

APPENDIX B PLANNING CONSIDERATIONS



Boulder River Mainstem

Segment #1: Fourmile Guard Station to Two-Mile Bridge (Mile 53 to 40)

- ***Small Tract Development/Church Camps***

Buildings situated too close to the river may potentially cause channel instability, restrict floodplain access, and be sources of water quality pollutants. Proper set-backs of structures, the maintenance of healthy riparian buffers, control of weeds, and effective septic maintenance should be promoted. Sponsoring small landowner workshops (DNRC small landowner workshops), mail-outs, and personal contacts would be an approach to inform small tract landowners about these issues.

Medium Priority

- ***Noxious Weeds***

Infestations of *Ox-Eye Daisy*, *Common Tansy*, and *Sulphur Cinquefoil* are common throughout this reach. Many of these infestations are found in pastures off from the river. A comprehensive weed management education and control program should target small tract, seasonal residents.

High Priority



Boulder River Mainstem

Segment #2: Two-Mile Bridge to Natural Bridge (Mile 40 to 33)

- ***Small Tracts***

Whispering Pines and Ken-Dan Acres Subdivisions: Floodplain and channel encroachment from structures, landscaping, septic systems, and channel rip-rap/floodplain dikes are common (Mile 34.5 to 39.5). Small landowner workshops that emphasize riparian buffers, weed management, septic system evaluations/maintenance, and structure set-backs should be conducted.

High Priority

- ***Noxious Weeds***

Ox-Eye Daisy, Canada Thistle, Spotted Knapweed, and Common Tansy infestations vary in extent throughout this reach. There have also been small patches of *Tall Buttercup* and *Blue Weed* found. There is a weed management project currently wrapping up on Ken-Dan Acres subdivision. The Whispering Pines subdivision needs a similar effort. A cooperative, long-term weed management effort from the headwaters down to Natural Bridge should be formally organized to curb their spread.

High Priority

- ***Stream Bank Stabilization***

The four mile section of river immediately above the Natural Bridge (Mile 33.5 to 38) is especially sensitive to bank instability due to inherent erodible soils and natural channel dynamics. This reach requires a detailed reach investigation to develop site-specific management alternatives to maintain and improve long-term channel stability. Management alternatives may include riparian fencing, off-stream livestock water development, and bioengineered bank stabilization measures.

Medium Priority



Boulder River Mainstem

**Segment #3: Natural Bridge to East
Boulder Road Bridge (Mile 33 to 23)**

- ***Livestock Management***

Many sections of river are traditionally used as *calving and/or winter feeding pastures* that sometimes times exhibit heavy browse of the riparian vegetation and bank trampling by livestock. Maintaining a healthy riparian buffer in these high use areas (with temporary fencing and off-stream water) would reverse this trend.

Medium Priority

The reach of the river immediately upstream from the East Boulder Road Bridge has experienced *heavy livestock impacts* (Mile 23 to 24.5). Developing off-stream water and power fencing would be necessary to reverse the downward trend of the riparian plant community.

Low Priority

- ***Irrigation Infrastructure***

McLeod Irrigation Ditch: More detailed investigation is necessary to determine if there are cost-effective alternatives that may work to stabilize the ditch canal along

the toe of the land slide on the Beaver Meadows Ranch (Mile 32). There are other sections of this ditch that also need attention.

Low Priority

Boe-Engle Ditch: Because the Boe-Engle Ditch is situated high up on the east valley wall, there is an excellent opportunity for gravity or low pressure sprinklers on the upper benchland and/or the valley floor. A more detailed feasibility investigation would be necessary to develop specific alternatives.

Medium Priority

- ***Noxious Weeds***

Leafy Spurge and *Canada Thistle*: Infestations of these two weeds are widespread throughout this reach. A cooperative multi-landowner weed management program has been initiated and will run to 2008. An integrated, long-term approach to effectively contain the spread of these weeds has the best likelihood of success.

High Priority

Spotted Knapweed, *Common Tansy*, *Ox-Eye Daisy*, *Whitetop*, *Woodland Sage*, *Blue Weed*, and *Houndstongue*: Infestations of these species throughout this reach are sporadic. A focused landowner weed management and education program could contain and potentially eradicate some of these species over time.

