatering has degraded the channel below the reservoir; the channel is narrowing, straightening and filling with sediment.

**Hydrologic alteration:** Above the diversion a natural hydrologic regime is intact, creating excellent wildlife potential and a potentially important contribution to flows in the Roaring Fork River. Complete diversion of this stream to the Front Range has deleterious impacts on ecosystem functions.

**Riparian habitat:** High quality riparian habitat occurs both above and below the reservoir but is degraded by trampling and disturbance around the reservoir. The entire stream riparian zone is characterized by a mosaic of willow carrs, sedge and rush breaks, marsh marigold and narcissus anemone meadows and open water ponds where beaver have been active.

Below the reservoir dewatering has allowed riparian vegetation to encroach into the stream channel resulting in channel narrowing. Additionally, because overbanking flows no longer occur, soils are drying which is resulting in a change in the plant community.

Colorado Natural Heritage Program has identified the area above the reservoir as a Potential Conservation Area due to the occurrence of a "globally common riparian community" that is in excellent condition. The "excellent condition" of this area is the reason for the designation and results in the area having "high biodiversity significance".

**Wildlife:** Wildlife potential is high because of the "excellent condition" of the riparian habitat and because of the relative lack of disturbance. Excellent habitat conditions, including vegetative structure, age class distribution and plant species diversity creates the circumstances for viable populations of a complete suite of native wildlife including Canada lynx which have been documented in this area.

Breeding neotropical migrant populations are abundant and diverse. A variety of raptors are frequently observed hunting in the valley. Ungulate populations including mule deer and elk are abundant but, due to the abundance of high quality vegetation, have not overgrazed or impacted plant vigor. Small mammals are also abundant and include snowshoe hare, pika, yellow-bellied marmot, chickaree, least chipmunk and northern pocket gopher. Consequently native predator species including pine marten, coyote, and Canada lynx, are also common as indicated by frequently observed sign and direct observation. In the fall of 2005 we observed recent lynx tracks and signs of recent snowshoe hare kill. Black bears and their sign were also commonly observed.

Colorado River cutthroat trout occur in the stream above the reservoir. In this stream the trout population is threatened by competition with brook trout and hybridization with rainbow trout. Cutthroats in the Lost Man drainage are isolated from other cutthroat populations due to habitat fragmentation resulting from stream dewatering below the reservoir. Without genetic exchange from other populations, the long-term viability of the Lost Man population is threatened.

**Threats and management recommendations:** To protect this landscape the ecological processes that support the ecosystem must be preserved; this requires maintaining the entire hydrologic regime that is central to the viability of this watershed. This stream initiates from snowmelt and, later in the season, ground water discharge that originates from snowmelt – any alteration to the surrounding uplands, such as mining, will certainly affect the entire stream system.

