# Coeur d'Alene Lake and River (17010303) Sub-basin Assessment and Proposed Total Maximum Daily Loads

Idaho Department
of Health and Welfare
Division of
Environmental Quality

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# 1. Executive Summary of the Coeur d'Alene Lake and River (17010303) Sub-basin Assessment and Proposed Total Maximum Daily Loads

The Coeur d'Alene Lake and River Sub-basin consists of the Coeur d'Alene Lake and River and those water bodies which drain directly to the river and the lake. The sub-basin contains 30 water bodies which have been listed as water quality limited on the Section 303(d) Clean Water Act lists. The beneficial uses of these streams and lakes are generally cold water biota and primary contact recreation although the river and the lake and a few additional lakes have more extensive beneficial uses designated in the Idaho water quality standards. These water bodies are listed for one or more of the following pollutants: bacteria, habitat alteration, nutrients, sediment, dissolved oxygen, oil and grease, pH and temperature.

The existing data for each of the water bodies is reviewed in the sub-basin assessment. Where those data were inconclusive, additional data on bacteria, nutrients and temperature were collected during the summer months of 1999. The sediment generation of the watersheds of those water bodies listed as limited by excess sedimentation was modeled. Following analysis of the data and the modeling results, eighteen water bodies in the sub-basin were verified to be water quality limited by at least one pollutant: eleven for temperature, eight for sediment and one for bacteria. Fernan Lake was not found limited, but nutrient levels are sufficiently high to warrant an advisory total maximum daily load (TMDL). The temperature TMDLs have been deferred by the state until state temperature criteria are fully examined and if necessary adjusted. The sediment limitations in the upper two segments of the Coeur d'Alene River can practically be addressed by sediment TMDLs for the North and South Forks of the Coeur d'Alene River. Lake Creek, which is sediment limited, is wholly on the Coeur d'Alene Reservation and the lead agency responsible is EPA.

Proposed total maximum daily loads for sediment were developed for Wolf Lodge Creek including its tributary Cedar Creek, Cougar Creek, Mica Creek and Latour Creek including its tributaries Baldy and Larch Creeks. A TMDL for bacteria was developed for Mica Creek.

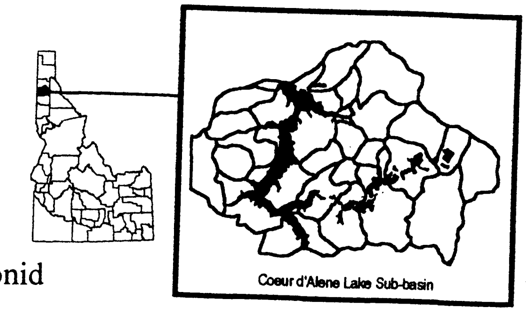
A thirty-day public comment period was provided from November 18 through December 17, 1999. Three letters of comment containing twenty-three substantive comments were received by the close of the comment period. The draft TMDLs were revised based on the comment recieved. A responsiveness summary discusses all the comments received.

# 2. COEUR D'ALENE LAKE AND RIVER SUB-BASIN (17010303) ASSESSMENT

## 2.0 Coeur d'Alene Lake and River Sub-basin Water Quality at a Glance

**<u>Water Quality at a Glance:</u>**

| | |
|---|---|
| *Hydrologic Unit Code* | 17010303 |
| *Water Quality Limited Segments* | Coeur d'Alene Lake and River with several tributaries |
| *Beneficial Uses Affected* | Cold Water Biota, Salmonid Spawning, Recreation |
| *Pollutants of Concern* | Sediment, temperature |
| *Known Land Uses* | Forestry, agriculture, urban |




### 2.0.1 Prologue:

The impacts of the trace (heavy) metals cadmium, lead and zinc have been addressed in assessments of the Coeur d'Alene River and the Coeur d'Alene Lake Plan (IDEQ, 1996a; IDEQ, 1998a). Total maximum daily load documents have been developed for these pollutants (IDEQ, 1998b; IDEQ, 1998c). This sub-basin assessment addresses the non-metallic pollutants of concern. For background on the lake and the river the reader is referred to the documents cited.

## 2.1. Characterization of the Watershed

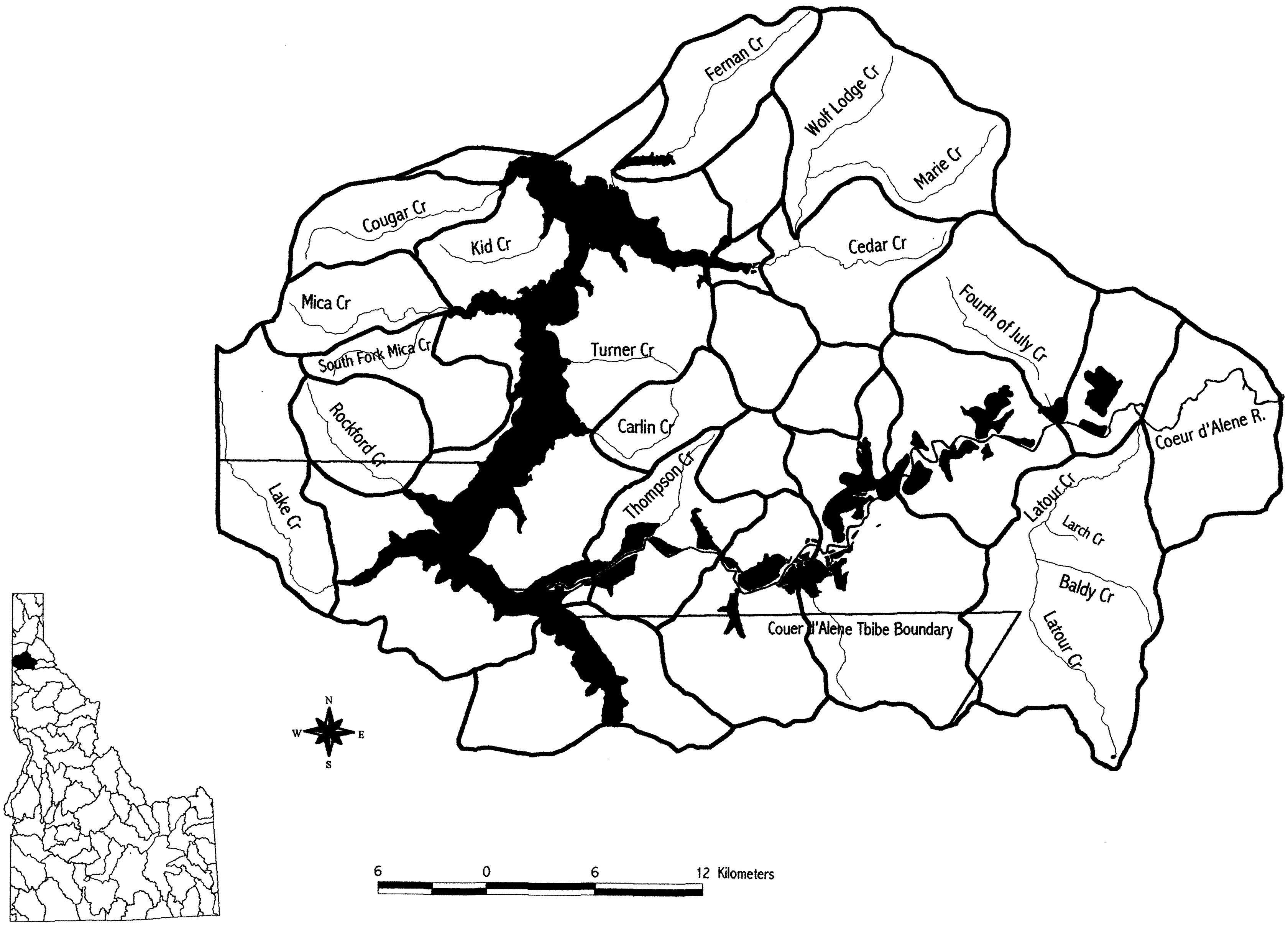
The Coeur d'Alene Lake and River sub-basin (17010303) includes Coeur d'Alene Lake and the Coeur d'Alene River[1] and the tributaries to these two water bodies (figure 1). The Coeur d'Alene River flows from the confluence of the North and South Forks of the Coeur d'Alene Rivers near Enaville, Idaho westward to its discharge to the Lake Coeur d'Alene near Harrison, Idaho (Figure 1). The City of Coeur d'Alene is located at the northern end of the lake. The Spokane River flows from the lake outlet into the State of Washington.

### 2.1.1. Physical and Biological Characteristics

The physical and biological characteristics of the sub-basin are described in the following sections on climate, hydrology, landform, geology and soils, vegetation, aquatic fauna and cultural impacts.

[1] The Coeur d'Alene River above the South Fork Coeur d'Alene River was renamed the North Fork Coeur d'Alene River in 1991. (U.S. Board of Geographic Names, 1991.)

# Figure 1. Coeur d'Alene Lake and River Sub-basin HUC 17010303

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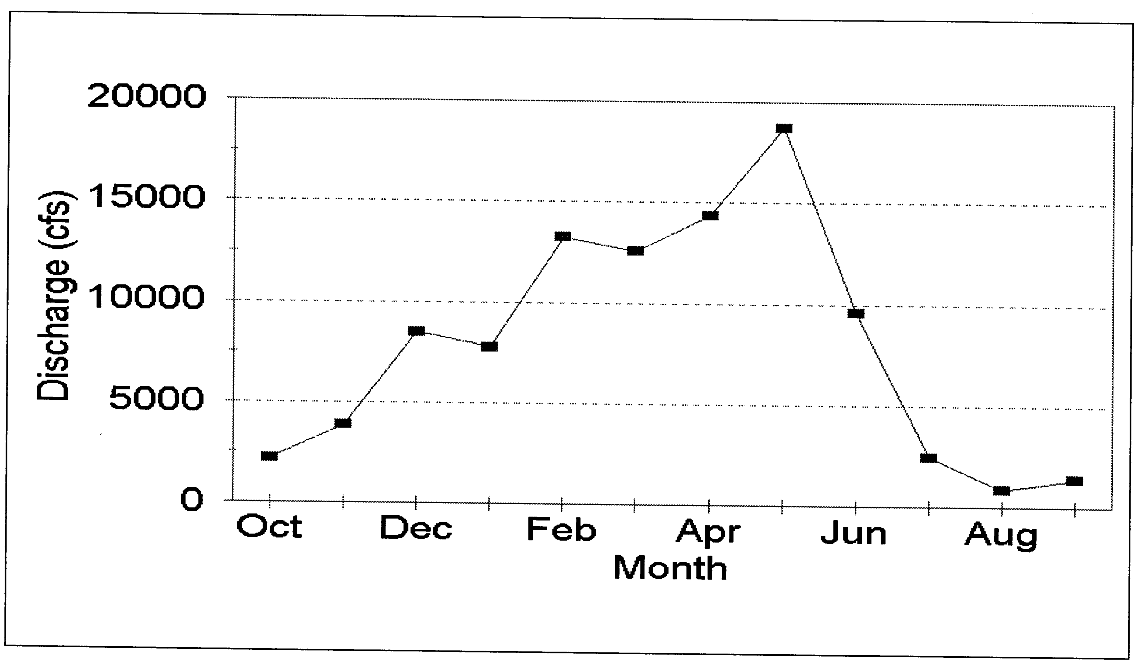
### 2.1.1.1 Climate

The Coeur d'Alene Lake sub-basin is located in the Northern Rocky Mountain physiographic region to the west of the Bitterroot Mountains. Local climates are influenced by both pacific maritime air masses from the west as well as continental air masses from Canada to the north. The annual weather cycle generally consists of cool to warm summers with cold and wet winters. The relative warmth of summers or winters depends on the dominance of Pacific or continental air masses. Precipitation is most generous in the winter months. Precipitation takes the form of rain generally below 3,000 feet of elevation, while it is in the form of snow above 4,500 feet. The transitional zone between 3,000 and 4,500 feet holds a transient snow pack, which is subject to rapid melt when wet Pacific air masses predominate. The result of these snow melt events are high discharge rain on snow events.

### 2.1.1.2. Hydrology

The discharge hydrograph of the Spokane River near Post Falls Idaho and immediately downstream of the lake outlet is provided in Figure 2. The discharge of the streams of the sub-basin is dominated by the spring snow melt. The streams draining the Coeur d'Alene and St. Joe Mountains have watersheds predominantly in the elevation range (3,000 - 4,500 feet) subject to winter "rain on snow" discharge events. The relative low elevation of the watersheds causes earlier maximum discharge (mid-March), than from the majority of the watersheds of the North and South Forks of the Coeur d'Alene River. The immediate watersheds of the river and the lake are 34.8% of the total watershed. For this reason the river and the lakes' stage are little affected by the discharge of these streams.

Figure 2: Mean Monthly Discharge of the Post Falls Station 1995-1999.



### 2.1.1.3 Land forms, Geology and Soils

The Coeur d'Alene River flows through a generally broad floodplain ranging from a quarter to one and three-quarters miles in width. The river and its floodplain are bound on the north by the Coeur d'Alene Mountains and on the south by the St. Joe Mountains. Coeur d'Alene Lake is a submerged river valley impounded initially by the outwash of the Pleistocene Missoulian floods. The lake has been augmented by the Post Fall Dam. Tributaries to the river and the eastern shore of the lake flow from the Coeur d'Alene and St. Joe Mountains. Tributaries to the lake from the west flow either from the Palouse Hills or from the most southerly mountains of the Selkirk Range.

Eleven lakes and numerous wetlands are located laterally to the river below Rose Lake. The lakes vary in size, while the wetlands surrounding them are extensive. The lakes and wetlands are expressions of the high water table of the lower river valley. The lakes are hydrologically connected to the river by surface channels in all but three cases where the connection is through the valley aquifer. Large wetlands are found in the valley above Rose Lake, notably in the area of Cataldo Flats.

The Coeur d'Alene and St. Joe Mountains are composed primarily of Belt Supergroup meta-sedimentary rocks. This geology weathers to predominantly silt size particles with rounded cobbles as the primary transitional material found in the higher gradient streams. The Selkirk Range, from which streams flowing from the northwest drain to the lake, is a granitic formation. These granite substrates weather to sand. The predominant bedload of these streams is sand. The surface soils of the Palouse Hills are largely composed of wind blown silt. The soil is underlain by Columbia River basalt. The basalt is found at the surface near the lake shore. The division between granitic sands of the Selkirk Range and the silts of the Palouse Hills occurs at the northern end of the Lake Creek watershed.

Tributaries to the river and lake flowing from the mountains are high gradient streams channels (Rosgen B), until they reach the valley bottoms. As these streams enter the valley of the river or the lake, an abrupt transition to low gradient (Rosgen C) channels occurs in their final half mile in the case of the river and final few miles in the case of tributaries to the lake. Streams flowing from the Palouse Hills have lower gradients near their headwaters, but have steep channels over basalt deposits as these streams approach the lake.

### 2.1.1.4. Vegetation

The predominant vegetation of the Coeur d'Alene, St. Joe and Selkirk Mountains which comprise 80% of the sub-basin is mixed coniferous forest. Dominant conifers are pines, true fir, Douglas fir, tamarack and red ceder. Cottonwood, aspen and alder are the predominant deciduous species. The Palouse Highlands have grasslands as well as wooded areas. These areas were likely maintained by fire as grasslands prior to European settlement. Grasslands and wooded areas would have expanded and contracted dependent on the fire cycle which was controlled by the indigenous people. Valley bottoms with little slope are currently grasslands. Vegetation along the Coeur d'Alene River has been diminished by bank erosion and the influence of fluvially deposited metals contaminated sediments. The metals bind phosphate making it less available for plant nutrition. The result is a diminished vegetative cover in some areas. For additional information on the vegetation of the Coeur d'Alene Basin refer to the Coeur d'Alene Lake Management Plan (IDEQ, 1996a).

#### 2.1.1.5. Aquatic Fauna

The native trouts of the sub-basin's streams are cutthroat trout and bull trout. Sculpin, shiners and bullhead catfish are also indigenous. The tailed frog, giant salamander and turtles completed the list of indigenous vertebrate species. The fish fauna of the lake and the river have been greatly altered by the introduction of several trouts, salmon and warm water species. A detailed discussion of the current fishery of Coeur d'Alene Lake and River is available in the Coeur d'Alene Lake Management Plan (IDEQ, 1996a). Although the lake and river have highly altered aquatic fauna due to introductions, headwater streams retain native species with the addition of rainbow and brook trout and the loss of bull trout. Although fish composition appears stable in the headwaters, fish abundance is generally believed to be reduced from historic levels reported as the area was settled. Fish abundance in Coeur d'Alene Lake and River as well as the lateral lakes is high (IDEQ, 1996a).