High Priority

- ***Channel Stability***

Floodplain Dike (near Mile 30) located on the Beaver Meadows Ranch should be removed to restore high water access to the historic floodplain and reduce pressure on the downstream river banks.

Low Priority

Unstable Channel (Mile 25 to 27) located on the Engle Ranch is primarily due to a high bedload and historic stream bank rip-rap/floodplain dike restrictions. This two mile reach requires a detailed investigation to develop alternatives that would return this reach of the river back to a more natural state.

High Priority



Boulder River Mainstem

Segment #4: East Boulder Road Bridge to West Boulder Confluence (Mile 23 to 19.5)

- ***Channel Stability***

Floodplain Dike (Mile 22) should be removed to allow high water access to the floodplain and to reduce the active erosion and instability of a downstream terrace.

Medium Priority

- ***Irrigation Tailwater***

Irrigation Tailwater coming off hayfields above and below the Susie Creek Bridge (Mile 21) is causing bank sloughing and erosion where the tailwater drops off the field into the Boulder River. Constructing tailwater ditches, dikes and/or tailwater drop pipes would prevent further damage. Another possible alternative would be to convert from flood irrigation to sprinkler irrigation (big gun).

Medium Priority

- ***Grazing Management***

Heavy Livestock Use of riparian vegetation and the trampling of the river bank is occurring (Mile 20) across from the Boulder River Fishing Access. Relatively low-cost practices such as riparian fencing and off-stream water development would greatly reduce livestock impacts on this reach.

Low Priority



Boulder River Mainstem

**Segment #5: West Boulder River
Confluence to 8 Mile Bridge (Mile
19.5 to 11)**

- ***Irrigation Infrastructure***

Goeddel Irrigation Headgate/Ditch (Mile 18.5) – downstream from the West Boulder Confluence: This rock irrigation diversion is situated on an outside bend that tends to catch debris during high water events. A redesign of this diversion would reduce maintenance time and costs.

Medium Priority

Smoot Irrigation Headgate/Diversion (Mile 14): The existing rock diversion tends to catch debris during high flows. Redesign/reconstruction of the rock diversion would reduce long-term maintenance costs.

Low Priority

Crest Ditch Headgate (Mile 12): Concrete is breaking up on parts of the headwall. Repairs are needed to maintain the future integrity of the structure.

Low Priority

- ***Irrigation Water Management***

1) Irrigation Tailwater: Throughout this segment of the Boulder River, irrigation tailwater sporadically flows directly over the river bank back into the river often creating small gullies and delivering sediment to the river. On-farm irrigation improvements, tailwater collection ditches, and constructed discharge outlets would help remedy this situation.

2) Ditch Seepage: Water leakage from conveyance ditches on the adjacent benches is common. Sections of conveyance ditches should be considered for lining or sealing. Water loss measurements are necessary to identify the most critical sections of ditch to optimize water savings.

Medium Priority

McComb-Campbell Irrigation Ditch: Investigate the lower end of the ditch system for possible conversion from flood irrigation to gravity sprinkler irrigation (Mile 13.5 to 14.5).

Medium Priority

- ***Grazing Management***

Heavy livestock use/small corral systems occur in a few locations along this river segment. These high use areas are often associated with a large weed infestation. Grazing land improvements such as fencing, off-stream livestock water development, and riparian buffer establishment would greatly benefit these areas.

Low Priority

- ***Noxious Weeds***

Leafy Spurge, Common Tansy, and Houndstongue: Infestations are widespread along this entire reach. An integrated landowner weed management program to contain these weeds is needed.

Medium Priority



Boulder River Mainstem

**Segment #6: 8 Mile Bridge to
Interstate 90 Bridge (Mile 11 to
2.5)**

- ***Irrigation Infrastructure/Channel Stability/Fish Capture***

Ellison Mutual Irrigation Ditch Diversion (Mile 10.5): A minor redesign of the in-channel diversion using bedded angular rock would reduce the need for continual

maintenance after high water events.

Low Priority

Clause-Weaver Irrigation Ditch (Mile 10): A detailed evaluation of the entire ditch system would be necessary to determine gravity/low pressure sprinkler opportunities and to develop alternatives that will prevent the ditch from eventually sloughing into the river where it is located immediately next to the river (Mile 8.5).