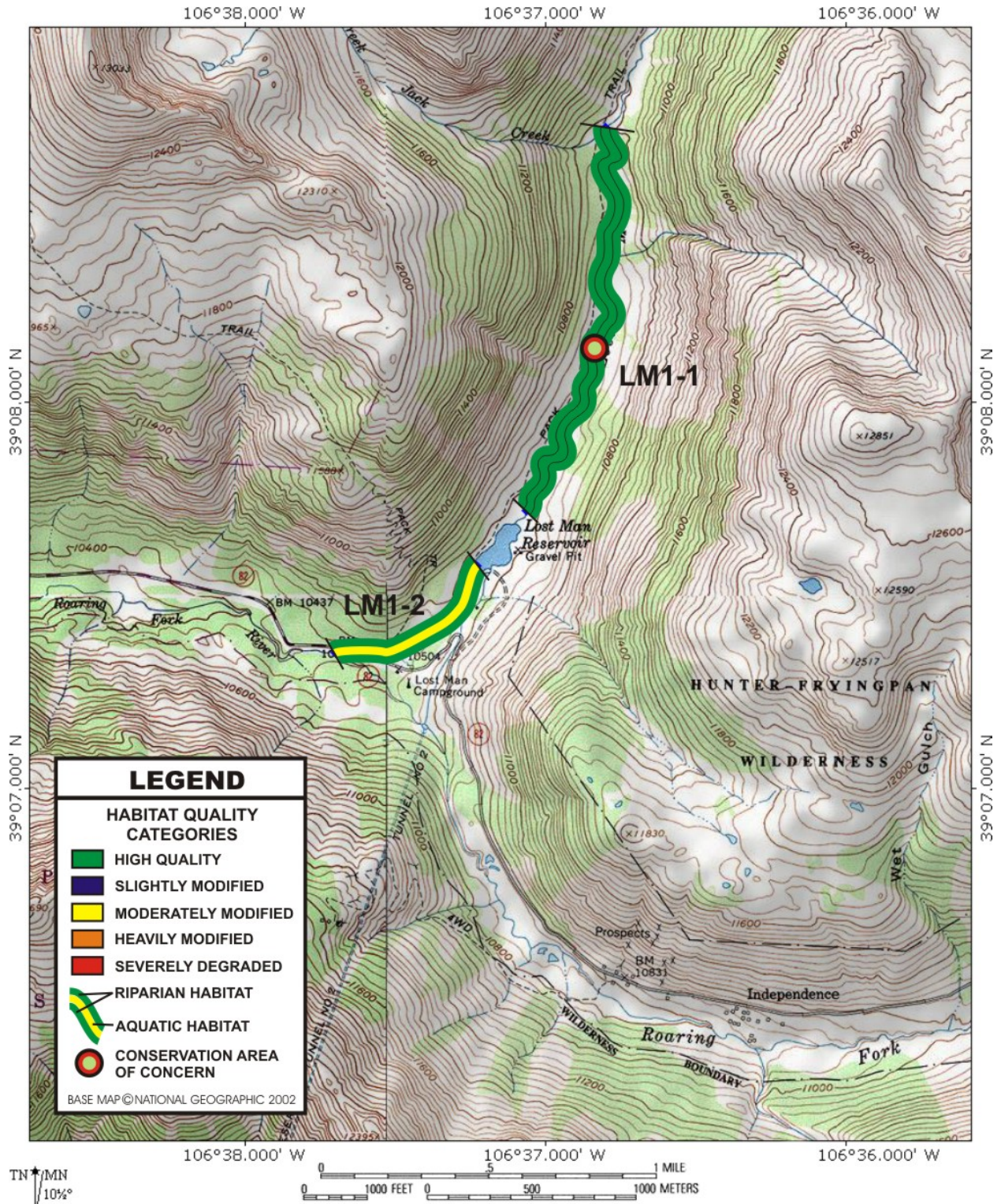
#### **Threats**

- Recreation induced wildlife disturbance and vegetation trampling.
- Dewatering and stream habitat fragmentation due to the Twin Lake's diversion, dam and reservoir with consequent degradation of stream habitat and harm to cutthroat trout populations.
- Non-native fish species including brook trout and rainbow trout threaten cutthroat with competition and hybridization respectively.
- Highway induced habitat fragmentation and consequent wildlife mortality.

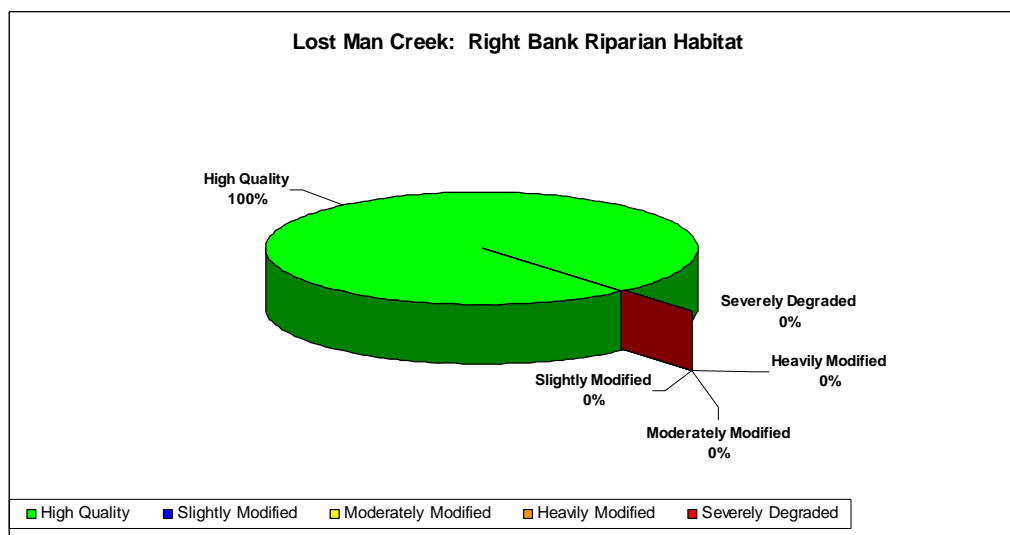
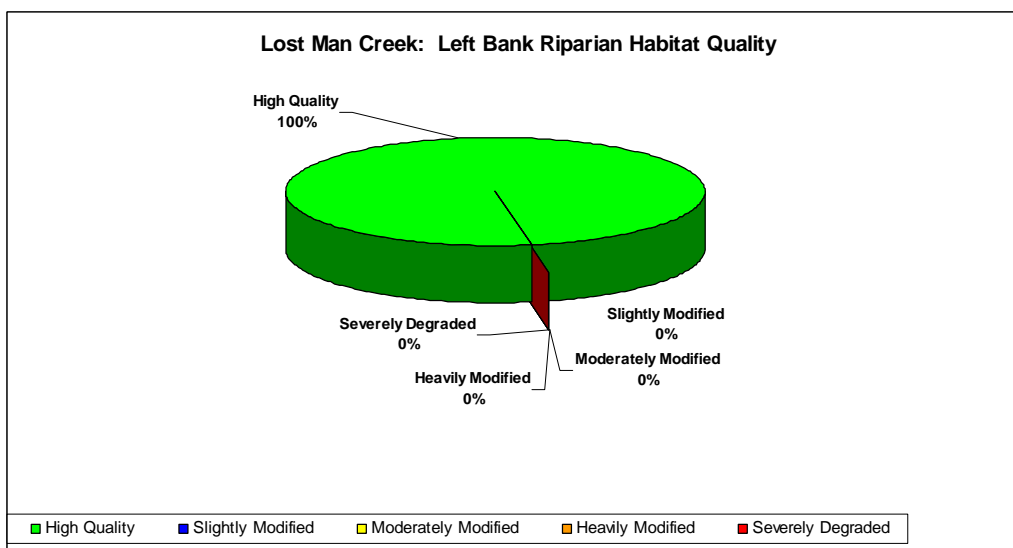
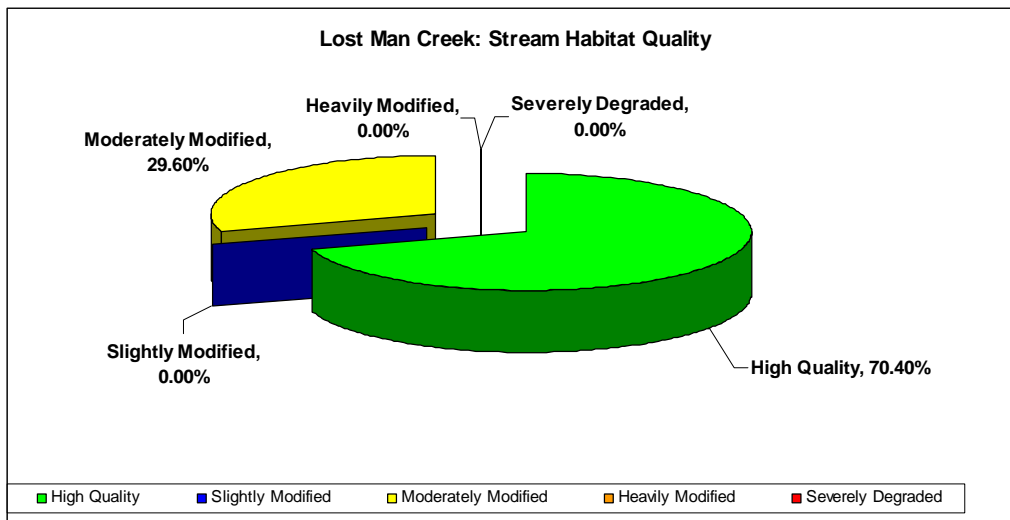
#### **Management Recommendations**