### 2.1.2 Cultural Impacts:

The watersheds of the Coeur d'Alene and St. Joe Mountains which drain to the river and the lake are managed primarily for timber production and dispersed recreation. Timber management has been moderately intense with large clear-cut areas and dense road development. Some watersheds as Wolf Lodge and Cedar Creeks have had intense forest management and road development. Land management in this area is primarily by the U.S. Forest Service. Watersheds of the southern Selkirk mountains are also managed primarily for timber production. These tracts are in private and industry ownership. Some forested watersheds on either side of the lake were logged using railroad systems. Near the population centers of Coeur d'Alene, Harrison and the intervening east lake shore, timber management has been less intense to protect scenic values.

From the Lake Creek watershed south in the Palouse Hills region and on Harrison Flats east of the lake, agriculture is the major land use. The Palouse area and Harrison Flats supported wheat production over most of the history of cultivation. In recent years blue grass seed production has replaced some wheat production. Substantial farm land acreage has been placed in the Conservation Reserve Program.

The main population center in the sub-basin is the City of Coeur d'Alene at the north end of the lake. In some nearby watersheds residential development is prevalent. Fernan and Cougar Creeks are examples of watersheds which have residential development. Residences exist in strips along the east and west shore of the lake more or less continuously. Many of these residences are summer cabins but many have become year around residences in recent years. Additional population centers include Harrison, Worley, Plummer, Rose Lake and Cataldo. These towns have populations less than 300. For additional information on the land use and demographics of the Coeur d'Alene Basin refer to the Coeur d'Alene Lake Management Plan (IDEQ, 1996a).

## 2.2. Regulatory Requirements

The regulatory requirements for the water bodies of the sub-basin are summarized by listing the segments of concern, the assigned beneficial uses and the water quality standards supportive of those uses.

### 2.2.1. Segments of Concern

The stream segments listed in the 1998 Section 303(d) Clean Water Act List for non-metallic pollutants in sub-basin 17010303 are provided in Table 1.

Table 1: List of 1998 Section 303(d) Clean Water Act listed water bodies.

| Water body Name | HUC Number | Boundaries | Pollutant(s) |
|---|---|---|---|
| Cd'A River | 17010303 4021 | SF Cd'A R to French Gulch | Habitat alteration, pH and sediment |
| Cd'A River | 17010303 4018 | French Gulch to Skeel Gulch | Habitat alteration, pH and sediment |
| Cd'A River | 17010303 4022 | Skeel Gulch to Latour Creek | Habitat alteration, pH and sediment |
| Cd'A River | 17010303 4019 | Latour Creek to Fourth of July Creek | Habitat alteration, pH and sediment |
| Cd'A River | 17010303 4017 | Fourth of July Creek to Fortier Creek | Habitat alteration, pH and sediment |
| Cd'A River | 17010303 4016 | Fortier Creek to Robinson Creek | Habitat alteration, pH and sediment |
| Cd'A River | 17010303 4020 | Robinson Creek to Cave Lake | Habitat alteration, pH and sediment |
| Cd'A River | 17010303 4015 | Cave Lake to Black Lake | Habitat alteration, pH and sediment |
| Cd'A River | 17010303 3529 | Black Lake to Thompson Lake | Habitat alteration, pH, temperature and sediment |
| Cd'A River | 17010303 4023 | Thompson Lake to Cd'A Lake | Habitat alteration, pH and sediment |
| Latour Creek | 17010303 3535 | Headwaters to Cd'A River | Bacteria, habitat alteration, sediment and temperature |
| Baldy Creek | 17010303 7535 | Headwaters to Latour Creek | Bacteria, habitat alteration, sediment and temperature |
| Larch Creek | 17010303 7536 | Headwaters to Latour Creek | Bacteria, habitat alteration, sediment and temperature |
| Fourth of July Creek | 17010303 3534 | Headwaters to Cd'A River | Habitat alteration and sediment |

| Water body Name | HUC Number | Boundaries | Pollutant(s) |
|---|---|---|---|
| Willow Creek | 17010303 3531 | Headwaters to Cd'A River | Sediment |
| Black Lake | 17010303 7529 | | Nutrients |
| Thompson Creek | 17010303 3530 | Headwaters to Cd'A River | Habitat alteration and sediment |
| Wolf Lodge Creek | 17010303 3541 | Headwaters to Cd'A Lake | Bacteria, habitat alteration, nutrients and sediment |
| Marie Creek | 17010303 7541 | Searchlight Creek to Wolf Lodge Creek | Habitat alteration |
| Cedar Creek | 17010303 3541 | Headwaters to Wolf Lodge Creek | Habitat alteration, oil and gas and sediment |
| Fernan Lake | 17010303 | | Nutrients |
| Fernan Creek | 17010303 3543 | Fernan Lake to Cd'A Lake | Bacteria, dissolved oxygen, habitat alteration, nutrients and sediment |
| Cougar Creek | 17010303 3545 | NF Cougar Creek to Cd'A Lake | Habitat alteration, nutrients and sediment |
| Kidd Creek | 17010303 3546 | Headwaters to Cd'A Lake | Habitat alteration, nutrients and sediment |
| North Fork Mica Creek-Mica Creek | 17010303 3547 | Headwaters to Cd'A Lake | Bacteria, dissolved oxygen, habitat alteration, nutrients and sediment |
| Lake Creek | 17010303 3549 | House(Kruse?) Creek to Cd'A Lake | Sediment |

Additional water bodies had been listed on the 1996 list. These are listed in Table 2. These water bodies were removed from the list when analysis of more recent water quality data indicated these streams are not presently water quality limited (IDEQ 1996c).

Table 2: List of additional water bodies included on the 1996 Section 303(d) list, but delisted as a result of sufficiently high water quality scores.

| Water body | HUC Number | Boundaries | Pollutant(s) |
|---|---|---|---|
| Carlin Creek | 17010303 3538 | Headwaters to Cd'A Lake | Sediment |
| Turner Creek | 17010303 3539 | Headwaters to Cd'A Lake | Sediment |
| Fernan Creek | 17010303 3544 | Headwaters to Fernan Lake | Habitat alteration, nutrients, sediment and pathogens |
| Rockford Creek | 17010303 3548 | Headwaters to Cd'A Lake | Habitat alteration, nutrients and sediment |

### 2.2.2. Beneficial Uses

Of the listed water bodies, the Coeur d'Alene River, Wolf Lodge Creek and Fernan Lake and its outlet creek have beneficial uses specifically designated in the Idaho Water Quality Standards

(IDAPA 16.01.02.) Beneficial uses of the other listed water bodies would be, by interpretation of the standards, cold water biota and secondary contact recreation (IDAPA 16.01.02101.01.a).

The Coeur d'Alene River has designated uses in the Idaho water quality standards (IDAPA 16.01.02110,01.ee.) of agricultural water supply, cold water biota, primary and secondary contact recreation and salmonid spawning. A use attainability and beneficial use status assessment was completed for the waters of the Coeur d'Alene Basin during 1992 (Hartz, 1993). All the designated uses were assessed as attainable. The river was assessed to be supporting agricultural water supply, primary and secondary contact recreation uses. Both cold water biota and salmonid spawning were assessed to be partially supported due primarily to exceedences of the zinc standard for the support of freshwater biota in the water column and concern that contaminated sediments may be affecting the freshwater biota through food chain interactions. Although Ellis (1940) reported the Coeur d'Alene River to be nearly devoid of all life to its mouth, more recent studies (Bauer, 1975; Hornig, Terpening and Bogue, 1988) indicate that self-sustaining populations of fish and macroinvertebrate species have returned to the river and the lakes of its floodplain. Macro-invertebrate numbers appear lower near the mouth and in the lower reaches of the river as compared to the control areas in the St. Joe River (Skille et. al., 1983). Phytoplankton productivity may also be affected by metals in the water column (Rabe, Wissmar and Minter, 1973). Adfluvial cold water fish (west slope cutthroat and bull trout (indigenous) and Chinook and Kokanee Salmon (introduced)) use the Coeur d'Alene River as a migratory route (Horner, personal comm.). A more thorough discussion of the Coeur d'Alene River and the lakes of its floodplain is provided in the Coeur d'Alene River Problem Assessment (IDEQ, 1997).

Wolf Lodge Creek (PB-360S) has designated uses of domestic water supply, agricultural water supply, cold water biota, salmonid spawning and primary and secondary contact recreation (IDAPA 16.01.02110,01.hh.). Fernan Lake and its outlet creek (PB-350S) have designated use of domestic water supply, agricultural water supply, cold water biota, salmonid spawning and primary and secondary contact recreation (IDAPA 16.01.02110,01.oo.).

### 2.2.3. Water Quality Standards

Water quality standards supportive of the designated beneficial uses are stated in the Idaho Water Quality Standards and Wastewater Treatment Requirements (IDHW 1996b). The criteria supporting the beneficial uses are outlined in Table 3. In addition to these criteria cold water biota and salmonid spawning are supported by two narrative criteria. The narrative sediment criterion states:

*Sediment shall not exceed quantities specified in section 250 or, in the absence of specific sediment criteria, quantities which impair designated beneficial uses. Determinations of impairment shall be based on water quality monitoring and surveillance and the information utilized as described in Subsection 350.02.b.*(IDAPA 16.01.02.200.08).

The excess nutrients criterion states:

*Surface waters of the state shall be free from excess nutrients that can cause visible slime growths or other aquatic growths impairing designated beneficial uses.* (IDAPA 16.01.02.200.06).

Table 3: Water quality criteria supportive of beneficial uses.

| **Designated Use** | **Primary Contact Recreation** | **Secondary Contact Recreation** | **Cold Water Biota** | **Salmonid Spawning** |
|---|---|---|---|---|
| Coliforms and pH | 500 FC/100mL | 800 FC/100mL | pH between 6.5 and 9.5 | pH between 6.5 and 9.5 |
| Coliforms and dissolved gas | 200 FC/100mL geometric mean over 30days | 400 FC/100mL geometric mean over 30 days | dissolved gas not exceeding 110% | dissolved gas not exceeding 110% |
| chlorine | | | total chlorine residual less than 19 ug/L/hr or an average 11 ug/L/4 day period | total chlorine residual less than 19 ug/L/hr or an average 11 ug/L/4 day period |
| toxics substances | | | less than toxic substances set forth in 40 CFR 131.36(b)(1) Columns B1, B2, D2 | less than toxic substances set forth in 40 CFR 131.36(b)(1) Columns B1, B2, D2 |
| dissolved oxygen | | | exceeding 6 mg/L D.O. | exceeding 5 mg/L intergravel D. O.; exceeding 6 mg/L surface |
| temperature | | | less than 22°C (72°F) instantaneous; 19°C (66°F) daily average | less than 13°C (55°F) instantaneous; 9°C (48°F) daily average |
| ammonia | | | low ammonia (formula/tables for exact concentration | low ammonia (formula/tables for exact concentration |
| turbidity | | | less than 50 NTU greater than background instantaneous; 25 NTU over 10 days greater than background | |

## 2.3. Water Quality Concerns and Status

The water quality concerns and status are addressed in the following sections by identifying potential pollutant sources and reviewing the existing data for the listed water bodies.

### 2.3.1. Pollutant Sources

The water bodies of the sub-basin placed on the 1996 list have reported pollutant exceedences for one or more of the following pollutants: bacteria, habitat alteration, nutrients, sediment, dissolved oxygen, oil and grease, pH and temperature. In most cases bacterial contamination would be predominantly from livestock grazing. Habitat alteration can occur from several actions. An incomplete list of these actions would include nearby road construction, removal of riparian vegetation, channelization or excess sedimentation. Excess nutrients normally are the result of human residential development or livestock grazing activities in the waters under assessment. Nutrients may also naturally build up in a lake over time causing a naturally eutrophic lake. Shallow lakes which have limited water flow through the lake on an annual basis are more likely to be eutrophic. Any water body, which has its source in a eutrophic lake, will itself be rich in nutrients. Sediment is a water constituent naturally yielded from erosion of the watersheds to water bodies in question. Excess sedimentation in these watersheds most often has its origin in roads developed for logging or access to a watershed and bank erosion associated with grazing. Roads may yield sediment directly from their surfaces or bed through mass wasting or their locations may cause the adjacent stream to begin bank cutting or incising its bed. Dissolved oxygen may be deficient in lakes and some streams as the result of the presence of biological oxygen demanding materials. Often eutrophic lakes have sufficient algal and weed growth to engender dissolved oxygen problems. Streams may have insufficient dissolved oxygen as a result of temperature exceedences. Oxygen solubility declines with increased water temperature. Temperature exceedences in these waters are often due either to insufficient water flow, alteration of the stream structure to a broad shallow morphology or lack of riparian vegetation to supply shading (Platts, Megahan and Minshall., 1983). Streams which have their source in shallow warm lakes often are warm as well. Oil and grease can be yielded to the streams by major roads such as an Interstate. Oil may be yielded after rains to nearby streams. Oil and tar have been spilled during accidents on these roads and these materials can find their way into the nearby streams. Excessively low pH normally results from acid mine drainage or from mill tailings materials associated with mining. Although a few natural acid rock drainages can be found in the sub-basin, data indicates these do not alter the pH of streams, significantly.

### 2.3.2. Available Water Quality Data

The available data for the water bodies of the 1998 list are provided in the following sections.

#### 2.3.2.1. Coeur d'Alene River

Water temperature and pH data have been collected on the Coeur d'Alene River as part of three years of metals monitoring. The pH data are from composite water samples collected monthly or bimonthly at the Cataldo, Rose Lake and Harrison monitoring stations (Table 4). The recorded pH values range between 6.5 and 7.5 and consistently have mean values above neutrality. These are typical pH values for the waters of northern Idaho. The data do not indicate any exceedence of the general aquatic pH standard (6.5-9.5)(IDAPA 16.01.02250.02.a.i.). Water temperature data were collected near the shore at the three monitoring stations as a part of the sampling procedure (Table 5). Water temperatures exceed cold water biota criteria in a very few cases during warm summers. Since these data were collected near shore, they are likely a few degrees warmer than water temperature offshore and at depth in the river. A few midsummer shore temperatures were in excess of the cold water biota standard (22°C)(IDAPA 16.01.02.250.c.ii.). Data developed by Golder and Associates (1998) support the data collected by DEQ, but none of these data were collected at depth in the river. In addition, sufficient data were not available to assess the daily average temperature cold water biota standard. To address this data gap, water temperature was continuously measured at the Harrison and Bull Run Bridges during the summer of 1999. The sensors were placed at four levels and three locations in the river at the Harrison Bridge and at two levels in the river at the Bull Run Bridge. The results from the eight sensors at the Harrison Bridge were remarkably similar. The between early July and late September. A lower number of exceedences occurred at depth. At the Bull Run Bridge the standard was exceeded 10% of the period at depth and 16% nearer the surface. The results indicate the river, which is too broad to be shaded, warms as it flows slowly downstream to the lake. However, the river exceeds the average temperature standard for cold water biota upstream. These results demonstrate the river is exceeding the current temperature standard for cold water biota.

Salmonid spawning occurs only in the reach of the river between the confluence of the North and South Forks of the river and Skeel Gulch (segments 4021 and 4018). This reach has riffles and

Table 4: Mean and deviation of pH data collected for three water years at the Cataldo, Rose Lake and Harrison Monitoring Stations on the Coeur d'Alene River.

| | pH Data for W Y 1995 | | pH Data for W Y 1996 | | pH Data for W Y 1997 | |
|---|---|---|---|---|---|---|
| Station | Mean | Standard Deviation | Mean | Standard Deviation | Mean | Standard Deviation |
| Cataldo | 7.09 | 0.24 | 7.23 | 0.22 | 7.12 | 0.15 |
| Rose Lake | 7.06 | 0.31 | 7.29 | 0.27 | 7.15 | 0.17 |
| Harrison | 7.15 | 0.21 | 7.11 | 0.17 | 7.20 | 0.19 |

gravels conducive to spawning. This reach has chinook salmon (September 15 to April 1) rainbow and cutthroat trout (January 1 to July 15) and whitefish (October 1 and April 1) spawning(IDAPA 16.01.02.250.d.iv.). The Cataldo monitoring station is located on this upper reach of the river. Temperatures are sufficiently low for whitefish spawning. (<13°C)(IDAPA 16.01.02250.d.ii.). Temperatures recorded in September exceed numeric temperature standards for chinook salmon spawning. Temperatures recorded in June and July exceed numeric temperature standards for rainbow and cutthroat trout spawning. The thermograph data collected downstream during the summer 1999 suggests that salmonid spawning temperature standards are violated. On the weight of the available evidence it appears that numeric salmonid spawning standards are regularly exceeded in the upper reach of the river.