High Priority

Lamp-Nelson Irrigation Diversion/Ditch (Mile 9):

- 1) Redesign the rock diversion to incorporate larger and more angular rock that would assure long-term permanence and less annual maintenance.
- 2) Detailed evaluation of the entire ditch system to determine gravity/low pressure sprinkler opportunities, ditch consolidation potential with the Clause-Weaver Ditch, and the development of alternatives to keep the ditch from sloughing into the river at the same site (Mile 8.5) where the Clause-Weaver Ditch is being threatened.

High Priority

Post-Kellogg Irrigation Diversion (Mile 7): Redesign of the rock/canvas diversion to reduce annual maintenance costs and impacts to the river.

Medium Priority

Clayton Irrigation Headgate (Mile 5): 1) The concrete footings of the headgate are being undercut. The headgate structure needs repairs for it to remain functional. 2) Consider the possibility of consolidating the Clayton Ditch with the Conwell Ditch.

Low Priority

Hansen Irrigation Headgate (Mile 5): Headgate is close to being washed out and needs to be totally replaced and relocated. The headgate also needs a viable diversion to check water into the structure. An alternative approach would be to investigate the possibility of consolidating this ditch with upstream conveyance systems (Conwell or Clayton).

Low Priority

Electric Light Irrigation Diversion (Mile 4): A redesign of the rock/canvas diversion would reduce debris entrapment and maintenance costs. The headgate should eventually be moved upstream to lessen the need for such a large diversion.

Medium Priority

Pioneer Irrigation Diversion (Mile 3): The design and construction of a permanent diversion is critical to reduce annual maintenance costs, eliminate the periodic impacts to the river, and maintain the adequate delivery of water to the system. In addition, an engineering review of the upstream dike and rip-rap structures should be made to determine if these channel modifications should be altered to reduce their impacts on the river.

High Priority

Fish Capture: Develop a cooperative program with Montana Fish Wildlife and Parks to survey the amount of fish capture by the major irrigation ditches. Where surveys show significant numbers of fish being captured, voluntary cost-effective solutions should be developed that would reduce fish capture in these irrigation ditch systems.

Medium Priority

Irrigation Conveyance Ditch Seepage: Develop alternatives to reduce irrigation delivery ditch loss. Specific sections of ditch to target would be determined by the water measurement efforts being conducted by DNRC and the Boulder River Watershed group.

Low Priority

- ***Small Tract Development/Church Camps***

Small tract development, horse pastures, and small corrals situated too close to the river often cause channel instability and are potential sources of water quality pollutants. Proper set-backs of structures, the maintenance of healthy riparian buffers, control of weeds, and effective septic maintenance should be encouraged. Sponsoring small landowner workshops (DNRC small landowner workshops) would be an approach to better inform small tract landowners about these issues.

Medium Priority

- ***Noxious Weeds***

Leafy Spurge, Spotted Knapweed, Canada Thistle, Musk Thistle, and Common Tansy infestations vary in extent throughout this reach, although weeds are more prevalent than in upstream reaches. A cooperative, multi-landowner weed management effort is necessary to begin curbing their spread.

Medium Priority



Boulder River Mainstem

Segment #7: Interstate 90 Bridge to Mouth (Mile 2.5 to 0)

- ***Noxious Weeds***

Spotted Knapweed, Leafy Spurge, Canada Thistle, and Common Tansy infestations are abundant throughout this reach. A cooperative effort by the Montana Dept. of Transportation (MDT), the town of Big Timber, and small tract landowners is

needed in this reach to control the further spread of these weeds.

High Priority

- ***Small Tracts and Town Lots***

Urban Development on the high benches along the river may be a potential source of water quality pollution to the river stemming from lawn fertilizers/pesticides, stormwater run-off, and poorly functioning septic systems. Appropriate set-backs of structures, stormwater education programs, weed management, proper lawn care, and septic maintenance would be important topics for small landowner workshops or campaigns.

Medium Priority

- ***River Crossings***

There are *three major bridges* (Interstate 90, Old Boulder Road, and Highway 10) and *one BNSF Railroad trestle* in this reach. All of them have bedload deposition/islands formed immediately upstream of each structure that forces flow laterally creating bank instability. When these structures are scheduled for replacement or major maintenance, MDT and BNSF should be encouraged to properly design replacement structures that will provide adequate high flow capacity.

Low Priority

- ***Irrigation Infrastructure***

Irrigation Headgate (underneath BNSF trestle – Mile 1) – This small irrigation headgate should be replaced and possibly relocated to make it more functional.