- Recreational impacts from hiking, horse packing, fishing, hunting, and camping have the potential to negatively impact this high quality ecosystem;
  - Monitoring of stream and riparian habitat to detect changes in habitat condition should occur at a minimum of every five years.
  - To protect wetland ecosystems, trail maintenance or re-routing is necessary in those areas where the trail goes through wet meadows and willow carrs.
  - Close and revegetate social trails; eliminate the trail on the east side of the reservoir; harden the trail on the west side of the reservoir.
  - Monitor recreational impacts and take appropriate action if further habitat degradation is documented.
  - LM1-1 is one of the very few reaches in the entire watershed where there are no noxious weeds; since trails are conduits for weed invasion this condition should be monitored yearly and appropriate actions taken if weeds are detected.
- Restore sustainable instream flows and a natural hydrologic regime, including flooding flows, to the entire stream.
- Remove non-native fish species and from the reservoir and the upper stream reaches; the dam and diversion also can act to prevent reinvasion.

**Conservation Area of Concern: LM1-1.** The upper part of the Lost Man watershed is in relatively pristine condition. But, due to the high elevation environment the ecosystem is more susceptible to degradation than lower elevation systems. Threats to the area come from recreation including hiking, horse packing and hunting. Use levels and impacts should be monitored and appropriate action taken if/when environmental degradation is detected.



Lost Man Creek assessment area and habitat quality.



**6.7 Lost Man creek: Stream habitat assessment results.**

See Appendix A for a description of habitat parameters and ranking criteria.

<b>Stream Habitat Parameters</b>	<b>LM1-1</b> N39 08.714 W106 36.805	<b>LM1-2</b> N39 07.576 W106 37.232
<b>1. Epifaunal Substrate/Cover (0-20)</b>	19	16
<b>2a. Embeddedness (0-20)</b>	19	11
<b>2b. Pool Substrate Characteristics (0-20)</b>	NA	NA
<b>3a. Velocity/Depth Regime (0-20)</b>	16	10
<b>3b. Pool Variability (0-20)</b>	NA	NA
<b>4. Sediment Deposition (0-20)</b>	19	13
<b>5. Channel Flow Status (0-20)</b>	19	8
<b>6. Channel Alteration (0-20)</b>	19	10
<b>7a. Riffle Frequency (0-20)</b>	16	11
<b>7b. Channel Sinuosity (0-20)</b>	NA	NA
<b>8. Bank Stability (LB: 0-10/RB: 0-10)</b>	10/10	10/10
<b>9. Bank Veg. Protection (LB: 0-10/RB: 0-10)</b>	10/10	10/10
<b>10. Riparian Zone Width (LB: 0-10/RB: 0-10)</b>	10/10	10/10
<b>Reach Total (LB/RB)</b>	<b>187</b>	<b>139</b>
<b>Habitat Condition</b>	<b>HQ</b>	<b>HM</b>

**High Quality: 180-200**  
**Slightly Modified: 160-179**  
**Moderately Modified: 140-159**  
**Heavily Modified: 120-139**  
**Severely Degraded: Below 120**

**6.7 Lost Man creek: Riparian assessment results.**

See Appendix A for a description of habitat parameters and ranking criteria.

