B. Watershed Health and Aquatic Habitats

1. Existing Condition

Stream Size

The landscape assessment area contains part of two 5^{th} code Hydrologic Unit Code (HUC) watersheds, 17010201050 and 17010201040 (figure IA-1). 6^{th} code HUC delineation within the landscape is not finalized and the code number as well as the boundary of the 5^{th} code HUCs depicted may change with completion of the 6^{th} code delineation (MT NRIS, pers. comm. 3/29/07).

The eastern edge of the project area is within the Boulder Mountains and forms the headwaters of the nine major drainages. No gaging stations are present in the project area. However, numerous flow measurements taken in 2002 and from 2004-2006 by KirK Environmental help to put the typical size of these streams into perspective (appendix 2). The location of the flow measurement sites in appendix 2 is shown in figure IIB-1 provided in appendix 1.

Photo: Lower Cottonwood Creek at WRC site C4 during spring runoff June 2005.


Photo: Headwaters tributary to Cottonwood Creek.

In general, the streams are relatively small, with Cottonwood Creek being the largest stream and Sand Creek being the smallest. Sand Creek is considered to be an ephemeral drainage, only flowing during storm events. Several springs were identified in the stream corridor of Sand Creek during field work conducted by KirK Environmental technical staff in 2002 and drought conditions have apparently impacted flow based on discussions with landowners in 2002. Girard Gulch did have flowing water in early 2002 and is considered an intermittent stream. Perkins Gulch, Dry Cottonwood Creek, Sand Hollow, Orofino Creek, and Caribou Creek are perennial in the headwaters through midstream, and intermittent to ephemeral in the middle to bottom reaches. Field inventories from KirK Environmental (2003) provide information that the lower stream reaches of Girard Gulch, Perkins Gulch, Sand Creek, Sand Hollow, Orofino Creek, and Caribou Creek consist primarily of fluvial outwash plains, absent of riparian communities, supporting the interpretation that they only flow under extreme storm and high runoff events.

Most streams in the project area are considered losing streams in the lower reaches. High infiltration rates on coarse sand, gravel and cobbles appears to be the limiting factors for why most streams do not reach the Clark Fork River. Expansive dry benches divide the streams in the landscape, and several miles of rangeland typically separate one stream from the next. The result of a spatially limited water supply is critical for how ecosystem and agricultural practices interface in the landscape. Notably, the streams act as linear oases that draw wildlife and cattle into the riparian areas for water. Pressure from excess riparian cattle watering and use is one of the key limiting factors leading to aquatic impairment in the streams.

Photo: Perkins Gulch at Eastside Road during an infrequent connection to the Clark Fork River, spring runoff 2005.

Photo: Beaver dam and aspens in Caribou Creek riparian area (private land).

Cottonwood Creek, Peterson Creek, and Dry Cottonwood Creek have irrigation water use, which exacerbates surface water loss. Cottonwood Creek is completely dewatered by diversion for approximately ¼ mile along lower reaches above Deer Lodge during summer irrigation. Peterson Creek is typically connected to the Clark Fork River. However, depending upon irrigation water use during summer drought conditions Peterson Creek may have dry sections. Dry Cottonwood Creek connects to the Clark Fork River only during large storm events and during spring runoff of some years. For several of the intermittent streams irrigation water rights are listed with Montana Department of Natural Resources and Conservation (DNRC). Based on field observations in 2002 and interviews with landowners described in KirK Environmental (2003), few of the water rights on the smaller streams, such as Caribou Creek, have been recently exercised due to drought as well as a general inability to exercise the water rights under normal flow conditions. The exceptions are stock water rights on all of the streams, and two irrigation diversions on Dry Cottonwood Creek, which are used to irrigate a very small area of the stream corridor flood plain. The existence of irrigation water rights on smaller streams such as Girard Gulch, Perkins Gulch, Orofino and Caribou Creeks may attest to these streams containing higher and more reliable flows during periods of wet climate occurring on inter-annual or decadal time scales.

Management Effects on Streams

Past management activities affecting the water resource include road construction and maintenance, timber harvest, grazing, recreation, and mining. These activities continue to affect water resources at the present time.

Road systems vary widely in classification and density (figure IIE-1 in appendix 1). Timber harvest and/or mining typically have extensive networks of primitive and/or improved road systems associated with them. Recreational trail use is also prevalent. A small area in the headwaters of Baggs, Cottonwood, and Peterson Creeks is managed as roadless.