Low Priority

- ***Car Bodies***

Old car bodies (Mile 0.5) placed in the channel as bank stabilization should be removed and disposed of. Bioengineered stabilization measures should then be installed to protect this bank and provide fish habitat.

High Priority

- ***Big Timber Lagoon***

Discharge from the Big Timber Sewage Lagoon appears to be the source of nutrients causing heavy algal growth in the lower Boulder River. The Boulder River Watershed group may want to work with the town of Big Timber and the Montana DEQ to determine if the current lagoon discharge permit is adequately taking care of nutrient pollution. If not, the Boulder River Watershed group may want to work closely with the town of Big Timber to help them up-grade their sewage lagoon system.

Medium Priority



**West Boulder River: USFS
Campground to Mouth (Mile 17 to 0)**

- ***Noxious Weeds***

Sulphur Cinquefoil and *Spotted Knapweed*: These weeds are sporadically found along the West Boulder River. Target areas are the West Boulder Reserve and downstream from the Swingley Bridge. A focused multi-year weed management effort could effectively eradicate this isolated infestation before it spreads further.

High Priority

Leafy Spurge: The target reach for leafy spurge begins at the Swingley Bridge and goes upstream for approximately 1.5 miles (Mile 9 to 10.5). There is an excellent opportunity to contain this infestation (possibly even eradicate it) if a multi-year weed control campaign is actively implemented.

High Priority

Musk Thistle: The target reach begins at the Swingley Bridge and goes downstream for approximately two miles (Mile 7 to 9). Most of the musk thistle infestations are found on upper benches adjacent to the river. Smaller infestations of Musk Thistle were sporadically found above and below this target reach. Some landowners have begun active musk thistle control (EQIP Program) which needs to be continued.

Medium Priority

Canada Thistle, *Burdock*, *Houndstongue*, and *Black Henbane*: The extent of these weeds varies throughout the drainage. The encouragement and education of individual landowners to help them identify and control these weeds would be the best approach.

Low Priority

- ***Riparian Grazing Management***

Targeted reach: Swingley Bridge area (Mile 7 to 9) - *Livestock trailing, noxious weed infestations, and heavy browsing of riparian shrubs*. There are other smaller segments of the West Boulder River where comparable livestock impacts are occurring. Grazing improvements have been recently initiated (EQIP Program) on some riparian areas and should be expanded further to help reverse the trend.

Medium Priority

- ***Irrigation Infrastructure Improvements***

Elges Ditch Turnout (near Mile 8):

- 1) This irrigation system needs a headgate to manage water flows entering the ditch. Headgate installation is scheduled for 2005.
- 2) The conveyance ditch also commonly plugs up with debris at farm road culvert crossings causing ditch overtopping that often creates small headcuts down to the river. Ditch crossing should be redesigned to allow adequate transport of water and passage of debris. A full evaluation of the ditch system is encouraged.

Medium Priority

Elges-Muncaster Headgate (near Mile 7): Concrete headgate structure needs repairs to the scoured footings to prevent future failure of the structure. Repair work was initiated in 2005.

Low Priority

Rule-Work Diversion/Headgate (Mile 2.5): There needs to be a major redesign of the irrigation diversion, headgate structure, and river channel to adequately divert irrigation water while allowing debris in the river to effectively by-pass the headgate.

High Priority

- ***Small Tract Development***

There are some *small tracts* associated with horse pastures, pens, lawns, and buildings located immediately next to the river channel. Riparian buffers and reasonable set-backs for development are suggested to adequately maintain stream bank integrity and water quality. Small landowner workshops (DNRC-CARDD) may serve this drainage well to educate non-agricultural residents about noxious weeds, grazing management, and water quality. If future development continues along the river, this item should be reevaluated as possibly a higher priority.

Low Priority



East Boulder River: USFS Campground to Mouth (Mile 8 to 0)

- ***Livestock Management***

Concentrated livestock use and corrals are located at the mouth of *Enos Creek* before it joins the East Boulder River (Mile 3). This site may be a potential source of nutrient pollutants to the East Boulder River. Off-stream livestock water, channel

buffers, and corral relocation would be possible alternatives to alleviate this condition.