<b>Riparian Habitat Parameters</b>	<b>LM1-1</b> N39 08.714 W106 36.805	<b>LM1-2</b> N39 07.576 W106 37.232
<b>1. Stream Incisement (0-8)</b>	8	8
<b>2. Lateral Cutting (0-6)</b>	6	6
<b>3. Stream Balance (0-6)</b>	6	4
<b>4. Sufficient Soil (LB: 0-3/RB: 0-3)</b>	3/3	3/3
<b>5. Stream bank Rootmass (LB: 0-6/RB: 0-6)</b>	6/6	6/6
<b>6. Weeds (LB: 0-3/RB: 0-3)</b>	3/3	2/2
<b>7. Disturbance-caused Undesirable Plants (LB: 0-3/RB:0-3)</b>	3/3	3/3
<b>8. Woody Species Establishment &amp; Regeneration (LB: 0-8/RB: 0-8)</b>	8/8	8/8
<b>9. Browse/Utilization of Trees and Shrubs (LB: 0-4/RB: 0-4)</b>	3/3	3/3
<b>10. Veg. Cover in Riparian, Floodplain &amp; Stream bank Zone (LB: 0-8/RB: 0-8)</b>	8/8	8/8
<b>11. Riparian Energy Dissipation (LB: 0-6/RB: 0-6)</b>	6/6	6/6
<b>Reach Total (LB/RB)</b>	<b>60/60</b>	<b>57/57</b>
<b>Riparian Habitat Condition</b>	<b>HQ</b>	<b>HQ</b>

**High Quality: 55-61**

**Slightly Modified: 49-54**

**Moderately Modified: 43-48** scores below 49 indicate riparian/stream habitat that is at risk.

**Heavily Modified: 37-42**

**Severely Degraded: < 37** scores < 37 indicate riparian/stream habitat that is not sustainable.

### **Lost Man Creek Segment 1, Reach 1.**

**Habitat Condition:** Stream – high quality; LB/RB Riparian – high quality/high quality .  
**Stream Class (Rosgen) – E3.      Stream Order – 3<sup>rd</sup>.      Reach Length – 2.24 km.**

#### Summary

#### **Hydrologic considerations**

*Channel Condition:* Channel shape is appropriate for the landscape and there are no anthropogenic alterations that degrade stream function. Flow regime is diverse, stream bank vegetation has optimal coverage and helps maintain appropriate channel morphology, and there are no water diversions out of this reach.

*Instream heterogeneity:* Instream morphology is diverse and contributes to stream function. Sinuosity is high providing added instream heterogeneity. Riffles are frequent and pools are abundant. All four velocity/depth regimes occur in a fairly even distribution; fast-deep is present on 35% of the stream, fast-shallow on 35%, slow-deep on 20% and slow-shallow on 10%.

*Hydrologic Alteration:* Width/depth ratio is appropriate for this stream class. Stream gradient is 1.5-1.75% and appropriate for the landscape. Bank-full flows occur throughout the year with less than 15% of the substrate exposed even during low flow season. Flood plain inundation occurs yearly with spring snowmelt even during years with a low snowpack. Riparian zone width is optimal at typically >18m and frequently >50m. Consequently, riparian vegetation plays a positive and important role in flood energy dissipation, sediment trapping, and enhancing infiltration. Beaver activity is common. Beaver activity further enhances water storage, sediment trapping and flood abatement.

*Stream balance / Erosion – deposition:* This reach of stream is in balance with regard to the amount of water and sediment in the channel. Water flow is sufficient with regard to amount of sediment in the stream; there is neither excess sedimentation nor embeddedness.

#### **Upland contribution to degradation**

Upland landuse and management makes a positive contribution to water quality, quantity and instream habitat functions. Slopes are well-vegetated and soils are stable, enabling a high degree of precipitation infiltration. Consequently late-season ground water discharge contributes to maintaining adequate stream flows.

#### **Vegetation considerations**

*Riparian Zone:* Riparian zone width is optimal at >25m over the entire reach and human activities have not impacted the zone. Diversity of plant species and structural complexity is appropriate for this ecosystem type. The floodplain is characterized by a sub-alpine willow carr. Willow and bog birch dominate the plant community composition; tree canopy cover is < 6%; shrubs have a total canopy cover of 60% evenly distributed between two layers; herbaceous cover is >70% and is dominated by sedges and rushes. All age classes are represented in the shrub layer rendering the ecosystem highly resilient.

Both sufficient kinds and abundances of native plant species are present to enable stream bank stability; >85% of the riparian cover has a stability rating >6. Additionally >90% of stream bank surfaces are covered with native vegetation further enhancing stream bank stability. Soils are sufficient and compositionally appropriate to enable seedling establishment and water storage.

*Stream bank Stability:* stream banks are stable over 90% of the reach with <10% of the reach with areas of erosion. With current hydrologic conditions long-term stream bank and floodplain sustainability is likely.

*Floodplain characteristics:* Characteristics that enhance flood energy dissipation and sediment trapping, such as woody debris, dense vegetation, and large boulders are abundant and extensive across the entire floodplain.

*Weedy and undesirable species:* Neither weeds nor disturbance-induced undesirable plant species were observed in the riparian zone of this reach.