Forest road systems can adversely affect streams by increasing sediment loads (e.g. road stream crossing failures, landslides, road surface erosion, etc.), changing runoff rates (e.g. ponding behind stream crossings, diverting flow), and changing stream morphology (Furniss et. al. 1991; Reid & Dunne 1984). Road-related mass wasting events (e.g. road-induced landslides, road fill failures, and gullying), surface erosion, road construction, and road stream crossing failures generally cause the most impact on watersheds of any land activity. The magnitude and frequency of natural mass movements such as landslides, debris flows, slumps, and earthflows are greatly increased by road systems (Sidle et. al. 1985). Roads change the slope, structure, and flow patterns of individual hillslopes. Improper road placement, insufficient or poor (e.g. side casting material into streams) road maintenance, steep hillslopes, deficiently-sized culverts, and poorly drained roads all lead to increases in hillslope processes (Furniss et. al. 1991). Many road stream crossings contain large quantities of sediment in the fill prisms. Periodically, these crossings wash out (e.g. culvert plugs with woody debris) or sustain damage (e.g. road is overtopped but not washed out). The sediment is dumped directly into the stream channel. Undersized or improperly aligned culverts can lead to failures during high flow events.

Surface erosion occurs on road surfaces, cut and fill faces, drainage ditches, and during construction. Road surface erosion is mainly a function of usage, surfacing type, and maintenance (Reid & Dunne 1984). High road usage increases fine sediment delivery to stream channels. Road usage in fish sensitive streams is reduced by closing roads or moving management activities to other areas.

Roads affect stream channel morphology by increasing sediment loads, changing the flow regime (e.g. ponding behind culverts creates scour below and deposition above), and displacing stream beds. Roads placed on the floodplain, mid-slope in steep terrain, or that cross streams can be expected to increase sedimentation, while roads built along ridge tops or on high terraces will minimize sediment input to streams. Stream crossings that restrict the channel dimensions can be expected to alter the local channel geometry, the runoff flow-rate, and possibly fish migration. Stream-road crossings (i.e. culverts or bridges) are common places for inboard ditches to dump water and sediment runoff into the stream system. Culverts can also create passage problems especially for upstream fish migration where a perched outlet (too high to jump), a culvert installed at a steep angle (velocities too fast), or a culvert that is too long exists (the water velocities tire the fish out over the distance).

Timber harvest has occurred throughout management areas (figure IA-1) containing suitable timberland. Timber harvest activities affect watersheds by modifying the way water is transported, changing hillslope processes, potentially increasing upland sediment yields which can modify fluvial processes and change channel morphology. Timber harvest may increase the rate and timing of snowmelt runoff by compacting soil, removing vegetation, and leaving forest openings which increase snow retention. Timber management often necessitates roading and stream crossings associated with travel to cut units and transporting logs. Fine sediment may increase from road surface erosion and bare or disturbed surfaces accelerate the surface erosion rates from rainfall and snowmelt runoff. In the draft Clark Fork-Flints LA the USFS notes that erosion from existing harvest units is not apparent.

Livestock grazing began as the landscape became settled and continues to the present time. Changes in management on National Forest land have improved upland forage conditions and have resulted in some improvement or at least stabilization of riparian systems. Livestock affect stream channels by increasing fine sediment input, destabilizing or trampling banks, reducing the functioning of riparian vegetation, increasing water temperatures and nutrients. Trampled banks increase sedimentation, which increases stream widths, diminishes stream depths and decreases particle size. Trampled banks and livestock trails also increase the damage potential (e.g. channel avulsion) during high flows. A trampled bank may appear to lose only vegetation, but high flows easily erode the bank.

Riparian vegetation reductions or species changes can occur from foraging livestock. Reduction or elimination of downstream vegetation may also happen below heavily used sections of stream from increased sedimentation (e.g. channel aggradation, widening, or changes in the water table). Enclosure studies give vegetation recovery rate estimates. However, few enclosure studies document changes in channel morphology.

Mining and smelting have played a prominent role in affecting water quality and stream function in some parts of the landscape. Placer operations have affected the physical function of some stream channels. Acid mine drainage from mine waste and direct adit discharge may also impair surface and groundwater near abandoned mine sites.