Despite these temperature measurements, young of the year trout and salmon are easily observed along the upper reach of the river. Observation of numerous young of the year is normally taken as a strong indication that spawning is successful. This observation suggests that trout and salmon have acclimated or adapted to temperature conditions by spawning earlier in the case of rainbow and cutthroat or delaying until later in the case of chinook salmon to take advantage of cooler stream conditions.

| Table 5: Temperature Data for the Coeur d'Alene River . | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | | | | |
| Water Year1995 | | | | | | | | | | | | | | | | |
| | Oct | Nov | Dec | Jan | Feb | Mar | Apr | Apr | May | May | Jun | Jun | Jul | Jul | Aug | Sep |
| CATALDO | | | | | | 5.0 | 5.0 | 7.0 | 7.9 | 10.5 | 14.0 | 14.5 | 16.0 | 16.0 | 15.5 | 17.0 |
| ROSE LAKE | | | | | | 5.0 | 5.0 | 9.0 | 9.0 | 13.0 | 16.0 | 17.0 | 19.0 | 19.0 | 16.0 | 18.0 |
| HARRISON | | | | | | 5.5 | 3.5 | 9.0 | 9.0 | 15.0 | 15.0 | 19.0 | 22.0 | 21.0 | 19.0 | 20.0 |
| | | | | | | | | | | | | | | | | |
| Water Year1996 | | | | | | | | | | | | | | | | |
| | Oct | Nov | Dec | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | | | | |
| CATALDO | 9.0 | 4.0 | 1.0 | 1.5 | 0.0 | | 5.0 | 7.5 | 11.0 | | | | | | | |
| ROSE LAKE | 9.5 | 4.5 | 1.0 | 1.5 | 0.0 | | 5.0 | 8.0 | 11.0 | | | | | | | |
| HARRISON | 9.0 | 6.5 | 1.5 | 2.5 | 1.0 | | 6.0 | 9.0 | 14.0 | | | | | | | |
| | | | | | | | | | | | | | | | | |
| Water Year1997 | | | | | | | | | | | | | | | | |
| | Oct | Nov | Dec | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | | | | |
| CATALDO | 8.0 | 5.0 | 2.0 | 2.0 | 2.0 | 5.0 | 7.0 | 6.9 | 10.2 | 15.7 | 17.0 | 16.0 | | | | |
| ROSE LAKE | 8.0 | 4.0 | 3.0 | 1.5 | 3.0 | 5.0 | 6.5 | 8.8 | 11.5 | 18.3 | 19.2 | 17.4 | | | | |
| HARRISON | 8.0 | 5.0 | 3.0 | 1.0 | 4.0 | 6.0 | 7.0 | | 13.6 | 19.9 | 21.6 | 20.2 | | | | |
| | | | | | | | | | | | | | | | | |
| Water Year1998 | | | | | | | | | | | | | | | | |
| | Oct | Nov | Dec | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | | | | |
| CATALDO | 11.4 | 5.4 | 3.6 | 2.8 | 3.1 | 4.2 | 8.0 | 7.3 | 13.1 | 20.1 | 17 | | | | | |
| ROSE LAKE | 10.8 | 5.0 | 3.8 | 3.1 | 3.5 | 4.3 | 8.5 | 8.0 | 14.9 | 23.0 | 19 | | | | | |
| HARRISON | 11.4 | 4.9 | 3.3 | 2.7 | 3.8 | 4.4 | 9.9 | 8.9 | 15.6 | 25.2 | 21 | | | | | |
| | | | | | | | | | | | | | | | | |
| Note. | | | | | | | | | | | | | | | | |
| Temperature in degrees centigrade. | | | | | | | | | | | | | | | | |
| Temperature taken from the bank. | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | |

### 3.2.2.2. Latour, Larch and Baldy Creeks:

Latour Creek and its tributaries, Larch and Baldy Creeks, had continuous temperature measurement during the summer of 1997. These data (figures 3-5) indicate that temperatures supportive of cold water biota are maintained by these streams year-round. The principle spawning salmonids of these drainages would be cutthroat and brook trout and whitefish. Temperature data are not available for the October 1 to April 1 spawning period of brook trout and cutthroat trout. This period is bracketed by the warmer summer and early fall period. The data suggest the temperature standard is not exceeded during the fall and winter incubation months. The data do indicate the salmonid spawning temperature standard (<13°C)(IDAPA 16.01.02250.d.ii.) was exceeded during July 1997 on these streams.

Bacteria are also listed as a pollutant of concern on these three streams. These are largely forested watersheds with some dispersed residential development along lower Latour Creek. The Bureau of Land Management has land management responsibilities in these watersheds. No current grazing permits are operating in these watersheds. The last permits were terminated in 1988 (BLM, 1998). The absence of livestock grazing in a significant amount would suggest bacterial contamination is no longer an issue in these sub-watersheds. No other significant bacterial sources exist.

The lack of bacteria contamination was confirmed during the low discharge period of summer 1999. Water samples from Larch, Baldy and Latour Creeks were analyzed for fecal coliforms and *Escherichia coli* (E-coli). The Baldy and Latour Creeks were found to have seven or less per 100 mL in each case. Larch Creek had slightly higher fecal coliform and E coli counts of 28 and 20 per 100 mL, respectively (BURP, 1999). These values are sufficiently well below the fecal coliform primary contact standards of 500 fecal coliform per 100 mL and the proposed recreational standard of 406 E. coli per 100 mL that no additional testing was deemed necessary.

Figure 3: Latour Creek Temperature Data Summer 1997

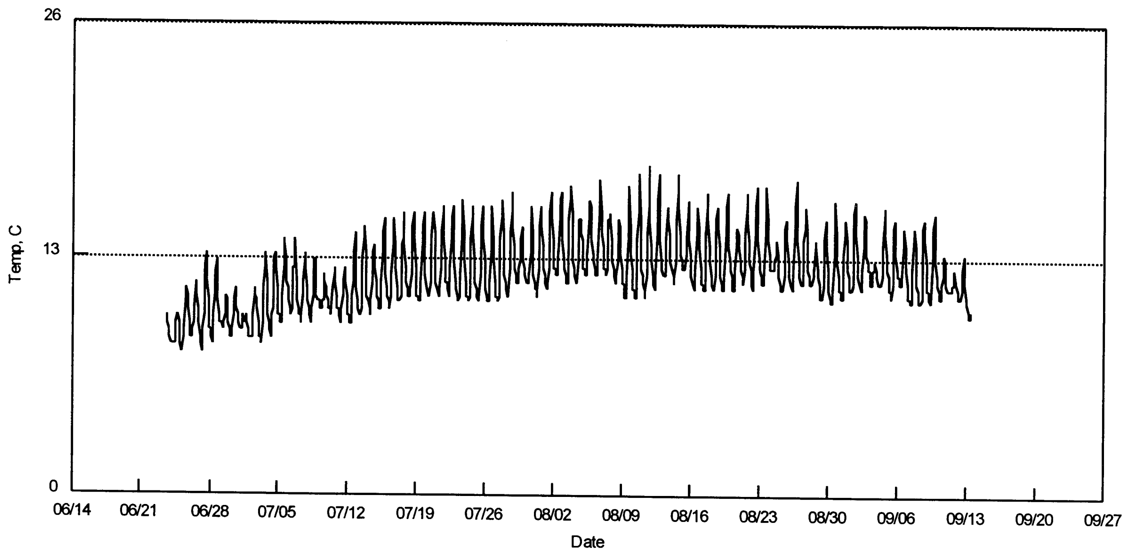


Figure 4: Larch Creek Temperature Data Summer 1997

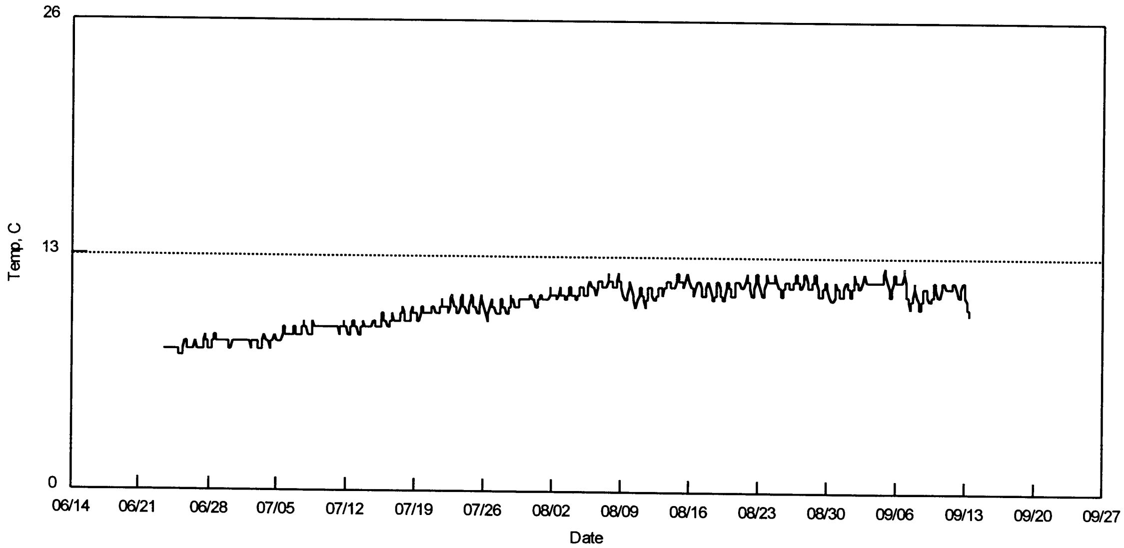
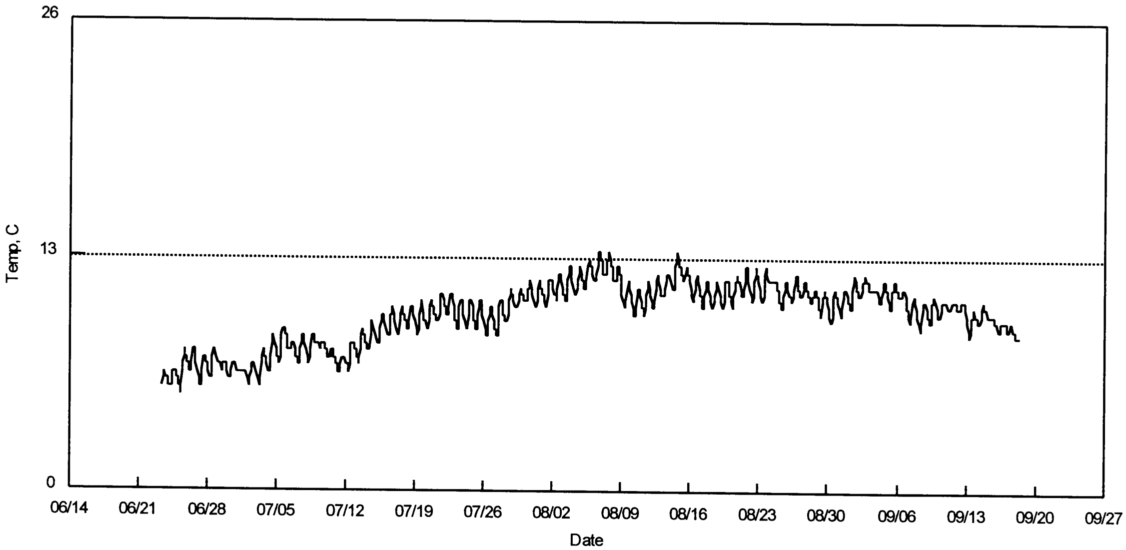


Figure 5: Baldy Creek Temperature Data Summer 1997




### 2.3.2.3. Black Lake:

Black Lake is a floodplain lake of the Coeur d'Alene River. The eleven floodplain lakes of the Coeur d'Alene River Valley are shallow, warm during the summer months and generally eutrophic (Table 6) (USGS 1993).

Table 6: Lateral Lakes Water Quality Nutrient Data 1992

| Lateral Lake | Total Inorganic N (mg/L) | Total Organic N (mg/L) | Total P (mg/L) |
|---|---|---|---|
| Anderson | 0.058 | 0.35 | 0.039 |
| Black | 0.020 | 0.85 | 0.046 |
| Blue | 0.021 | 0.20 | 0.010 |
| Bull Run | 0.021 | 0.35 | 0.063 |
| Cave | 0.033 | 0.25 | 0.058 |
| Killarney | 0.044 | 1.00 | 0.012 |
| Medicine | 0.016 | 0.35 | 0.085 |
| Rose | 0.252 | 0.80 | 0.058 |
| Swan | 0.078 | 0.55 | 0.013 |
| Thompson | 0.010 | 0.20 | 0.012 |

Note: Data not collected for Porter Lake

The generally accepted total phosphorous criterion for nuisance weed growth in lakes is 25 ug/L (USEPA, 1972). Black Lake total phosphorous values collected in 1992 (Table 6) and in 1997 (Table 7) indicate the lake is well above the criterion (approximately 50 ug/L). Table 6 indicates that eight of the ten lateral lakes measured are above the criterion and that Black Lake, is intermediate in its phosphorous level. The nutrient level of Black Lake and other lakes of the Coeur d'Alene River floodplain are typical of self-fertilizing eutrophic lakes (IDEQ, in draft). These lakes have likely been eutrophic for thousands of years (Rember, 1999). Organic and inorganic nitrogen levels support this interpretation. Eutrophy is simply a gauge of the nutrient status and age of the lake. The beneficial uses of Black Lake, which supports warm water biota, primary and secondary contact recreation, are not impaired by its eutrophic nature. The trophic status of Black Lake in relation to its expected condition as a small shallow floodplain lake does not support water quality limited listing for nutrients.

Table 7: Black Lake Water Quality Nutrient Data 1997

| Location | Total Inorganic N (mg/L) | Total Phosphorous (mg/L) |
|---|---|---|
| Mid-lake | 0.039 | 0.055 |

### 2.3.2.4. Wolf Lodge Creek

Absence of the reported bacteria contamination was found during the low discharge period of summer 1999. Bacterial samples from Wolf Lodge and Stella Creeks were analyzed from fecal coliform and E-coli. The streams were found to have 22 and 11 fecal coliform per 100 mL and 33 and 10 E-coli per 100 mL (BURP, 1999). These values are sufficiently well below the fecal coliform primary contact standards of 500 fecal coliform per 100 mL and the proposed recreational standard of 406 E. coli per 100 mL that no additional testing was deemed necessary.

Nutrients supportive of aquatic plant growth were assessed on water samples from Wolf Lodge Creek. Total phosphorous concentration was 14 ug/L as phosphorous. The guideline used by DEQ for interpretation of the excess nutrients narrative standard is 100 ug/L total phosphorous in flowing streams (USEPA, 1972). Total Kjeldahl nitrogen was 100 ug/L, while nitrate-nitrite analysis was 142 ug/L as nitrogen. The nitrogen data indicates that nearly all the nitrogen is in the form of nitrate-nitrite. The guideline for excess nitrate is 300 ug/L as nitrogen (Sawyer, 1947; Müller, 1953). The concentrations measured in Wolf Lodge Creek are less than half the guideline indicating the stream is not water quality limited by nitrogen.

### 2.3.2.5. Fernan Lake and Creek

A lake water quality assessment was completed on Fernan Lake during the 1991 field season (Mosier 1992). Nutrient data indicate the lake was mesotrophic (Table 8) and was not exceeding the nuisance weed growth criterion. Additional parameters collected in 1991 support the mesotrophic condition of Fernan Lake. Algal blooms have commonly been observed on the lake suggesting it is at or close to a eutrophic classification. The lake is currently in a state that intervention in the watershed could reduce phosphorous export to the lake and slow the pace of eutrophication. The possibility that the lake would become anoxic in its bottom waters is remote. The lake is relatively shallow (7 meters) allowing for wind driven re-oxygenation even at depth. Dissolved oxygen measurements completed at the time of the assessment showed bottom water to be low in oxygen during the summer (0.8 mg/L), but not anoxic. Water quality measurements collected to date from Fernan Lake do not violate water quality standards. However, the lake is close to violations and algal blooms occur on a yearly basis. An advisory TMDL should be developed for the lake based on further measurements of phosphorous loading.