#### **Wildlife considerations**

*Instream:* Epifaunal substrate is optimal; overhanging vegetation and large woody debris is abundant, riffles and pools occur frequently, backwater pools and overflow channels are present throughout the reach. The stream is in balance; neither excess sedimentation nor embeddedness negatively impact benthic macroinvertebrate or fish habitat.

Unlike the vast majority of stream reaches in this watershed, this reach is the beneficiary of a natural flow regime, thus this reach provides potentially appropriate habitat for native fish, if non-native could be prevented from moving from the reservoir upstream into this reach.

*Riparian:* Vegetation structure, density, and species diversity provide habitat and resources to support a complete and sustainable suite of native wildlife species and therefore a sustainable community of native wildlife

**Management Recommendations:**

- Protection and conservation are critical to maintain ecological integrity of this valuable refuge for native wildlife.
- Upland conservation: a recreational trail traverses this valley and has the potential to bring excessive human disturbance into the willow carr. Recreational monitoring should occur to insure that human use is not impacting either upland or riparian ecosystem, such as would occur with the creation of social trails.
- Hydrologic regime: maintaining natural flows throughout the year is essential to reach sustainability.
- Restore native cutthroat fish populations and eliminate non-natives - this is feasible due to the dam at the bottom of the reach. Although this would isolate the cutthroat from other populations it would also prevent re-invasion by non-natives.



**Beaver activity enhances overbanking into the floodplain and water storage for release during low-flow season thus helping to maintain in-stream flows. Slowing of flood water also allows sediment to drop out of the water column resulting in both enhanced water quality and soil building.**

### General Characteristics

**Location LM1-1:** 39 08.714/106 36.805; 39 07.722/106 37.067.

**Elevation:** 10,775'. **Life Zone:** subalpine.

**Ecosystem:** willow carr.

**Watershed Features:** predominant surrounding land use – Forest; local watershed NPS pollution – no evidence; local watershed erosion – none.

**Dominant Native Vegetation:** Riparian – willow spp., bog birch, sedge and rush spp., native grasses. Upland – spruce-fir forest mixed with willow carrs and herbaceous meadows.

**Instream Features:** stream width – 5 m; stream depth – 0.5 m; canopy cover – 30%; high water mark – 0.5 m; stream morphology types – riffles 35%, pools 30%, runs 35%; channelized – no; dam present – no.

**Large Woody Debris** (0 none to 4 abundant): 2 (common).

**Dominant Aquatic Vegetation:** dominant species – periphyton: % of reach with aquatic vegetation – 25-50%.

**Water Quality:** water odors – normal; water surface oils – none; turbidity – clear.

**Sediment/Substrate:** odors – normal; oils – absent; deposits – none; undersides of unembedded stones black – no.

**Inorganic Substrate Components:** bedrock 0; boulder 10; cobble 70; gravel 10; sand 10; silt 0; clay 0.

**Organic Substrate Components:** detritus (CPOM) 10; muck-mud (FPOM) 10; marl 0.

### Assessment Data

**EPA Habitat Assessment Score:** 187/200

**NRCS Habitat Assessment Score:** left bank – 60/61; right bank – 60/61.

**Weedy species:** none observed.

**Disturbance-caused undesirable plants:** none observed.

**Dominant Native Riparian Vegetative Species:**

*Trees:* Engelmann spruce, lodgepole pine.

*Shrubs:* willow spp. including grayleaf, planeleaf and wolf, bog birch.

*Grasses and Forbs:* sedge spp. including mountain and Bebb's, rush spp. including Drummonds and swordleaf, marsh marigold, narcissus anemone, white bog orchid, Parry's gentian, elephant head.

**Watershed Activities and Disturbances Observed** (intensity – low, moderate, heavy):

Residential: NA

Recreational: Hiking trails - L

Agricultural: NA

Stream management: NA

Other Human Influences:

Nutrient enrichment: clear water along entire reach, little algal growth.

Barriers to fish movement: dam, reservoir and diversion at bottom of reach prevents fish migration.

Manure presence: none.

Site Characteristics:

Waterbody character (5-1 pristine to disturbed/appealing to unappealing): 5/5.

Beaver: beaver sign – common; flow modification – major.

Dominant Land Use – forest; forest age class >75.