Specific water quality, stream channel and riparian evaluation is described in the following sections. Stream impairment by individual waterbody, probable causes, and ancillary comments for the water quality chemical, benthic macroinvertebrate (BMI), and Hansen riparian assessments described in the following sections is summarized in appendix 3.

Water Quality

Surface water quality sampling data is on record in the landscape with EPA, MBMG, and the WRC per the KirK Environmental (2003) report for sites shown in figure IIB-1. Water quality sites in KirK Environmental (2003) include a broad range of locations both on the BDNF and off-forest to capture large scale patterns in water quality. Priority abandoned mines are also shown in this figure to indicate potential water quality concerns.

TMDL Listed Streams

The Clean Water Act, Section 303(d) and 40 CFR (Part 130), requires each state to identify waterbodies that are water quality limited. After water quality limited waterbodies have been identified, they are prioritized and targeted for TMDL (Total Maximum Daily Load) development. The 1996 Montana 303(d) list includes Peterson Creek from Jack Creek to the Clark Fork River (figure IIB-1). Peterson Creek is listed as impaired under 303(d) because the following beneficial uses are not supported: aquatic life support, cold water fishery (trout), drinking water, primary contact, bathing, recreation and aesthetics. Causes of impairment include dewatering, flow alteration, other habitat alterations, riparian degradation, and thermal modifications. Other streams in the watershed are not 303(d) listed.

Metals

KirK Environmental (2003) provides low level metal (Al, Sb, Ar, Br, Be, B, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mn, Mg, Mo, Ni, Se, Si, Ag, Sr, Tl, Ti Vn, Zn) analysis from samples taken during summer 2002 for sites shown as WRC samples in figure IIB-1. During sampling in 2002 Girard Gulch and Caribou Creek had relatively minor exceedences of DEQ WQB-7 acute aquatic life standards for total recoverable lead based on water hardness of those samples. A sample from Girard Gulch exceeded chronic and acute total recoverable copper WQB-7 standards. The exceedences for Girard Gulch are relatively small considering flows in this stream do not support a fishery. Some copper results from Peterson and Orofino Creeks also exceeded aquatic life standards. However, duplicate samples were not consistent and analysis QA/QC suggests that additional sampling is necessary to draw conclusions on metal trends in Peterson and Orofino Creeks.

Metals do impair selected Cottonwood Creek tributaries in the Emery Mining District located between Baggs Creek and the Middle Fork of Cottonwood Creek. In 2002, the USFS completed mine reclamation on Spring Creek, tributary to the North Fork of Cottonwood Creek. A detailed explanation of the soil and water analyses for the project, water quality issues, along with the cleanup recommendations are summarized in the USFS Spring Creek Mine Tailings Site Engineering Evaluation / Cost Analysis (EE/CA) dated May 19, 2001, available from the BDNF.

Other water quality issues are also suspected in the Emery Mining District, and DEQ is currently attempting to work with the responsible party on access to conduct an EE/CA on the private property and remove contaminated tailings. Sample results from 2002 downstream of the Emery Mining District did not detect any metals consistent with acid mine drainage suggesting that metals impacts from mine runoff do not reach $^{7}/_{10}$ mile downstream.

Nutrients

Montana's narrative standards pertaining to nutrients indicate that, "surface waters must be free from substances attributable to municipal, industrial, agricultural practices or other discharges that will: create conditions which produce undesirable aquatic life" (ARM 17.30.637{e}). Nitrogen and phosphorous are essential components of aquatic ecosystems, but excessive amounts of these nutrients can stimulate the growth of nuisance levels of algae, which can in turn interfere with the beneficial uses of streams and rivers. The undesirable aquatic life most commonly associated with elevated nutrient concentrations are excess benthic algae and macrophytes. In excess amounts, algae can produce unpleasant tastes and odors in drinking water, taint the taste of fish flesh, produce allergic reactions in humans, clog and corrode water supply and irrigation equipment, alter the composition of macroinvertebrate and fish communities, and interfere with aesthetic and recreational uses of rivers and streams (Nordin, 1985). In shallow streams and rivers, benthic chlorophyll-a concentration is commonly used to measure the amount of aquatic plant growth on the stream bottom.

Photo: Nutrient management issue on private lands on Peterson Creek. This operation is planned to be modified in cooperation with the WRC.