Table 8: Fernan Lake Water Quality Average Nutrient Data

| Location | Total Inorganic N (ug/L) | Total Phosphorous (ug/L) |
|---|---|---|
| mid-lake | 50 | 21 |

Fernan Creek is listed for bacteria, dissolved oxygen, habitat alteration, nutrients and sediment. The stream currently has stable banks with stable vegetation. Sediment sources to the immediate stream are few and not severe. Upstream sources are precluded by Fernan Lake. No apparent source of bacteria exists. The habitat may have been altered in the past but stable habitats have reestablished along the stream. The stream is well shaded and shallow suggesting oxygen level would not be a problem. The pollutant listing on the 1998 303(d) lists may well date back to 1988 when the golf course and highway were under construction. A decade has past since the construction period. Vegetation has reestablished reducing sedimentation and producing habitats. The creek likely has a residual nutrient problem associated with its primary source of water, Fernan Lake, and possibly exacerbated by fertilization of the adjacent golf course.

Water samples from Fernan Creek were collected for fecal coliform and E coli analysis during the low discharge period of summer 1999. Analysis indicated four fecal coliform and ten E coli per 100 mL (BURP, 1999). These values are sufficiently well below the fecal coliform primary contact standards of 500 fecal coliform per 100 mL and the proposed recreational standard of 406 E. Coli per 100 mL that no additional testing was deemed necessary.

The stream likely does receive water enriched in nutrient from the lake. The golf course which flanks the west edge of the quarter-mile segment may also be a source of nutrients dependent on the turf management. The lower eighth-mile of stream fronts the golf course on one side. It is unlikely that a short segment would receive an important nutrient load or it would have an affect before discharge to the lake.

Nutrients supportive of aquatic plant growth were assessed on water samples from lower Fernan Creek. Samples were collected above the golf course. Total phosphorous concentration was 28 ug/L as phosphorous. The guideline used by DEQ for interpretation of the excess nutrients narrative standard is 100 ug/L total phosphorous in flowing streams (USEPA, 1972). The total phosphorous concentration measured for the creek is well below the guideline. Total Kjeldahl nitrogen was 230 ug/L as nitrogen, while nitrate-nitrite analysis was 290 ug/L as nitrogen. The nitrogen data indicate that most of the nitrogen is in the form of nitrate-nitrite. The guideline for excess nitrate is 300 ug/L as nitrogen (Sawyer, 1947; Müller, 1953). The concentration measured in lower Fernan Creek is quite close to the guideline, but below it. The high nutrient level most probably has its origin in Fernan Lake.

### 2.3.2.6. Cougar and Kidd Creeks

Nutrients supportive of aquatic plant growth were assessed on water samples from Cougar and nearby Kidd Creeks. Cougar Creek's total phosphorous concentration was 62 ug/L as phosphorous. Total Kjeldahl nitrogen was 190 ug/L as nitrogen, while nitrate-nitrite analysis was 156 ug/L as nitrogen. Kidd Creek's total phosphorous concentration was 43 ug/L as phosphorous. Total Kjeldahl nitrogen was 130 ug/L, while the nitrate-nitrite nitrogen measure was in error. The guideline used by DEQ for interpretation of the excess nutrients narrative standard is 100 ug/L total phosphorous in flowing streams (USEPA, 1972). Although Cougar and Kidd Creek's phosphorous concentrations are higher than expected, they are well below the guideline concentration. The guideline for excess nitrate is 300 ug/L as nitrogen (Sawyer, 1947; Müller, 1953). The concentration measured in Cougar Creek is roughly half the guideline. The Kidd Creek nitrogen data indicates the stream does not exceed the guideline, but additional testing of nitrate-nitrite is necessary. Unfortunately Kidd Creek does not flow late in the summer season.

### 2.3.2.7. Mica Creek

Water samples from Mica Creek and the North Fork Mica Creek were collected for fecal coliform and E. coli analysis during the low discharge period of summer 1999. Summer discharge measurements (2.5 cfs) indicate that secondary contact is the appropriate beneficial use for the stream. Both the acute (800 fecal coliform/ 100 mL) and chronic (geometric mean of 200 fecal coliform/100 mL) standards protective of secondary contact recreation were exceeded (Table 9). Analysis for E. coli was also made in anticipation of the proposed bacteria standard. Both the acute and chronic levels of this proposed standard were violated. The results indicate that Mica Creek and its North Fork are water quality limited by coliform bacteria. A TMDL addressing both the current fecal coliform and proposed E coli standards will be developed.

Table 9: Fecal and E. coliform bacteria from two locations on Mica Creek

| Date | Mica Creek FC | Mica Creek EC | NF Mica Creek FC | NF Mica Creek EC |
|---|---|---|---|---|
| 7/23/99 | 5100 | 2900 | 400 | 180 |
| 7/23/99 | | 1300 | | 200 |
| 7/27/99 | 570 | 150 | 600 | 130 |
| 7/30/99 | 730 | 630 | 500 | 380 |
| 8/4/99 | 800 | 220 | 720 | 190 |
| 8/24/99 | 570 | 300 | 600 | 300 |
| Geometric Mean | 993 | 535 | 553 | 216 |

Nutrients supportive of aquatic plant growth were assessed on water samples from Mica Creek and the North Fork Mica Creek. Total phosphorous concentration was 33 ug/L and 22 ug/L as phosphorous for Mica Creek and its North Fork, respectively. The guideline used by DEQ for interpretation of the excess nutrients narrative standard is 100 ug/L total phosphorous in flowing streams (USEPA, 1972). Total Kjeldahl nitrogen was 140 ug/L as nitrogen, while nitrate-nitrite analysis was 112 ug/L as nitrogen for Mica Creek. Total Kjeldahl nitrogen was 110 ug/L as nitrogen and 133 ug/L as nitrogen for the North Fork. The nitrogen data from both streams indicate that most of the nitrogen is in the form of nitrate-nitrite. The guideline for excess nitrate is 300 ug/L as nitrogen (Sawyer, 1947; Müller, 1953). The concentrations measured in Mica Creek and its North Fork are less than half the guideline, indicating the streams are not water quality limited by nitrogen.

#### 2.3.2.8. Lake Creek

Considerable water quality monitoring has been completed on Lake Creek, most recently for 1996 through 1998 (Bauer, Golden and Pettit, 1998). The stream transports large amounts of fine sediment primarily from agricultural fields and stream banks during high discharge events. The most recent work has found statistically significant and strong correlations between turbidity, suspended sediment and total phosphate and the signal output of an optical particle sensor. During storm events turbidity caused by suspended sediment transport can rise well above the criterion of 50 NTU above measurements at the upstream background station.. Peak turbidities of 600 to 1,000 NTU were observed during these events. When the background station is comapred these values are well above the salmonid sight feeding criterion (Table 3), indicating the stream is water quality limited for sediment.

#### 2.3.2.9. Sediment Data

Available sediment data for the streams and model results are summarized in the following sections.

##### 2.3.2.9.1. Riffle Armor Stability

A quantitative index of stream bed instability is the riffle armor stability index (RASI)(Kappesser, 1993). The measurement is not of value for the Coeur d'Alene River below the reach terminating at Skeel Gulch (4018). The measurement is of value above this point and in the tributaries to the river and the lake. Unfortunately, data of this type has not been collected for any of the water quality limited segments of the sub-basin.

##### 2.3.2.9.2 Residual Pool Volume

One consequence of stream sedimentation is a loss of pool volume through pool filling. The amount of pool volume in streams can be estimated using residual pool volume measurements. Residual pool volume is the volume a stream pool would occupy if the stream reached a zero discharge condition. Under this condition water would not flow over stream riffles, stream runs would hold little water and the pools would make up the majority of the wetted volume of the stream. Residual pool volume is calculated using a box model from measurements of average pool depth, average pool width, pool length and average pool tailout depth. Average pool tailout depth is subtracted from average pool depth to develop the third side of the box model. Residual pool volume is normally developed for a reach of stream twenty times bank full width in length. The values are normalized on the basis of pool volume per mile of stream. Residual pool volume increases with stream width. For this reason, residual pool volume values must be stratified by stream width to assess the relative amount of pool volume. Residual pool volume data for the water quality limited segments has been stratified by bankfull stream width (Table 10). The measurement has little meaning in the Coeur d'Alene River, which as a low gradient Rosgen C channel, is a single pool below the Cataldo boat ramp. It does help gage the level of sedimentation of smaller high gradient streams, especially in the Belt terrane. Residual pool volumes are adequate in Latour and Wolf Lodge Creeks. Volumes in Marie, Lake and Fourth of July Creeks appear diminished with respect to the amount measured in the much smaller Willow Creek. The lack of pools in Cougar, Kid and Mica Creeks may be the result of assessment of low gradient reaches of these streams or that these streams are located on granitic terrane with far more sand as sediment. This assessment has not been made on all water quality limited streams of the sub-basin.

Table 10: Mean residual pool volume and stream width for the water quality limited segments of the Coeur d'Alene Lake and River Sub-basin. Streams are stratified by bankfull width.

| **Stream** | **HUC Number** | **Bank Full Width (ft)** | **Residual Pool Volume ($ft^3$/mi)** |
|---|---|---|---|
| Latour Creek | 17010303 3535 | 24.7 | 34,969 |
| Wolf Lodge Creek | 17010303 3541 | 14.0 | 35,995 |
| Marie Creek | 17010303 7541 | 13.7 | 13,181 |
| Lake Creek | 17010303 3549 | 10.1 | 17,304 |
| Fourth of July Creek | 17010303 3534 | 10.0 | 18,737 |
| North Fork Mica Creek-Mica Creek | 17010303 3547 | 8.3 | 0 |
| Cougar Creek | 17010303 3545 | 7.8 | 0 |
| Willow Creek | 17010303 3531 | 6.9 | 45,678 |
| Kid Creek | 17010303 3546 | 6.0 | 0 |
| Cedar Creek | 17010303 3541 | N.D. | N.D. |
| Fernan Creek | 17010303 3543 | N.D. | N.D. |
| Baldy Creek | 17010303 7535 | N.D. | N.D. |
| Larch Creek | 17010303 7536 | N.D. | N.D. |
| Thompson Creek | 17010303 3530 | N.D. | N.D. |

Note: Data developed from IDEQ (Hartz, 1993)

### 2.3.2.10. Fish Population Data

Sedimentation can interfere with natural trout recruitment and cause the filling of pools. The effect may be reflected in the trout populations. Trout population density has been assessed in some tributaries of the lake and river by DEQ beneficial use reconnaissance teams. The Coeur d'Alene Tribe has developed fish population data for Lake Creek (Appendix A).

Cutthroat and brook trout are the salmonids found in these tributaries. Trout population densities (salmonid/$m^2$/ hour effort) of the listed segments are summarized in Table 11. Reference streams, elsewhere in the Coeur d'Alene River basin, range from 0.1 - 0.3 salmonid/$m^2$/hour effort (IDEQ, 1999). Similar population density was found for reference streams in granitic geologic settings near Priest Lake (Fitting and Dechert, 1997) It is necessary to default to these reference streams, because no appropriate references have been assessed in the sub-basin. Where data are available in the sub-basin, trout density values in most water quality limited segments are an order of magnitude lower than these reference values. The exceptions are Cedar and Cougar Creeks, which have values above the range of the reference values. Three age classes of salmonids were found only two streams; Latour and Cougar Creeks. Sculpin population density was typically found in a range of 0.1 - 0.5 fish/$m^2$/hour effort in reference streams (IDEQ, 1999). This range or slightly higher was found in sub-basin streams where data is available, except for Mica Creek. Sculpin may not be favored by the sandy bottom of this stream, where cobble is not available for the cover these fish use. Tailed frogs were found exclusively in Cedar Creek.

Table 11: Fish population per unit stream area of the water quality limited segments of the Coeur d'Alene Lake and River Sub-basin.

| Stream | HUC Number | Salmonid Density (fish/m²/hr effort) | Presence of Three Salmonid Age Classes | Sculpin Density (fish/m²/hr effort) | Presence of Sculpin and/or Tailed Frogs |
|---|---|---|---|---|---|
| Coeur d'Alene River | 17010303 3529 - 4023 | N.D. | N.D. | N.D. | N.D. |
| Latour Creek [1] | 17010303 3535 | 0.0271 | Yes | 0.1834 | No |
| Baldy Creek | 17010303 7535 | N.D. | N.D. | N.D. | N.D. |
| Larch Creek | 17010303 7536 | N.D. | N.D. | N.D. | N.D. |
| Fourth of July [1] Creek | 17010303 3534 | 0.0529 | No | 0.6247 | No |
| Willow Creek | 17010303 3531 | N.D. | N.D. | N.D. | N.D. |
| Thompson Creek | 17010303 3530 | N.D. | N.D. | N.D. | N.D. |
| Wolf Lodge Creek [1] | 17010303 3541 | 0.0639 | No | 0.7204 | No |
| Marie Creek | 17010303 7541 | N.D. | N.D. | N.D. | N.D. |
| Cedar Creek [1] | 17010303 3541 | 0.6570 | No | 0.5734 | Yes |
| Fernan Creek | 17010303 3543 | N.D. | N.D. | N.D. | N.D. |
| Cougar Creek [1] | 17010303 3545 | 0.4537 | Yes | 0.3871 | No |
| Kid Creek | 17010303 3546 | N.D. | N.D. | N.D. | N.D. |
| North Fork Mica [1] Creek-Mica Creek | 17010303 3547 | 0.0600 | No | 0.0480 | No |
| Lake Creek [2] | 17010303 3549 | 0.0279 | No | N.D. | N.D. |

Note: 1- data from DEQ beneficial use reconnaissance program; 2 - data from Coeur d'Alene Tribe; N.D. - no data

## 2.3.2..11. Sedimentation Estimates:

### 2.3.2.11.1. and Use Type Areas, Road Density and Impacts

Several tributaries to the lake and river are listed as water quality limited for sediment impacts. The river is affected by sediment in its upper segments above Skeel Gulch. Below Skeel Gulch, the river is gradient limited from carrying sediment particles larger than a fine grain of sand and is insulated from tributary sedimentation by its broad floodplain. As discussed earlier, sedimentation of the upper segments is the result of sediment loads primarily from the North and South Forks of the River. These impacts must be addressed in those watersheds.

Land use areas and roads information is required to model sedimentation. It was developed from

Geographical Information Systems (GIS) coverages. Existing coverages of land use and road systems developed by the Forest Service (CDASTDS) and Idaho Department of Lands were used where these were available (Wolf Lodge Creek). Where these were not available, canopy coverage was developed using USGS digital orthophoto quadrangles. Canopy coverage was ground verified by CWE crews cumulative watershed effects. Road coverage was available through the Idaho Department of Lands (IDL) from the Forest Service, timber companies and the counties. Forest fire coverage was supplied by the Forest Service (IPFIRES) All constructed GIS coverages were developed by Idaho Department of Lands personnel. Land use and roads data is presented in Table 12. After assessment of the watersheds by Idaho Department of Lands specialists, cumulative watershed effects (CWE) scores were developed. Additional sediment model assumptions and documentation are in Appendix B.

### 2.3.2.11.2. Sediment Yield and Export Coefficients

Sediment yields were developed separately for agricultural, forest lands and forest roads. The models used assume 100% export of the yielded sediment to the stream.

#### 2.3.2.11.2.1. Agricultural Land Sediment Yield and Export.

Sediment yield was estimated from agricultural lands (pasture and dry agriculture) using the Revised Universal Soil Loss Equation (RUSLE) (equation 1)(Hogen, 1998).

Equation 1: $A = (R)(K)(LS)(C)(D)$ tons per acre per year where:

: A is the average annual soil loss from sheet and rill erosion
: R is climate erosivity
: K is the soil erodibility
: LS is the slope length and steepness
: C is the cover management and
: D is the support practices.

RUSLE does not take into account bank erosion, gully erosion or scour. RUSLE applies to cropland, pasture, hayland or other land which has some vegetation improvement by tilling or seeding. Based on these soils characteristics of the agricultural land, the slope, sediment yield was developed for the agricultural land use of each watershed (Table 13). Sediment yield from agricultural lands was estimated by applying the sediment yield coefficients to the land area in agricultural use (Table 15).