**Functional Rating:** sustainable

**Biological Indicators of Stream and Riparian Condition:**

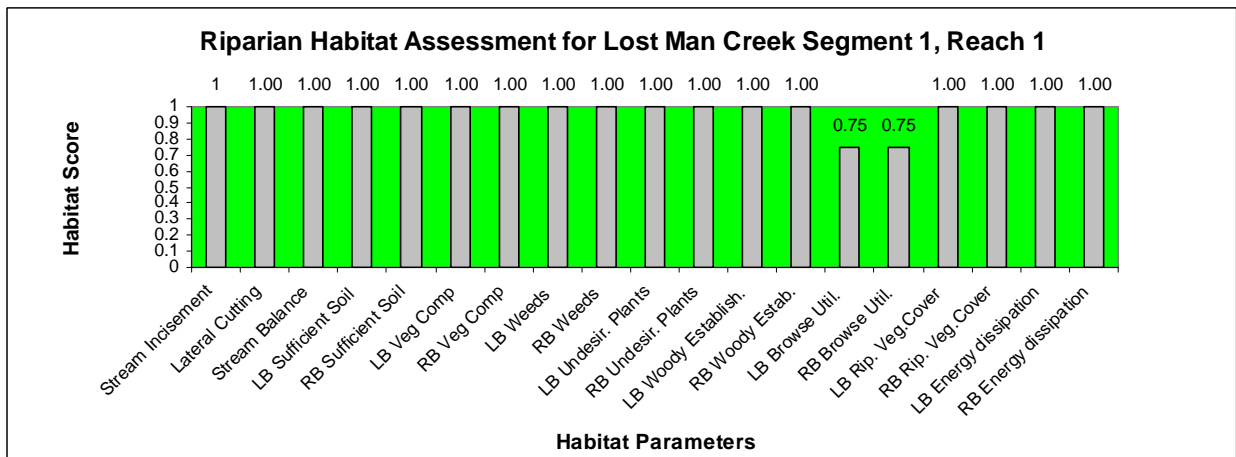
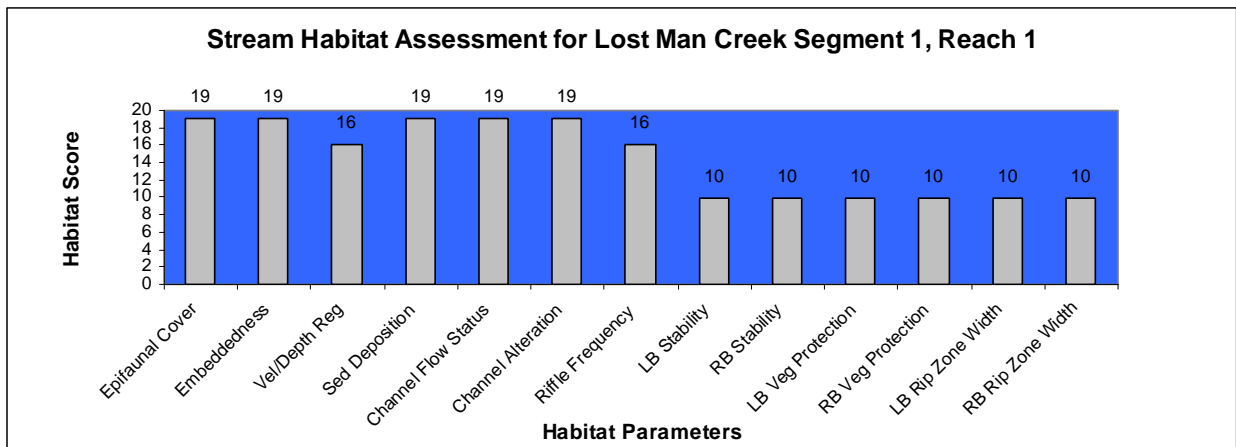
- Benthic macroinvertebrate community ratio of pollution intolerant to facultative to tolerant individuals was 24/27/3. This result may warrant further study as the number of facultative to intolerant macroinvertebrates seems somewhat high.
- Two dippers were observed in the study area during breeding season which, given the size of the stream is a high abundance and indicates good quality breeding habitat with sufficient forage, nest sites and protected habitat.
- Breeding bird surveys recorded 55 individuals in 11 species for a biodiversity score of 2.004. Species richness is lower compared to reaches at lower elevations but is appropriate for this life zone. Bird species such as fox sparrows, Lincoln's sparrows, olive-sided flycatchers, and Wilson's warblers were abundant and indicate undisturbed habitat that provides abundant resources for foraging, nesting and also the solitude necessary for breeding and raising young.
- Periphyton abundance was "2" (common) indicating appropriate levels of nutrient enrichment.



A beaver dam across the stream enhances energy dissipation and overbanking thereby increasing soil moisture that supports riparian vegetation.



Even during low-flow season the stream channel remains full and thus provides adequate habitat for aquatic wildlife.



## Roaring Fork Mainstem Segment 1, Reach 2.

**Habitat Condition:** Stream – heavily modified. LB/RB Riparian – high quality/high quality.  
**Stream Class** (Rosgen) – E3.      **Stream Order** – 3<sup>rd</sup>.      **Reach Length** – 0.94 km.

### Summary

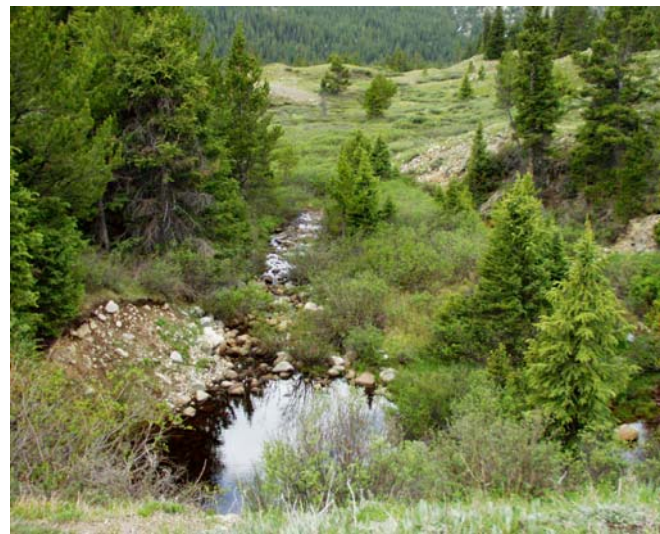
#### Hydrologic considerations

*Channel Condition:* Severe channelization occurs due to impacts from a reservoir, dam and a diversion. Dewatering of this reach has resulted in a lack of flow diversity, channel narrowing, and vegetation encroachment into the channel. Additionally a footbridge and a highway bridge contribute, although relatively minimally, to channelization.