Medium Priority

The *East Boulder River* reach near the mouth (Mile 0 to 0.5) is a bedload depositional reach that is highly braided and dynamic, highly vulnerable to bank erosion. Proper livestock grazing management is especially important on the lower end of the East Boulder River.

Medium Priority

The middle section of the *Craft Ditch* passes through summer livestock rangeland where the ditch banks are being heavily trampled by livestock. This impact is causing erosion of the ditch banks that is generating a noticeable sediment load in the ditch ultimately finding its way to Elk Creek and the East Boulder River. Constructed livestock ditch crossing and water gaps (rock fords) would reduce the impacts of livestock and improve the long-term stability of the ditch.

High Priority

- **County Road/Bridges**

The *county bridge* at Mile 4.5 encroaches into the active river channel. When this bridge is replaced, it should be replaced with a wider spanned bridge to allow unimpeded high water flows.

Low Priority

County Road:

- 1) Segments of the East Boulder River have the county road located immediately alongside. *Road sediment* is often pushed directly into the river when the road is being maintained.
- 2) *Magnesium chloride* is occasionally applied for dust control so it undoubtedly enters the river directly or indirectly with the sediment bladed off the road. Discussions with the Stillwater Mine Co. and the County Commissioners should be initiated to determine what can be done to mitigate this activity.

Low Priority

- **Noxious Weeds**

Ox-Eye Daisy: There are varying degrees of infestation along the river. (Mile 0 to 8). More landowner education and encouragement on managing this weed should be encouraged.

Medium Priority

Leafy Spurge: This weed is primarily concentrated just upstream of the Elk Creek confluence on down to the mouth (Mile 0 to 3.5). A multi-landowner effort is needed to keep leafy spurge from moving upstream and to contain it on the lower reach of the East Boulder River.

High Priority

Spotted Knapweed and Woodland Sage: Small, sporadic patches of both these weeds exist along the stream corridor (Mile 0 to 7). There is an excellent opportunity to eradicate these weeds on the East Boulder with a focused landowner weed management effort.

High Priority

Canada Thistle, Bull Thistle, Burdock, and Houndstongue: The extent of these weeds varies throughout the drainage. The continued education of individual landowners to help them identify and control these weeds is the best approach.

Low Priority

- ***Irrigation Infrastructure Improvements***

Craft Ditch (east bench): Upper sections of the Craft Ditch are leaking significant amounts of water. The downslope saturation may be exacerbating the occurrence of large land slides (Mile 3 to 5) in an already geologically unstable area. Based upon more detailed water measurement investigations, sections of ditch should be considered for lining or sealing.

High Priority

Boe-Engle Ditch: The irrigation headgate needs repair and the diversion should be constructed to be more permanent and require less maintenance (upstream from Mile 6). The conveyance ditch system has not been fully investigated, but there are probable opportunities to improve water use efficiencies (gravity sprinklers), turnout structures (drop pipes), and wastewater ditch erosion. A full ditch evaluation for cost-effective improvements is recommended.

Medium Priority

Miles Flower Ditch (Mile 2) and Davenport Ditch (Mile 1) Headgate/Diversions: The irrigation diversions associated with these two headgates/ditches should be designed and replaced with permanent diversions that require less maintenance and are more compatible with the stream.

Low Priority



**Elk Creek: Yerk-Woolsey
Headgate to Mouth (Mile 3 to 0)**

- ***Livestock Management***

There are several segments of Elk Creek that are experiencing *concentrated*

livestock use/small corrals and pens immediately along the creek. This heavy use is causing stream bank trampling and inputs of nutrient pollutants in some areas. Proper distribution of livestock is a challenge in this narrow valley, but off-stream livestock water development, riparian buffers, and fencing may be appropriate practices to consider in alleviating excessive livestock pressure on the creek bottom.

High Priority

- ***Irrigation Infrastructure Improvements***

Yerks-Woolsey & Davenport Ditches – Late in the summer, the entire stream flow is often being captured by these ditches. There may be opportunities to improve the conveyance system and increase on-farm efficiencies to maintain an in-stream flow. This item should maybe be up-graded to a higher priority if the landowners express interest in investigating alternatives for water savings.

Low Priority

- ***Noxious Weeds***

Leafy Spurge, Ox-Eye Daisy, and Houndstongue are sporadically found along the Elk Creek stream corridor and adjacent county road. This area is currently a focus area for the County Weed District.

High Priority