#### 2.3.2.11.2.2. Forest Land Sediment Yield and Export

Forest land sediment yield was based on sediment production rates used in the Forest Service WATSED Model (Patten, personal comm.). These are 25 tons per square mile per year with a range from 22-35 for the Kaniksu granitic terrane and 15 tons per square mile per year with a range from 12-17 for the Belt Supergroup terrane. The mean values were used for all conifer

Table 12: Land use of selected watersheds draining to Coeur d'Alene Lake and River.

| Watershed | Wolf Lodge Creek | Cedar Creek | Cougar Creek | Kid Creek | Mica Creek | Thompson Creek | Willow Creek | Fourth of July Creek | Baldy Creek | Larch Creek | Latour Creek[2] |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Pasture/ dry ag (ac) | 946 | 77 | 869 | 906 | 422 | 820 | 453 | 1,548 | 0 | 0 | 257 |
| Conifer forest (ac) | 27,254 | 11,128 | 1,589 | 750 | 2,385 | 1,587 | 3,386 | 16,193 | 5,372 | 548 | 23,181 |
| Unstocked forest (ac) | 121 | 26 | 2,025 | 833 | 3,475 | 80 | 36 | 165 | 145 | 0 | 3,855 |
| Highway (ac) | 85 | 358 | 59 | 38 | 62 | 0 | 0 | 336 | 0 | 0 | 0 |
| Forest Road (mi) | 197.2 | 92.2 | 50.0 | 18.0 | 40.0 | 21.0 | 22.5 | 77.6 | 48.2 | 0.5 | 186.9 |
| Forest road density ($mi/mi^2$) | 4.6 | 5.7 | 3.0 | 3.1 | 1.7 | 5.4 | 3.7 | 2.8 | 5.4 | 0.6 | 4.4 |
| Stream crossings | 58 | 23 | 66 | 10 | 47 | 23 | 16 | 76 | 12 | 0 | 65 |
| Road Crossing Frequency[3] | 0.5 | 0.2 | 1.6 | 0.8 | 0.9 | 2.2 | 1.5 | 1.2 | 1.1 | 0 | 0.5 |
| Road Contributing (mi) | 4.4 | 1.7 | 5.0 | 0.8 | 3.6 | 1.7 | 1.2 | 5.8 | 0.9 | 0 | 4.9 |
| Road encroaching (mi) | 8.8 | 6.3 | 1.9 | 0.3 | 1.6 | 1.3 | 0.9 | 0.4 | 0.4 | 0 | 6.4 |
| CWE Score | 18.9 | 18.9 | 15 | 10 | 17.8 | 17.3 | 24.6 | 20.2 | 13.3 | 13.3 | 13.3 |

Table 13: Estimated sediment yield coefficients dry agriculture, pasture and rangelands. [1.]

| Watershed | Wolf Lodge Creek | Cedar Creek | Cougar Creek | Kidd Creek | Mica Creek | Thompson Creek | Willow Creek | Fourth of July Creek | Latour Creek |
|---|---|---|---|---|---|---|---|---|---|
| Rangeland (tons/ac/yr) | 0.040 | - | 0.321 | 0.391 | 0.541 | 0.541 | 0.240 | 0.741 | - |
| Pasture (tons/ac/yr) | 0.030 | 0.040 | 0.030 | 0.050 | 0.050 | - | 0.040 | 0.030 | 0.020 |

[1.] Pasture, and dry agriculture, sediment production and export based on the revised universal soil loss equation for lands of 0-2% slope.

Table 14: Estimated sediment yield coefficients for forest land uses on the terrane of the watersheds.

| Land use type sediment export coefficient | (Kaniksu) Granitic Terrane | (Belt Supergroup) precambrium meta sediments Terrane |
|---|---|---|
| Conifer forest (tons/ha/yr)[1] | 0.038 | 0.023 |
| Unstocked forest (tons/ac/yr)[1] | 0.055 | 0.027 |
| Areas of double fire tons/acre/yr) | 0.017 | 0.004 |
| Highway (tons/ac/yr)[2] | 0.034 | 0.019 |

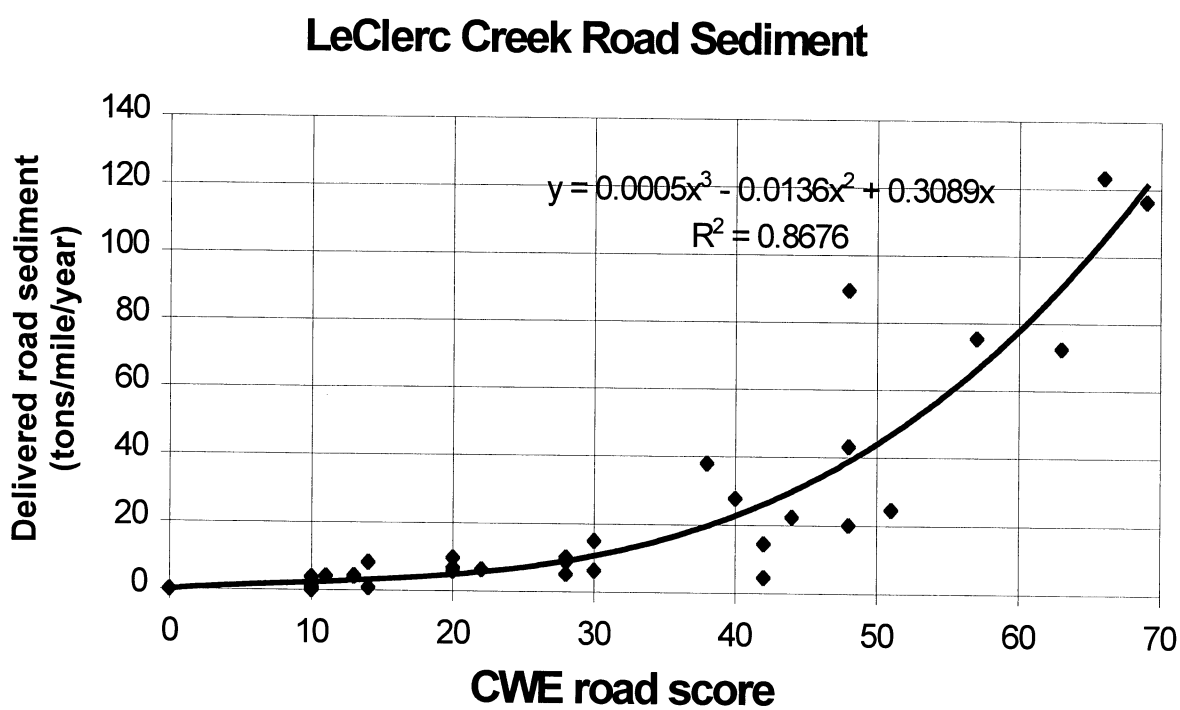
[1] Forest "natural" sediment production rates based on 25 tons/mi$^2$/yr (range 22-35) from Kaniksu granitics and 15 tons/mi$^2$/yr (range 12-17) for Belt Supergroup terranes. All conifer forest except unstocked acreage assumed to have median export coefficient. Unstocked forest lands(lands not meting FPA stocking rate) assumed to have the highest export coefficient. Areas of double fires adjusted to highest coefficient.

forest, which was fully stocked. The highest values in the range were used for parcels which were not fully stocked with trees, based on the Idaho Forest Practices Act standards. The lowest value for the Belt and Kaniksu terrane were applied to highway rights of way (Table 14). Sediment yield from forest lands was estimated by applying the sediment yield coefficients to the land area in forest use (Table 15). It was assumed all yielded sediment was delivered to the stream system.

### 2.3.2.11.2.3 Forest Roads

Forest road sediment yield was estimated using a relationship between CWE score and the sediment yield per mile of road (Figure 6). The relationship was developed for roads on a Kaniksu granitic terrane in the LaClerc Creek watershed (McGreer, pers comm.). Its application

Figure 6: Sediment export of roads based on Cumulative Watershed Effects




to roads on Belt metamorphic terranes conservatively overestimates sediment yields from these systems. The watershed CWE score was used to develop a sediment load in tons per mile, which was multiplied by the estimated road mileage in the watershed yield total sediment load to streams. This road surface directly contributing was assumed to be that located 200 feet on either side of a stream crossing. (Table 12). In the case of roads, it was assumed that all sediment was delivered to the stream system. These assumptions conservatively over estimate actual delivery.

Roads deliver sediment to streams through two additional mechanisms. Road fills associated with stream crossings can fail. Based on the CWE data base, the actual fill failure and delivery was estimated. Fill failures are known to occur primarily during discharge events which reoccur every 10 - 15 years. The CWE data was divided by 10 years to estimate the watershed sedimentation from road failures in tons of sediment per year. The estimates were applicable to the specific watershed for which the CWE data were collected. The watershed wide impact was developed from road fill failure and delivery data from the road assessment scaled up by a factor reflecting the total roads in the watershed. Road fills are composed not only of fines, but course material as well. Since the road bed is most often built from the B and C horizons of the soil on hand, the percentage of fines from fill failures as compared to the course fraction (pebbles and larger). These estimates are developed from weighted averages of the major soils series of the watershed based on the STATSGO coverage of soils. Weighted averages were developed for each watershed from the weighted averages of the horizons of the major soil series in each map unit composing the watershed (Dechert, 1999)(Appendix B). These percentages are applied to the sediment yields to estimate the fines exported to the streams as compared to the pebble and larger fraction.

Many roads are sited in locations which encroach on the floodplain of the stream. This construction practice often alters the gradient of the stream. The gradient is effectively increased, because the stream length is shortened. The stream uses the resulting additional stream power to erode material and regain stream length to move towards its original steady-state gradient. The result is increased erosion and sediment export, either from the road bed or, if this is armored, from the bed and banks of the stream itself. Roads fifty feet from streams were assumed to be encroaching. The amount of erosion and subsequent sediment delivery is estimated based on the miles of encroaching stream. The bulk of the erosion is assumed to occur during the large discharge events occuring every 10 - 15 years. The materials eroded are primarily the native soils of the area with their characteristic distribution of fines and course materials. These percentages are estimated from the major soils series of the watershed. The gross deliver was divided by ten to account for the episodic nature of the mechanism's sediment delivery. Additional details on the sediment model used are available in Appendix B. The model spreadsheets for those watersheds modeled are in Appendix C.

#### 2.3.2.11.2.4. County and Private Roads

County and private road surface erosion was modeled with the RUSLE model (Sandlund, 1999). Based on slope length, soil type and surface material, a coefficient of tons per acre per year was developed. These coefficients were applied to the area of the road 200 feet on either side of stream crossings. Since the width of county and private roads is set by ordinance, an acreage associated with this distance could be calculated.

Road fill failure and encroachment were treated as the forest roads. The CDAROADS GIS coverage maps all roads; county, private and forest.

#### 2.3.2.11.2.4 Sedimentation Estimates

Sedimentation estimates were developed by addition of the various sediment yields. The models (RUSLE, WATSED) and methods used assume complete delivery to the stream channels (Table 15).

Table 15: Estimated sediment export of watersheds listed for sediment impairment.

| Watershed | Wolf Lodge Creek | Cedar Creek | Cougar Creek | Kidd Creek | Mica Creek | Thompson Creek | Willow Creek | Fourth of July Creek | Baldy Creek | Larch Creek | Latour Creek |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Pasture/ dry ag (tons/yr) | 28.4 | 2.3 | 78.3 | 88.6 | 130.3 | 24.7 | 18.1 | 46.4 | 0.0 | 0.0 | 5.1 |
| Conifer forest (tons/yr) | 626.9 | 256.0 | 298.5 | 71.7 | 463.9 | 43.0 | 77.9 | 372.4 | 123.6 | 12.6 | 533.2 |
| Unstocked forest (tons/yr) | 3.2 | 0.8 | 10.4 | 4.3 | 3.6 | 2.2 | 1.0 | 4.5 | 3.9 | 0.0 | 104.1 |
| Highway (tons/yr) | 1.6 | 6.8 | 2.0 | 1.3 | 2.1 | 0.0 | 0.0 | 6.4 | 0.0 | 0.0 | 0.0 |
| Road Crossing Fine (tons/yr) | 53.3 | 30.2 | 25.0 | 8.8 | 36.3 | 13.9 | 12.1 | 55.4 | 4.5 | 0.0 | 30.8 |
| Road Fills (tons/yr) | 0.1 | 1.4 | 42.7 | 0.0 | 3.3 | 0.0 | 0.0 | 1.3 | 0.0 | 0.0 | 38.7 |
| Road Encroaching (tons/yr) | 47.2 | 33.8 | 10.2 | 1.6 | 8.6 | 7.0 | 4.8 | 2.7 | 2.2 | 0.0 | 72.9 |
| Bank Erosion (tons/yr) | 33.0 | - | - | - | - | - | - | - | - | - | - |
| Total (tons/yr) | 792.7 | 331.3 | 476.1 | 176.3 | 647.8 | 90.8 | 117.9 | 489.1 | 134.2 | 12.6 | 784.8 |

### 2.3.3 Beneficial Use Support Status

Water bodies were not assessed for habitat alteration. Current Division of Environmental Quality Policy does not recognize habitat alteration as a quantifiable and therefore allocatable parameter. Temperature standards are currently under review to assess their applicability. Water bodies requiring thermal TMDLs are being deferred until this review is complete. The assessed support status of the water bodies based on the data available is provided in column 4 of Table 16. The need for development of a TMDL is noted. Column five explains why TMDLs are not needed for some pollutants listed on the 1998 303(d) list.

Table 16: Results of Water body assessment based on application of the available data.

| Water body Name | HUC Number | Boundaries | Assessed Support Status | Reasons TMDL not required for pollutants |
|---|---|---|---|---|
| Cd'A River | 17010303 4021 | SF Cd'A R to French Gulch | limited by sediment [1,3] | pH data provided Table 4 |
| Cd'A River | 17010303 4018 | French Gulch to Skeel Gulch | limited by sediment [1,3] | pH data provided Table 4 |
| Cd'A River | 17010303 4022 | Skeel Gulch to Latour Creek | limited by temperature | pH data provided Table 4 Sediment not impairing use |
| Cd'A River | 17010303 4019 | Latour Creek to Fourth of July Creek | limited by temperature | pH data provided Table 4 Sediment not impairing use |
| Cd'A River | 17010303 4017 | Fourth of July Creek to Fortier Creek | limited by temperature | pH data provided Table 4 Sediment not impairing use |
| Cd'A River | 17010303 4016 | Fortier Creek to Robinson Creek | limited by temperature | pH data provided Table 4 Sediment not impairing use |
| Cd'A River | 17010303 4020 | Robinson Creek to Cave Lake | limited by temperature | pH data provided Table 4 Sediment not impairing use |
| Cd'A River | 17010303 4015 | Cave Lake to Black Lake | limited by temperature | pH data provided Table 4 Sediment not impairing use |
| Cd'A River | 17010303 3529 | Black Lake to Thompson Lake | limited by temperature | pH data provided Table 4 Surface temperatures exceedences in Table 5 not expected at depth; HOBO data indicates standard exceedence ;. Sediment not impairing use |
| Cd'A River | 17010303 4023 | Thompson Lake to Cd'A Lake | limited by temperature | pH data provided Table 4 Sediment not impairing use |
| Latour Creek | 17010303 3535 | Headwaters to Cd'A River | impaired by temperature and sediment | bacteria below standard (section 3.2.2.2. ) |

| Water body Name | HUC Number | Boundaries | Assessed Support Status | Reasons TMDL not required for pollutants |
|---|---|---|---|---|
| Baldy Creek | 17010303 7535 | Headwaters to Latour Creek | limited by temperature | bacteria below standard (section 3.2.2.2. ) ;excessive sedimentation not found Table 15 |
| Larch Creek | 17010303 7536 | Headwaters to Latour Creek | limited by temperature | bacteria below standard (section 3.2.2.2. ) ; excessive sedimentation not found Table 15 |
| Fourth of July Creek | 17010303 3534 | Headwaters to Cd'A River | not impaired | excessive sedimentation not found Table 15 |
| Willow Creek | 17010303 3531 | Headwaters to Cd'A River | not impaired | excessive sedimentation not found Table 15 |
| Black Lake | 17010303 7529 | | not impaired | nutrients typical of eutrophic lake Table 6 |
| Thompson Creek | 17010303 3530 | Headwaters to Cd'A River | not impaired | excessive sedimentation not found Table 15 |
| Wolf Lodge Creek | 17010303 3541 | Headwaters to Cd'A Lake | impaired for sediment | bacteria and nutrients below standards (2.3.2.4.) |
| Marie Creek | 17010303 7541 | Searchlight Creek to Wolf Lodge Creek | TMDL not applicable[5] | habitat alteration not allocatable |
| Cedar Creek | 17010303 3541 | Headwaters to Wolf Lodge Creek | limited by sediment | oil and grease not found in stream |
| Fernan Lake | 17010303 | | not impaired, but advisory TMDL recommended; year 2000 | nutrients lower than weed growth guideline 25 ug/L Table 8 |
| Fernan Creek | 17010303 3543 | Fernan Lake to Cd'A Lake | not impaired | stream re-stabilized after highway and golf course construction; bacteria and nutrients below standards ( section 2.3.2.5.) |
| Cougar Creek | 17010303 3545 | NF Cougar Creek to Cd'A Lake | impaired by sediment | nutrients below guideline (section 2.3.2.6.) |
| Kid Creek | 17010303 3546 | Headwaters to Cd'A Lake | not impaired | nutrients below guideline (section 2.3.2.6.): excessive sedimentation not found Table 15 |
| North Fork Mica Creek-Mica Creek | 17010303 3547 | Headwaters to Cd'A Lake | impaired by sediment and bacteria | Nutrients below guideline (section 2.3.2.7.) |
| Lake Creek | 17010303 3549 | House(Kruse?) Creek to Cd'A Lake | impaired by sediment | |

1. Sedimentation must be addressed in South and North Fork Coeur d'Alene River TMDLs
2. Except for metals addressed in Coeur d'Alene River Metals TMDL.
3. Temperature likely limiting.
4. Sedimentation data incomplete. Treat as part of a Latour Creek TMDL.
5. Treat as part of a Wolf Lodge-Cedar Creeks TMDL.