*Instream heterogeneity:* Instream morphology has been homogenized due to dewatering and lack of flooding, scouring flows. Consequently vertical structure is greatly simplified. Only two of four velocity/depth regimes occur; a slow-shallow regime occurs on 90% of the reach and slow-deep on 10%. Generally, all of the reach is shallow riffles and, due to severe dewatering, run habitat is absent.

*Hydrologic Alteration:* Width/depth ratio is inappropriately high. Stream gradient, 1.5-1.75% is somewhat on the low side for this stream class. Bank-full flows do not occur. Water fill 50% of the available channel, but this is a deceptively high estimate because the channel has been narrowing from vegetation encroachment, which has occurred due to greatly reduced streamflow. Thus prior to the dam and dewatering the channel was wider and the amount of water that is now in the stream would have filled <25% of the channel. Flood plain inundation does not occur thus does not contribute to maintaining riparian vegetation. However, riparian vegetation does serve to help maintain at least a small amount of flow in this reach. Rather, in this reach riparian vegetation obtains the majority of its moisture from upland snowmelt – riparian plant rootmass is adept at holding onto soil moisture, so that soil moisture is slowly released into the stream throughout the year thus maintaining the small stream flow that does occur.

*Stream balance / Erosion – deposition:* Banks are stable and there is no incisement or lateral cutting. However there is a severe imbalance between the amount of water and sediment in the stream. Due to dewatering, flows are insufficient to move even small amounts of sediment that naturally eroded from the surrounding uplands. Over time sediment has filled pools and embedded cobbles and rooted vegetation is colonizing the stream substrate.



**Looking downstream from the top of the dam: A few hundred meters below the dam ground water discharge flows into Lost Man Creek.**

#### Upland contribution to degradation

Surrounding uplands are publicly owned National Forest and managed primarily for recreation. Two small trails, one on each side of the valley, parallel this reach but, because they are located upland, have very little impact on riparian or stream habitat. At the top of this reach a reservoir, dam and diversion canal control the characteristics of this reach by diverting the entire stream into a canal which moves water, ultimately, to the Eastern Slope via the Twin Lakes Diversion. A highway bridge crosses the lower part of the reach and surely contributes polluted runoff to the stream. However, this road is open only about 6 months of the year during early summer and autumn.

#### Vegetation considerations

*Riparian Zone:* Zone width is optimal at typically >18m and humans have not directly impacted the zone by obvious activities such as by trampling or vegetation removal. However, an altered hydrologic regime, which has resulted in drier soils, has impacted the zone by instigating a shift in the plant community. Thus, although plant species composition is similar to LM1-1, cover and distribution differs. Because soils here are not as saturated and conditions are much drier compared to LM1-1 there is less abundance of those species that require constant soil saturation such as marsh marigold, elephantella, sedges, rushes, etc..

There is both sufficient kinds and abundance of plant species capable of stabilizing soil; >85% of plants have a stability rating >6. Native vegetation cover >90% of stream banks and there is little evidence of disruption. Consequently stream banks are stable with <5% of stream banks showing areas of erosion or bank failure. All age

classes of woody species are represented in a fairly even distribution thus providing the potential for habitat maintenance and recovery.

A subalpine willow carr characterizes the riparian zone ecosystem. Although a few trees survive on small areas of higher ground they contribute only about 6% of the left and 3% of the right bank canopy cover. Shrub cover is comprised of two primary layers and totals 45% on the left and 40% on the right bank. Dominant species in the shrub layers are bog birch, shrubby cinquefoil, and willow (planeleaf, grayleaf, silver and wolf). Herbaceous cover on the left bank is 70% and 40% on the right bank.

*Floodplain characteristics:* Habitat characteristics such as dense vegetation, large boulders and overflow channels are present in sufficient abundance and frequency to dissipate flood energy and trap sediment should flows ever be reinstated.

*Weedy and undesirable species:* Weeds occur on 5% of the riparian area. Weedy species include Canada thistle, and yellow sweetclover. Disturbance-induced undesirable plant species occur on <5% of the riparian area and include Kentucky bluegrass. The occurrence of weeds in this reach differs dramatically from the upstream reach and is cause for concern as this area may act as a source for weed invasion into habitat that is currently weed-free.

### Wildlife considerations

*Instream:* Dewatering and its impacts degrade the stream and render it inhospitable to most native aquatic wildlife. Even at this high elevation, the shallow, slow-moving water has warmed enough to walk in barefoot. Pools are filled with sediment and riffles are embedded. Thus although there is ample epifaunal substrate for colonization, severely degraded environmental conditions preclude its use by most native stream biota. Only a few small brook trout were observed in the shallow pools. The benthic macroinvertebrate community was dominated by facultative species. No dippers were observed along the entire reach.

*Riparian:* Although the soil conditions are drier compared to LM1-1, vegetation composition and structure is diverse and provides abundant resources to the native wildlife community. Deer are abundant but do not negatively impact plant vigor. Snowshoe hare are common and provide prey for Canada lynx which frequent this part of the watershed. Breeding bird surveys indicate a change in composition that may be reflective of human disturbance or may be due to subtle changes in vegetation. Compared to LM1-1 more human tolerant species such as gray jays and American robins but fewer human intolerant species such as Wilson's warblers and Lincoln's sparrows were detected in the breeding bird survey.

### Management Recommendations:

- Restore natural hydrologic flow regime.
- Discontinue stocking the reservoir with non-native fish species.
- Remove non-native fish and restore native cutthroat.



**Below the dam, only leakage from the dam is allowed to flow back into the stream.**

### General Characteristics

**Location LM1-2:** 39 07.576/106 37.232; 39 07.351/106 37.703.

**Elevation:** 10,570'.

**Life Zone:** subalpine.     **Ecosystem:** willow carr.

**Watershed Features:** predominant surrounding land use – Forest; local watershed NPS pollution – some potential sources; local watershed erosion – minimal.

**Dominant Native Vegetation:** Riparian – willow spp., bog birch, sedge and rush spp., native grasses. Upland – LB spruce-fir forest, RB lodgepole pine.

**Instream Features:** stream width – 3 m; stream depth – 0.06 m; canopy cover – 30%; high water mark – 0.5 m; stream morphology types – riffles 85%, pools 10%, runs 5%; channelized – yes; dam present – yes.

**Large Woody Debris** (0 none to 4 abundant): 1 (rare).

**Dominant Aquatic Vegetation:** dominant species – attached algae; % of reach with aquatic vegetation – 75-100%.

**Water Quality:** water odors – normal; water surface oils – none; turbidity – clear.

**Sediment/Substrate:** odors – normal; oils – absent; deposits – sludge & sand; undersides of unembedded stones black – yes.

**Inorganic Substrate Components:** bedrock 0; boulder 20; cobble 60; gravel 10; sand 10; silt 0; clay 0.

**Organic Substrate Components:** detritus (CPOM) 10; muck-mud (FPOM) 20; marl 0.



**This diversion ditch diverts all flows, except that which leaks through the dam, to the Front Range via the Twin Lakes tunnel.**

### Assessment Data

**EPA Habitat Assessment Score:** 139/200.

Comments: reduced flows have altered instream habitat and diminished wildlife potential.

**NRCS Habitat Assessment Score:** left bank – 57/61; right bank – 57/61.

Comments: reduced flows have allowed riparian vegetation to encroach into the channel.

**Weedy species:** Canada thistle, yellow sweet clover.

**Disturbance-caused undesirable plants:** Kentucky bluegrass.

**Dominant Native Riparian Vegetative Species:**

*Trees:* Engelmann spruce, lodgepole pine.

*Shrubs:* willow spp. including grayleaf, planeleaf and wolf, bog birch, shrubby cinquefoil.

*Grasses and Forbs:* sedge spp. including mountain and Bebb's, rush spp. including Drummonds and swordleaf, marsh marigold, narcissus anemone, white bog orchid, Parry's gentian, elephant head.

**Watershed Activities and Disturbances Observed** (intensity – low, moderate, heavy):

Residential: historic mining cabins

Recreational: Hiking trails - L

Agricultural: Water withdrawal - H

Stream management: Dams - H

Other Human Influences:

Nutrient enrichment: abundant algal growth, thick algal mats.

Barriers to fish movement: dam, diversions and withdrawals inhibit fish movement.

Manure presence (evaluated only if livestock or human waste discharges are present): none.

Site Characteristics:

Waterbody character (5-1 pristine to disturbed/appealing to unappealing): 2/2.

Beaver: beaver sign – absent; flow modification – none.

Dominant Land Use – forest; forest age class >75.

**Functional Rating:** not sustainable.

**Biological Indicators of Stream and Riparian Condition:**

- Benthic macroinvertebrate community ratio of pollution intolerant to facultative to tolerant individuals was 14/37/3 indicating impaired water quality.
- No American dippers were observed in the study area during breeding season, which was expected given the severely degraded condition of the stream.
- Breeding bird surveys recorded 44 individuals in 15 species for a biodiversity score of 2.524. Compared to LM1-1, abundance was lower but richness was higher. Richness was probably greater due to the higher occurrence of trees that provided habitat for species such as yellow-rumped warblers, which were not present in LM1-1. Although the shrub canopy was nearly comparable to LM1-1, with regard to plant species and cover two species, Wilson's warblers and Lincoln's sparrows had notably lower abundances in this reach: at LM1-1 and LM1-2, respectively, we recorded 14 and 4 Wilson's warblers and 10 and 5 Lincoln's sparrows.
- Periphyton abundance was "1" (rare), filamentous algae "4" (dominant) and blue-green algae "3" (abundant). Abundance and composition indicates greatly excessive nutrient enrichment.
- Undersides of cobble substrate were black indicating probable anoxic environmental conditions and habitat impairment.



**During low flow season, there is minimal soil moisture discharge to fill the channel or maintain sustainable flows. Tina Palmer (left), botanist, is evaluating habitat structure while Cheryl Malone helps with data collection.**



An orange sludge covers stream substrate up to a depth of 1 dm.