The TMDLs required for HUC 17010303 can be grouped in some cases. The two most upstream segments of the Coeur d'Alene River are sediment impaired. This impairment is the result of sediment delivery from the North and South Forks of the river. Below Skeel Gulch sediments are fine and the river is at a sufficiently low gradient that the bed consists of fine sand rather than cobble bedded. In this case sedimentation does not impact beneficial use directly as in higher gradient channels. The sediment impairment above Skeel Gulch must be addressed in the source areas of the North and South Fork Coeur d'Alene Rivers.

Sediment and temperature impair Latour Creek. Its tributaries Baldy and Larch Creeks were found to be temperature impaired. Baldy and Larch Creeks will be treated in a Latour Creek TMDL which addresses excessive sedimentation. Temperature TMDLs have been postponed pending resolution of Idaho's temperature standards.

Wolf Lodge Creek and its tributary Cedar Creek appear from the sediment analysis to have elevated sedimentation. Although Marie Creek was not listed for sediment it will be treated in a Wolf Lodge Creek TMDL which also will address Cedar Creek. Individual sediment TMDLs will be required for Cougar, Kidd and Mica Creeks. A bacteria TMDL is required for Mica Creek.

A sediment TMDL is required for Lake Creek. The segment listed is located within the boundaries of the Coeur d'Alene Reservation making this TMDL the lead responsibility of the Environmental Protection Agency (EPA). Lake Creek had an active State Agricultural Water Quality Program (SAWQP). The program plan is with some rearrangement and the addition of an in-stream water quality goal, essentially a TMDL. A loading analysis and allocation are present in the current plan. Either the EPA or the Natural Resource Conservation Service could reshape the existing program plan into a TMDL. Implementation of that plan is currently underway.

### 2.4. Pollution Control

Some water pollution controls have been implemented. These are discussed in the following sections together with the pollution control strategies.

#### 2.4.1. Control Efforts to Date

Pollution control efforts to date have been in place on some of the watershed requiring additional TMDL measures.

Analysis of sediment in eleven watersheds of the basin indicates roads are the primary sediment producing infrastructures. Forest harvest methods have progressed from logging systems heavily dependent on haul roads to those less dependent of high road densities. At certain log prices, helicopter logging has become a viable alternative in some watersheds. Unfortunately, an inventory of old roads continue to yield sediment to the streams. The U.S. Forest Service has carried out an aggressive program of forest road retirement and obliteration in the past five years. These efforts should have some beneficial effect primarily in the Wolf Lodge Creek watershed. The Latour, Cougar and Mica Watersheds contain very limited or no lands under Forest Service Management.

The Forest Service Program has sought to obliterate entire roads. Recent analysis indicates roads cause sediment loading primarily near road crossings of streams and where roads are located within the stream floodplain causing gradient changes. Scarce funds obtained by the Forest Service might be better targeted on the sediment yield areas rather than on obliteration of the entire road.

Kootenai County has operated sediment traps in lower Latour Creek. These traps are fitted with rock sills to prevent head cutting. These traps collect excess sediment during high flow. The sediment is removed by a local gravel contractor and sold in the aggregate market. Similar gravel harvest occurs in Wolf Lodge Creek.

The Lake Creek SAWQP was discussed earlier. This program has contracts let for application of agricultural best management practices on 2,270 acres of the 8,147 critical cropland acres in the watershed. In addition 1,135 acres have been placed in the federal Conservation Reserve Program. The SAWQP program is currently 42% implemented.

### 2.4.2. Pollution Control Strategies

Pollution control strategies are required for sediment and temperature in one watershed, for sediment and bacteria in another and for sediment in an additional two watersheds.

A temperature TMDL would set thermal guidelines to meet state temperature criteria. The TMDL might then assess the amount of unshaded stream within the watershed. Relationships between the percent of stream shading and the thermal input to the stream have been developed. Based on these relationships and the inventory of stream shading, riparian plantings would be allocated to achieve a percent cover goal associated with a thermal goal.

Sediment TMDLs have a less precise criteria-based goal. In this case a level of sediment reduction based on best professional judgement of hydrologists and sedimentologists would be set for each watershed requiring a TMDL. Since roads are known to be the major sediment yielding areas, the TMDL would allocate sediment load reduction based on road improvements or abandoned road obliteration. Roads located within the floodplain of streams and affecting the stream gradient would be targeted for removal. Where stream gradient had been altered for agricultural purposes, stream realignment or armoring should be explored. Stream crossings are additional locations at which forest roads are a source of sediment generation, both directly or by increased water capture. Where no longer needed these crossings should be decommissioned to remove culverts, lay back the stream bed and make the road surface an out sloped an infiltrating surface, by grading and ripping the surface. Sediment reduction can be estimated for all of these measures. The watersheds can be inventoried to select a suite of sediment reducing projects. A system of pollution credit trading might be instituted as part of the TMDL to engage the private sector in the implementation of sediment reducing projects as best management practices are currently installed today as a part of doing business in forested watersheds. Agricultural incentives could be applied to promote application of stream channel's gradient restoration or armoring on private agricultural lands.

A bacterial TMDL would require reduction of bacteria numbers in a stream through different livestock management. The TMDL would require specific percent reductions of these management actions.

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# Appendix A: Fish population base data.

| Stream | HUC Number | Area Electrofished ($m^2$) | Time Electrofished (sec) | Number of Salmonids | Number of Sculpin | Salmonid Density (fish/$m^2$/hr effort) | Sculpin Density (fish/$m^2$/hr effort) |
|---|---|---|---|---|---|---|---|
| Coeur d'Alene River | 17010303 3529 - 4023 | N.D. | N.D. | N.D. | N.D. | N.D. | N.D. |
| Latour Creek[1] | 17010303 3535 | 783 | 4,237 | 25 | 169 | 0.0271 | 0.1834 |
| Baldy Creek | 17010303 7535 | N.D. | N.D. | N.D. | N.D. | N.D. | N.D. |
| Larch Creek | 17010303 7536 | N.D. | N.D. | N.D. | N.D. | N.D. | N.D. |
| Fourth of July[1] Creek | 17010303 3534 | 400 | 850 | 5 | 59 | 0.0529 | 0.6247 |
| Willow Creek | 17010303 3531 | N.D. | N.D. | N.D. | N.D. | N.D. | N.D. |
| Thompson Creek | 17010303 3530 | N.D. | N.D. | N.D. | N.D. | N.D. | N.D. |
| Wolf Lodge Creek[1] | 17010303 3541 | 400<br>2,200 | 1,041<br>3,897 | 13<br>37 | 160<br>137 | 0.1124<br>0.0155 | 1.3833<br>0.0575 |
| Marie Creek | 17010303 7541 | N.D. | N.D. | N.D. | N.D. | N.D. | N.D. |
| Cedar Creek[1] | 17010303 3541 | 350 | 861 | 55 | 48 | 0.6570 | 0.5734 |
| Fernan Creek[1] | 17010303 3543 | N.D.<br>(150) | N.D.<br>(801) | N.D.<br>(6) | N.D.<br>(0) | N.D.<br>(0.1798) | N.D.<br>(0.0000) |
| Cougar Creek[1] | 17010303 3545 | 200 | 744 | 19 | 16 | 0.4597 | 0.3871 |
| Kid Creek | 17010303 3546 | N.D. | N.D | N.D | N.D | N.D | N.D |
| North Fork Mica[1] Creek-Mica Creek | 17010303 3547 | 200 | 1,500 | 5 | 4 | 0.0600 | 0.0480 |
| Lake Creek[2] | 17010303 3549 | 93.88* | N/A | 2.61 | N.D. | 0.0279 | N.D. |

Note: 1 - data from DEQ beneficial use reconnaissance program 1993; 2 - data from Cd'A Tribe; * - calculated based on average number per 100feet (30.48m) and mean width of 10.1 feet (3.08m); ( ) - data from segment above WQL segment; N.D - no data.

# Appendix B: Sediment Model Assumptions and Documentation

## Sediment Model Assumptions and Documentation

*Background:*

Sediment is the pollutant of concern on the majority of the water quality limited streams of the Panhandle Region. The form the sediment takes is most often governed by the lithology or terrane of the region. Two major terranes dominate in northern Idaho. These are the meta-sedimentary Belt Supergroup and granitics present either in the Kaniksu batholith or in smaller intrusions as the Round Top Pluton and the Gem Stocks. In some locations Columbia River Basalt formations are important, but these tend to be to the South and West primarily on the Coeur d'Alene Reservation. Granitics weather to sandy materials with a lesser amount of pebbles or larger particle sizes. Pebbles and larger particle sizes with significant amounts of sand remain in the higher gradient stream bedload. The Belt terranes produce both silt size particles and pebbles and larger particle sizes. Silt particles are transported to low gradient reaches, while the larger sizes comprise the majority of the higher gradient stream bedload. Basalts erodes to silt size and particles similar to the Belt terranes, but the large basalt particles are less resistant, weathering to smaller particles.

Any attempt to model the sediment output of watersheds will provide, relative rather than exact, sediment yields. The model documented here attempts to account for all significant sources of sediment separately. This approach is used to identify the primary sources of sediment in a watershed. This identification of primary sources will be useful as implementation plans designed to remedy these sources are developed. The approach has the added advantage of identifying to the state of the technology all of the sources. If additional investigation indicates sources quantified as minor are not, the model input can be altered to incorporate this new information.

*Model Assumptions:*

### ***Land use and sediment delivery:***

RUSLE is the correct model for pasture. RUSLE accounts for production and delivery of sediment. Sediment modeled by RUSLE is fine.

WATSED covers production and delivery of sediment from forested areas. Sediment modeled by WATSED is fine and course.

Sparse and heavy forest of all age classes including seedling-sapling should be given mid range of the WATSED coefficient for the geologies, while areas not fully stocked by Forest Practices Act standards are given the upper end of the range.

WATSED coefficients can be modified within the range observed to estimate highway corridor land use and the effects of repeated wild fires.

Double burned areas have eroded significantly to the stream channel but are not now eroding; a residual sediment load in the channels is possible from previous catastophic burns.

***Road sediment production and delivery:***

Road erosion using the CWE approach should be limited to the 200 feet of road on either side of road crossings, not to total road mileage.

The use of the McGreer relationship between CWE score and road surface erosion is a valid estimate of road surface fines production and yield. In the case of Belt terrane, it is a conservative (overestimate) estimate.

CWE data collected for actual road fill failures and sediment delivery reflects the situation throughout the watershed. Since the great majority of road failures occur during episodic high discharge events with a 10 - 15-year return period, road failures reflect the actions of the last large event and must be divided by ten for an annualized estimate.

Fines and course loading can be estimated for stream reaches where roads encroach on the stream using estimated an erosion rate on defined model cross-section. Erosion resulting from encroachment occurs primarily during episodic high discharge events with a 10 - 15-year return period, road encroachment erosion must be divided by ten for an annualized estimate.

Failing road fill and eroding bank is composed of fines and course material. The proportions of fines and course material can be estimated from the soil series descriptions of the watershed.

***Sediment Delivery:***

100% delivery from forest lands estimated with WATSED coefficients

100% delivery from agricultural lands estimated with RUSLE

100% delivery from all road miles up to 200 feet from a stream crossing as estimated by the McGreer relationship.

Fines and course materials are delivered at the same rate from fill failures and from erosion resulting from road encroachment..

*Model Approach:*

The sediment model attempts to account for all sources of sediment by partitioning these sources into broad categories.

Land use is a primary broad category. It is treated separate from other characteristics as stream erosion and roads. Land use types are divided into agricultural, forest, urban and highways.

Agriculture may be subdivided into working farms and ranches and small ranchettes, which currently exist on subdivided agriculture land. Sediment yields from agricultural lands which receive any tillage, even on an infrequent basis are modeled with the Revised Universal Soil Loss Equation (RUSLE). Sediment yields were estimated from agricultural lands (rangeland, pasture and dry agriculture) using the Revised Universal Soil Loss Equation (RUSLE) (equation 1)(Hogan, 1998).

Equation 1: $A = (R)(K)(LS)(C)(D)$ tons per acre per year where:

: A is the average annual soil loss from sheet and rill erosion
: R is climate erosivity
: K is the soil erodibility
: LS is the slope length and steepness
: C is the cover management and
: D is the support practices.

RUSLE does not take into account bank erosion, gully erosion or scour. RUSLE applies to cropland, pasture, hayland or other land which has some vegetation improvement by tilling or seeding. Based on the soils, characteristics of the agriculture and the slope, sediment yields were developed for the agricultural lands of each watershed. RUSLE develops values which reflect the amount of sediment eroded and delivered to the active channel of the stream system annually.

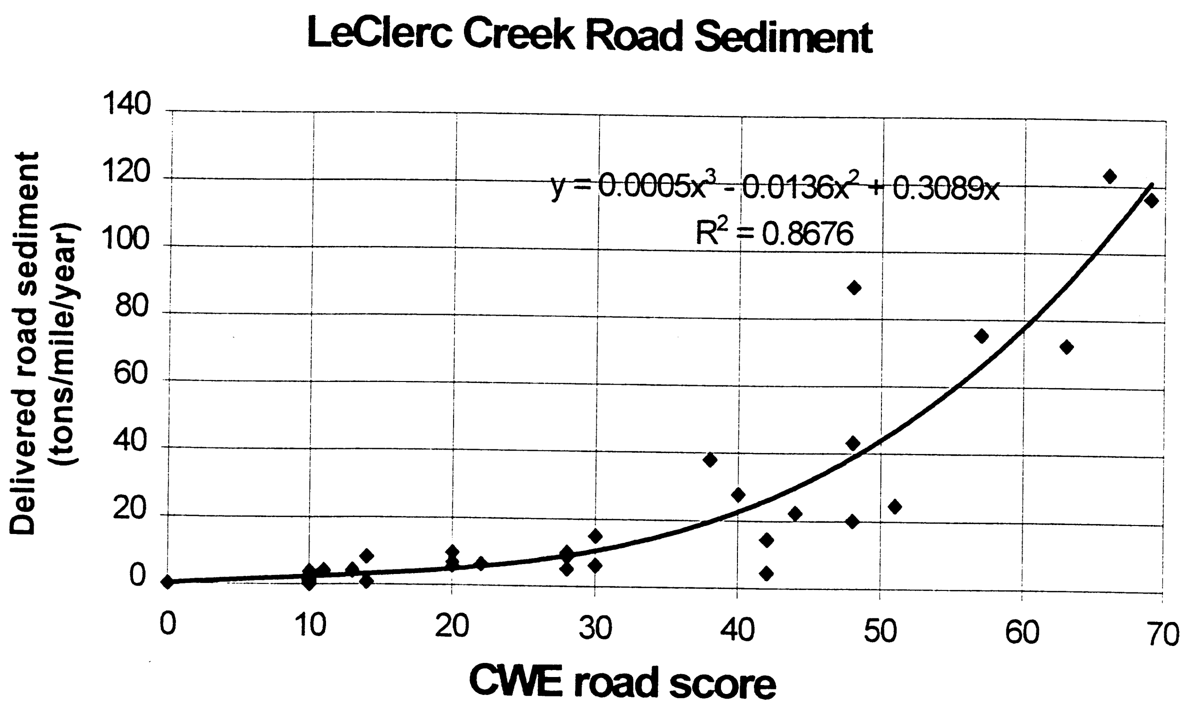
Forest lands and some land in highway rights of way are modeled using the mean export coefficients of the WATSED model for the particular geologic parent material (USFS, 1994). The values developed by WATSED are sediment eroded and delivered to the stream courses annually. Forest lands which are fully stocked with trees are treated with the median coefficient for sediment yields ascribed to that terrane. Lands not fully stocked by Idaho Forest Practices Act standards are assigned the highest coefficient of the range. Paved road rights of ways are assigned the lowest coefficient of the range. Areas which were burned by two large wild fires as delineated in IPFIRES are adjusted by a coefficient which is the difference between the highest value of the coefficient for the geologic type and the median.

All coefficients are expressed on tons per acre per year basis and are applied to the acreage of each land type developed from Geographical Information System (GIS) coverages. All land uses are displayed with estimated sediment delivery. Land use sediment delivery is totaled.

Roads are treated separately by the model. Forest haul roads are differentiated from county and private residential roads. County roads often have larger stream passage structures and are normally much wider and have gravel or pavement surfacing. Private residential roads are often limited in extent, but can have poor stream crossing structures. Sediment yields from county and private roads are modeled using a newer RUSLE model (Sandlund, 1999). Road relief, slope length, surfacing, soil material and width were the most critical factors. The sediment yield was applied only to the two hundred feet on either side of stream crossings. Failure of county and private road fills was assumed nonexistent, because such roads are often on more gentle terrain. As a consequence, road fill failures are rare.

Forest roads were modeled using data developed with the cumulative watershed effects (CWE) protocol. A watershed CWE score was used to estimate surface erosion from the road surface. Forest road sediment yield was estimated using a relationship between CWE score and the sediment yield per mile of road (Figure 1). The relationship was developed for roads on a Kaniksu granitic terrane in the LaClerc Creek watershed (McGreer, 1998). Its application to roads on Belt terrane conservatively estimates sediment yields from these systems. The watershed CWE score was used to develop a sediment tons per mile, which was multiplied by the estimated road mileage affecting the streams. In the case of roads, it was assumed that all sediment was delivered to the stream system. These are conservative estimates of actual delivery.

Figure 1: Sediment export of roads based on Cumulative Watershed Effects scores.



Forest road failure was estimated from actual CWE road fill failure and delivery data. These data were interpreted as primarily the result of large discharge events which occur on a 10 - 15-year return period (McClelland et. al, 1997). The estimates were annualized, by dividing the measured values by ten. The data are typically from a subset of the roads in a watershed. The sediment delivery value was scaled using a factor reflecting the watershed road mileage divided by the road mileage assessed. The sediments delivered through this mechanism contain both fine (material including and smaller than pebbles) and course material (pebbles and larger sizes). The percentages of fine and course particles were estimated using the described characteristics of the soils series found in the watershed. The weighted average of the fines and course composition of the B and C soil horizons to a depth of 36 inches was developed using the soils GIS coverage STATSGO, which contains the soils composition data provided by Soils Survey documents. The B and C horizons' composition was used because these are the strata from which forest roads are normally constructed. Based on the developed soil composition percentage and the estimated probable yield, the tons of fine and course material delivered to the streams by fill failure was calculated. This approach assumes equal delivery of fine and course materials.

Roads cause stream sedimentation by an additional mechanism. The presence of roads in the floodplain of a stream most often interferes with the streams' natural tendency to seek a steady state gradient. During high discharge periods, the constrained stream often erodes at the road bed, or if the bed is armored, erodes at the opposite bank or its bed. The erosion resulting from a road imposed gradient change results in stream sedimentation. The model assumes the roads causing gradient effects to be those within fifty (50) feet of the stream. The model then assumes one-quarter inch erosion per lineal foot of bank and bed up to three feet in height. The erosion is from the soils types in the basin with the weighted percentages of fine and course material. A bulk soil density of 2.6 g/cc is used to convert soil volume into weights in tons. The tons of fine and course material are totaled for all road segments within 50 lineal feet of the stream. The bulk of this erosion is assumed to occur during large discharge events which occur on a 10 - 15-year return period (McClelland et. al, 1997). The estimates were annualized, by dividing the measured values by ten.

The model does not consider sediment routing. The model does not attempt to estimate the erosion to stream beds and banks resulting from localized sediment deposition in the stream bed. The model does not attempt to measure the effects of additional water capture at road crossings. It is assumed, that on the balance, the additional stream power created by additional water capture over a shorter period would increase net export of sediment, even though some erosion would be caused by this watershed affect.

Where estimates of bank recession have been made along Rosgen C channels, these values are added into the watershed sediment load. The fine and course material fractions of the bank material are used to estimate fine and course material delivery.

*Model Operation:*

The model is a simple Excel spreadsheet model composed of four spreadsheets. Key data as acreage and percentages are entered into sheets one and two of the model. County and private road data are supplied in sheet four. The total estimated sediment from the varied sources is calculated in spreadsheet three.

*Assessment of Model's Conservative Estimate:*

Several conservative assumptions are made in the model construction, which cause its development of conservatively high estimations of sedimentation of the streams modeled. These assumptions are listed in the following paragraphs and a numerical assessment of the magnitude of the conservatism is assigned.

The model uses RUSLE and WATSED to develop land use sediment delivery estimates. The output values are treated as delivery to the stream. RUSLE dies assume delivery if the slope assessed is immediately up gradient from the stream system. This is not the case on the majority of the agricultural land assessed. Estimates made in the Lake Creek Sediment Study indicate that at most 25% of the erosion modeled was delivered as sediment to the stream Bauer, Golden and Pettit, 1998). A similar local estimate has not been made with WATSED, but it is likely this estimate would be 25% as well. The land use model component is 75% conservative.

The roads crossing component of the model assumes 100% delivery of fine sediment from the 200 feet on either side of a stream crossing. It is more like that some fine sediment remains in ditches. A reasonable level of delivery is 80%. The model is likely 20% conservative in this component. On Belt terrane, use of the McGreer model is conservative. Since the WATSED coefficient for Kaniksu granitic is 167% of the coefficient for Belt terrane, this factor is estimated to be 67% conservative.

Road encroachment is defined as 50 feet from the stream, primarily because this is near the resolution of commonly used mapping techniques. Roads fifty feet from streams but on side hills would not affect the stream gradient. The model is likely incorrect on encroachment 20% of the time and is conservative by this factor.

Fill failure data is developed from the actual CWE field assessments. The CWE assessment does not assess all the roads in the watershed. The failure rate data is scaled up by the factor of the roads assessed divided into the actual watershed road mileage. The roads assessed are typically those remote from the stream system, which are very unlikely to deliver sediment to the stream. The percentage of watershed roads assessed varies, but it is commonly 60% or less of the watershed roads. The model is 40% conservative in this component.

Table 1 summarizes the conservative assumptions and assesses its numerical level of over-estimation.

*Model Diagram:*

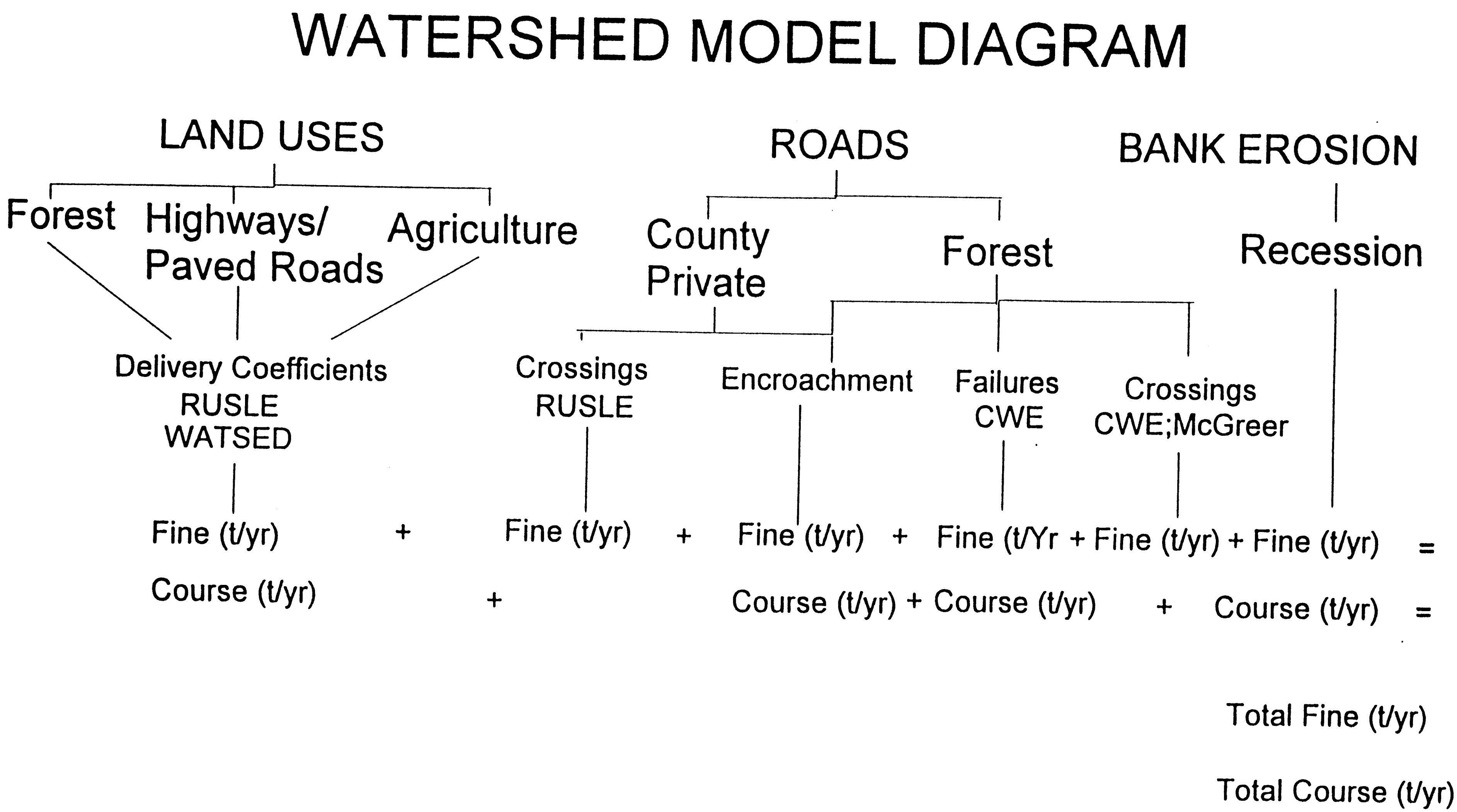


Table 1: Estimation of the conservative estimate of stream sedimentation provided by the model.

| **Model Factor** | **Kaniksu Granitic** | **Belt Supergroup** |
|---|---|---|
| 100% RUSLE and WATSED delivery | 75% | 75% |
| Crossing delivery | 29% | 20% |
| McGreer Model | 0% | 67% |
| Road encroachment at 50 feet | 20% | 20% |
| Road Failure | 40% | 40% |
| Total Assessment of Over-estimate | 164% | 231% |

The model provides an over estimate by factors of 1.6 and 2.3 for the Kaniksu and Belt terranes, respectively. This over estimation is a built in margin of safety of 167% for Cougar and Mica Creeks and 231% for Wolf Lodge and Latour Creeks.

*References cited:*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**Soil Fines and Stone or Cobble Content Based on Weighted Average of Soil Groups Present**

| Watershed | Fines (%) | Stone (%) |
|---|---|---|
| Wolf Lodge | 50 | 50 |
| Cedar | 50 | 50 |
| Cougar | 90 | 10 |
| Kidd | 70 | 30 |
| Mica | 70 | 30 |
| Latour | 40 | 60 |
| Fourth of July | 60 | 40 |
| Willow | 60 | 40 |
| Thompson | 60 | 40 |

# Appendix C: Sediment Model Data Spreadsheets

**Wolf Lodge Creek Sediment Budget**
**Wolf Lodge Watershed Land Use**

| Sub-watershed | Cedar Ck | Marie Ck | Wolf Lodge Ck. |
|---|---|---|---|
| Pasture (ac) | 77 | 23 | 923 |
| Forest Land (ac) | 11128 | 11537 | 15717 |
| Unstocked forest (ac) | 26.1 | 73.6 | 47.8 |
| Highway (ac) | 358 | 0 | 85 |
| Double Fires (ac) | 0 | 0 | 0 |
| **Wolf Lodge Watershed Roads** | | | |
| Forest roads (mi) | 92.2 | 90.1 | 107.1 |
| Ave. road density (mi/sq mi) | 5.7 | 5 | 4.1 |
| Forest road crossing freq. (#/mi) | 0.2 | 0.1 | 0.4 |
| Forest road crossing number | 20 | 12 | 46 |
| County & private road crossing number | 3 | 0 | 4 |
| CWE score | 18.9 | 18.9 | 18.9 |
| Unpaved county and private roads (mi) | 5.2 | 0.8 | 5 |
| Paved county roads (mi) | 0 | 0 | 4.6 |
| Yielding Forest roads (mi) | 1.5 | 0.9 | 3.5 |
| Yielding county and private roads (mi) | 0.2 | 0.0 | 0.5 |
| Forest road encroaching (mi) | 6.3 | 2.5 | 6.3 |
| County Road encroaching (mi) | 0 | 0 | 0 |

Wolf Lodge Creek Sediment Yield and Export Budget from Land Use Types

| Watershed | Cedar Ck | Marie Ck | olf Lodge Ck. | Yield Coeff. (tons/ac/yr) |
|---|---|---|---|---|
| Pasture (tons/yr) | 2.3 | 0.7 | 27.7 | 0.03 |
| Conifer Forest (tons/yr)(fine) | 128.0 | 132.7 | 180.7 | 0.023 |
| (course) | 128.0 | 132.7 | 180.7 | |
| Unstoched Forest (tons/yr)(fine) | 0.4 | 1.0 | 0.6 | 0.027 |
| (course) | 0.4 | 1.0 | 0.6 | |
| Highway (tons/yr)(fine) | 3.4 | 0.0 | 0.8 | 0.019 |
| (course) | 3.4 | 0.0 | 0.8 | |
| Double Fires (tons/yr)(fine) | 0.0 | 0.0 | 0.0 | 0.004 |
| (course) | 0.0 | 0.0 | 0.0 | |
| Bank erosion (tons/yr)(fine) | 0.0 | 0.0 | 16.5 | 33 tons/year (NRCS) |
| (course) | 0.0 | 0.0 | 16.5 | |
| Total Yield (tons/yr)(fine) | 134.0 | 134.4 | 226.4 | |
| (course) | 131.7 | 133.7 | 198.7 | |

County, Forest and Private Road Sediment Yield

| Watershed | Cedar Ck | Marie Ck | olf Lodge Ck | Yield Coeff. (tons/mi/yr) |
|---|---|---|---|---|
| Forest Roads | | | | |
| Surface fine sediment (tons/yr) | 13.6 | 8.2 | 31.4 | 9 |
| Road failure fines (tons/yr)* | 0.7 | 0.0 | 0.1 | * Uses mass failure and delivery rates developed from CWE protocol pro-rated for road mi |
| Road failure course (tons/yr)* | 0.7 | 0.0 | 0.0 | Soil Percent Fines/Cobble^ 0.243243 |
| Encroachment fines (tons/yr)# | 16.9 | 6.7 | 16.9 | 0.5 |
| Encroachment course (tons/yr)# | 16.9 | 6.7 | 16.9 | 0.5 |
| County and Private Roads | | | | ^ from weighted avearge of fines and stones in soils groups |
| Surface fine sediment (tons/yr) | 16.6 | 0.0 | 13.6 | |
| Road failure fines (tons/yr) | 0.0 | 0.0 | 0.0 | |
| Road failure course (tons/yr) | 0.0 | 0.0 | 0.0 | #Assume: one -quarter inch from three feet banks; density = 2.6 g/cc |
| Encroachment fines (tons/yr) | 0.0 | 0.0 | 0.0 | 0.020833 0.25"yr/12" |
| Encroachment course (tons/yr) | 0.0 | 0.0 | 0.0 | 48591972 l19*2*3*5280'*28317cc/ft3*2.6 g/cc = g/yr |

908000 454g/lb* 2000 lb/t
53.51539 t/yr/mile
276.1
204

Wolf Lodge Watershed Sediment Export

| Sub-watershed | Cedar Ck | Marie Ck | Wolf Lodge Ck. | Wolf Lodge Watershed | |
|---|---|---|---|---|---|
| Land use fines export (tons/yr) | 134.0 | 134.4 | 226.4 | 494.8 | |
| Land use course export (tons/yr) | 131.7 | 133.7 | 198.7 | 464.1 | |
| Road fines export (tons/yr) | 47.9 | 14.9 | 61.9 | 124.6 | |
| Road course export (tons/yr) | 17.6 | 6.7 | 16.9 | 41.2 | |
| Bank fines export (tons/yr) | 0.0 | 0.0 | 16.5 | 16.5 | |
| Bank course export (tons/yr) | 0.0 | 0.0 | 16.5 | 16.5 | |
| Total fines export tons/yr) | 181.9 | 149.2 | 304.8 | 635.9 | 635.9 |
| Total course export tons/yr) | 149.3 | 140.4 | 232.1 | 521.8 | 521.8 |
| | | | | 1157.6 | |
| Natural Background | 267 | 268 | 386 | | |

**Wolf Lodge Watershed County and Private Roads**

**Cedar Ck**

| name | county/pr | miles | width | grade (%) | % gravel | slope lgth | cut/fill | base mat. | oil textur | cut slope | live water | t/ac/yr | acres | tons/year |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Alder Ck | county | 5.2 | 30 | 3-4 | 5-10 | 500 | 50/50 | native | silt loam | vered/sta | crosses | 30 | 0.55 | 16.5 |
| | | | | | | | | | | | | | **total** | 16.5 |

Marie Ck

| name | county/pr | miles | width | grade (%) | % gravel | slope lgth | cut/fill | base mat. | oil textur | cut slope | live water | t/ac/yr | acres | tons/year |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Marie Ck | county | 0.8 | 30 | 1 | 15-20 | 750 | 0/100 | native | silt loam | N.A. | 20-100' | 5 | 0 | 0 |
| | | | | | | | | | | | | | **total** | 0 |

Wolf Lodge Ck.

| name | county/pr | miles | width | grade (%) | % gravel | slope lgth | cut/fill | base mat. | oil textur | cut slope | live water | t/ac/yr | acres | tons/year |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Gateway | private | 0.9 | 20 | 0 | 5-10 | 500 | 0/100 | native | silt loam | N.A. | crosses | 2.7 | 0.28 | 0.8 |
| Stella Ck | private | 0.5 | 20 | 2 | 0 | 500 | 25/75 | native | silt loam | vered/sta | none | 16 | 0 | 0 |
| Alder Ck. | county | 0.8 | 30 | 3-4 | 5-10 | 500 | 50/50 | native | silt loam | vered/sta | crosses | 28 | 0.28 | 7.8 |
| Toboggan | private | 1.8 | 20 | 6 | 0 | <500 | 50/50 | native | velly silt lo | vered/uns | none | 59 | 0 | 0 |
| Meyer Hill | county | 1 | 30 | 5-6 | 30 | 200 | 50/50 | native | velly silt lo | vered/sta | crosses | 18 | 0.28 | 5 |
| | | | | | | | | | | | | 24.7 | **total** | 13.6 |

Wolf Lodge Ck. Road Paved

**Cougar, Kidd and Mica Creeks Sediment Budgets**
**Watershed Land Use**

| Sub-watershed | Cougar | Kidd | Mica |
|---|---|---|---|
| Pasture (ac) | 2609 | 1772 | 2606 |
| Forest Land (ac) | 7854 | 1887 | 12209 |
| Unstocked forest (ac) | 189 | 78 | 64 |
| Highway (ac) | 59.4 | 38 | 61.8 |
| Double Fires (ac) | 0 | 0 | 0 |

Road Data

| Watershed | Cougar Ck | Kidd Ck | Mica Ck |
|---|---|---|---|
| Forest roads (mi) | 50 | 18 | 40 |
| Ave. road density (mi/sq mi) | 3 | 3.1 | 1.7 |
| Forest road crossing freq. (#/mi) | 1.6 | 0.8 | 0.9 |
| Forest road crossing number | 66 | 10 | 47 |
| County & private unpaved road crossing | 0 | 1 | 2 |
| presumed CWE score | 15 | 10 | 17.8 |
| Unpaved county and private roads (mi) | 12.8 | 2.4 | 1.2 |
| Paved county roads (mi) | | | |
| Yielding Forest roads (mi) | 5 | 0.8 | 3.6 |
| Yielding county and private roads (mi) | 0 | 0.1 | 0.2 |
| Forest road encroaching (mi) | 1.9 | 0.3 | 1.6 |
| County Road encroaching (mi) | 0 | 0 | 0 |

## Cougar, Kidd and Mica Creeks Sediment Yield and Export Budget from Land Use Types

| Watershed | Cougar Ck | Kidd Ck | Mica Ck |
|---|---|---|---|
| Pasture (tons/yr)(fine) | 78.3 | 88.6 | 130.3 |
| Conifer Forest (tons/yr)(fine) | 268.6 | 50.2 | 324.8 |
| (course) | 29.8 | 21.5 | 139.2 |
| Unstoched Forest (tons/yr)(fine) | 9.4 | 3.0 | 2.5 |
| (course) | 1.0 | 1.3 | 1.1 |
| Highway (tons/yr)(fine) | 1.8 | 0.9 | 1.5 |
| (course) | 0.2 | 0.4 | 0.6 |
| Double Fires (tons/yr)(fine) | 0.0 | 0.0 | 0.0 |
| (course) | 0.0 | 0.0 | 0.0 |
| Total Yield (tons/yr)(fine) | 389.1 | 165.9 | 600.0 |
| (course) | | | |

Yield Coeff. (tons/ac/yr)

| Cougar Ck | Kidd Ck | Mica Ck | |
|---|---|---|---|
| 0.03 | 0.05 | 0.05 | |
| 0.038 | | | |
| 0.055 | | | |
| 0.034 | | | |
| 0.017 | | | 174.4 |

## County, Forest and Private Road Sediment Yield

Forest Roads

| Watershed | Cougar Ck | Kidd Ck | Mica Ck |
|---|---|---|---|
| Surface fine sediment (tons/yr) | 25.0 | 2.3 | 35.6 |
| Road failure fines (tons/yr)* | 38.4 | 0.0 | 2.3 |
| Road failure cobble (tons/yr)* | 4.3 | 0.0 | 1.0 |
| Encroachment fines (tons/yr)# | 9.2 | 1.1 | 6.0 |
| Encroachment cobble (tons/yr)# | 1.0 | 0.5 | 2.6 |
| **County and private roads:** | | | |
| Surface fine sediment (tons/yr) | 0.0 | 6.5 | 0.7 |
| Road failure fines (tons/yr)* | 0.0 | 0.0 | 0.0 |
| Road failure cobble (tons/yr)* | 0.0 | 0.0 | 0.0 |
| Encroachment fines (tons/yr)# | 0.0 | 0.0 | 0.0 |
| Encroachment cobble (tons/yr)# | 0.0 | 0.0 | 0.0 |

* Fill failure rated as zero because crossings are bridges or on flat grade.

* Uses mass failure and delivery rates developed from CWE protocol pro-ratec

Yield Coeff. (tons/mi/yr)^

| | | | |
|---|---|---|---|
| 5 | 3 | 10 | |
| Soil Percent Fines | | | |
| 0.9 | 0.7 | 0.7 | Fines |
| 0.1 | 0.3 | 0.3 | Cobble |

^ from weighted aveage of fines and stones in soils groups

# Assume: one -quarter inch from three feet banks; density = 2.6 g/cc

0.020833 0.25"yr/12"
48591972 l19*2*3*5280'*28317cc/ft3*2.6 g/cc = g/yr
908000 454g/lb* 2000 lb/t
53.51539 t/yr/mile

Cougar, Kidd and Mica Creeks Watershed Sediment Export

| Sub-watershed | Cougar Ck | Kidd Ck | Mica Ck |
|---|---|---|---|
| Land use fines export (tons/yr) | 358.0 | 142.7 | 459.0 |
| Land use course export (tons/yr) | 31.1 | 23.2 | 140.9 |
| Road fines export (tons/yr) | 63.4 | 8.7 | 38.7 |
| Road cobble export (tons/yr) | 4.3 | 0.0 | 1.0 |
| Bank fines export (tons/yr) | 9.2 | 1.1 | 6.0 |
| Bank cobble export (tons/yr) | 1.0 | 0.5 | 2.6 |
| Total fines export tons/yr) | 430.6 | 152.6 | 503.7 |
| Total cobble export tons/yr) | 36.4 | 23.7 | 144.4 |
| | | | |
| Natural Background | 407.0 | 143.5 | 567.8 |

## Cougar, Kidd and Mica Watersheds County and Private Roads

### Cougar Ck

| name | county/pr | miles | width | grade (%) | % gravel | slope lgth | cut/fill | base mat. | soil textu | cut slope | live water | t/ac/yr | acres | tons/year |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Stand Elk | private | 0.25 | 20 | 1 | 5-10 | >500 | 0/100 | basalt | | covered/sta | none | 5.4 | 0.61 | 3.2 |
| Mdwbrook | county | 0.75 | 30 | 1 | 75 | 500 | 0/100 | native | | covered/sta | none | 0.8 | 2.72 | 2.2 |
| Heine | county | 1.3 | 30 | 2 | 50 | >500 | 25/75 | native | | covered/sta | 50' | 5.5 | 4.72 | 26 |
| Woodside | private | 0.5 | 20 | 2 | 50 | 300 | 0/100 | native | | covered/sta | at bottom | 1 | 1.21 | 1.2 |
| No name | private | 0.35 | 20 | 3 | 5 | >500 | 50/50 | native | | uncovered/uns | none | 17 | 0.85 | 14.4 |
| Thompson | county | 1.7 | 30 | 4-5 | 20-30 | 300-400 | 50/50 | native | | uncovered/uns | 20-50' | 14 | 6.18 | 86.5 |
| Bunn | county | 0.6 | 20 | 3-4 | 90 | >500 | 50/50 | native | | covered/sta | <100' | 0.1 | 1.45 | 0.1 |
| Cougar Et | county | 0.5 | 30 | 3-4 | 50 | 500 | 50/50 | native | | covered/sta | none | 3 | 1.81 | 5.5 |
| Clemetson | county | 0.9 | 30 | 3-4 | 50 | 400 | 50/50 | basalt | | covered/sta | crosses | 1.8 | 3.2 | 5.9 |
| Stack | county | 1.7 | 30 | 4-5 | 30 | 200 | 50/50 | native | | covered/sta | none | 12 | 6.18 | 74.2 |
| Cougar G. | county | 1.8 | 30 | 4-5 | 10 | 400 | 50/50 | native | | covered/sta | 50-100 | 0.1 | 6.54 | 0.6 |
| Miller | county | 1.5 | 30 | 4-5 | 20 | 500 | 50/50 | native | | uncovered/uns | none | 32 | 5.45 | 174.5 |
| Reynolds | private | 0.9 | 20 | 5-6 | 15 | 400-500 | 50/50 | native | | uncovered/uns | none | 41 | 2.18 | 89.45 |
| | | | | | | | | | | | | 10.3 | | |

### Kidd Ck.

| name | county/pr | miles | width | grade (%) | % gravel | slope lgth | cut/fill | base mat. | soil textu | cut slope | live water | t/ac/yr | acres | tons/year |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Hull | county | 0.9 | 30 | 2-3 | 20 | >500 | 50/50 | native | | covered/sta | none | 15 | 3.27 | 49.1 |
| Weniger | county | 0.6 | 30 | 5 | 10 | >500 | 50/50 | native | | covered/sta | crosses | 32 | 2.18 | 69.8 |
| | | | | | | | | | | | | 23.5 | | |

### Mica Ck.

| name | county/pr | miles | width | grade (%) | % gravel | slope lgth | cut/fill | base mat. | soil textu | cut slope | live water | t/ac/yr | acres | tons/year |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Carnie | county | 0.15 | 30 | 1 | 50 | >500 | 0/100 | basalt | | covered /sta | adjacent | 2.3 | 0.55 | 1.2 |
| Sausser | private | 0.75 | 20 | 1 | 70-80 | >500 | 0/100 | nat/basalt | | covered/sta | crosses | 0.7 | 1.81 | 1.3 |
| Mica Sprs | private | 0.3 | 20 | 6 | 90 | 100 | 50/50 | nat/basalt | | covered/sta | none | 1 | 0.73 | 0.7 |
| | | | | | | | | | | | | 1.3 | | |

**Latour, Baldy and Larch Creeks Sediment Budgets**
**Watershed Land Use**

| Sub-watershed | Latour Ck. | Baldy Ck. | Larch Ck. |
|---|---|---|---|
| Pasture (ac) | 257 | 0 | 0 |
| Forest Land (ac) | 23181 | 5372 | 548 |
| Unstocked forest (ac) | 3855 | 145 | 0 |
| Highway (ac) | 0 | 0 | 0 |
| Double Fires (ac) | 0 | 0 | 0 |

**Road Data**

| | | | |
|---|---|---|---|
| Forest roads (mi) | 186.9 | 48.2 | 0.5 |
| Ave. road density (mi/sq mi) | 4.4 | 5.4 | 0.6 |
| Road crossing freq. | 0.5 | 1.1 | 0 |
| Road crossing number | 65 | 12 | 0 |
| County and private unpaved road crossings | 2 | 0 | 0 |
| CWE score | 13.3 | 13.3 | 13.3 |
| Unpaved county and private roads (mi) | 4.4 | 0 | 0 |
| Paved county roads (mi) | 0 | 0 | 0 |
| Yielding Forest roads (mi) | 4.9 | 0.9 | 0 |
| Yielding County and Private Roads (mi) | 0.2 | 0 | 0 |
| Encroaching Forest Roads | 6.3 | 0.4 | 0 |
| Encroaching County and Private Roads (ml) | 0.1 | 0 | 0 |

Latour, Baldy and Larch Creeks Sediment Yield and Export Budget from Land Use Types

| Watershed | Latour Ck | Baldy Ck | Larch Ck | Yield Coeff. (tons/ac/yr) |
|---|---|---|---|---|
| Pasture (tons/yr) | 5.1 | 0.0 | 0.0 | 0.02 |
| Conifer Forest (tons/yr)(fine) | 213.3 | 49.4 | 5.0 | 0.023 |
| (course) | 319.9 | 74.1 | 7.6 | |
| Unstoched Forest (tons/yr)(fine) | 41.6 | 1.6 | 0.0 | 0.027 |
| (course) | 62.5 | 2.3 | 0.0 | |
| Highway (tons/yr) | 0.0 | 0.0 | 0.0 | 0.019 |
| Double Fires (tons/yr) | 0.0 | 0.0 | 0.0 | 0.004 |
| Total Yield (tons/yr)(fine) | 260.0 | 51.0 | 5.0 | |
| Total Yield (tons/yr)(course) | 382.3 | 76.5 | 7.6 | |

County, Forest and Private Road Sediment Yield

| Watershed | Latour Ck | Baldy Ck | Larch Ck | Yield Coeff. (tons/mi/yr) |
|---|---|---|---|---|
| Forest road | | | | |
| Surface fine sediment (tons/yr) | 24.6 | 4.5 | 0.0 | 5 |
| Road failure fines (tons/yr)* | 15.5 | 0.0 | 0.0 | |
| Road failure cobble (tons/yr)* | 23.2 | 0.0 | 0.0 | |
| Encroachment fines (tons/yr)# | 13.5 | 0.9 | 0.0 | |
| Encroachment cobble (tons/yr)# | 20.2 | 1.3 | 0.0 | |
| County and private roads | | | | |
| Surface fine sediment (tons/yr) | 6.2 | 0.0 | 0.0 | |
| Road failure fines (tons/yr)* | 0.0 | 0.0 | 0.0 | |
| Road failure cobble (tons/yr)* | 0.0 | 0.0 | 0.0 | |
| Encroachment fines (tons/yr) | 0.2 | 0.0 | 0.0 | |
| Encroachment cobble (tons/yr) | 0.3 | 0.0 | 0.0 | |
| Total fine yield (tons/yr) | 60.0 | 5.4 | 0.0 | |
| Total cobble yield (tons/yr) | 43.8 | 1.3 | 0.0 | |

* Uses mass failure and delivery rates developed from CWE protocol pro-rated

Soil Percent Fines^

| | |
|---|---|
| 0.4 | Fines |
| 0.6 | Cobble |

^ from weighted avearge of fines and stones in soils groups

# Assume: one -quarter inch from three feet banks; density = 2.6 g/cc

| | |
|---|---|
| 0.020833 | 0.25"yr/12" |
| 48591972 | I19*2*3*5280'*28317cc/ft3*2.6 g/cc = g/yr |
| 908000 | 454g/lb* 2000 lb/t |
| 53.51539 | t/yr/mile |

* Fill failure rated as zero because crossings are bridges or on flat grade.

Latour Watershed Sediment Export

| Sub-watershed | Latour Ck | Baldy Ck | Larch Ck | Latour Creek Watershed |
|---|---|---|---|---|
| Land use fines export (tons/yr) | 260.0 | 51.0 | 5.0 | 316.1 |
| Land use course export (tons/yr) | 382.3 | 76.5 | 7.6 | 466.4 |
| Road fines export (tons/yr) | 46.3 | 4.5 | 0.0 | 50.9 |
| Road cobble export (tons/yr) | 23.2 | 0.0 | 0.0 | 23.2 |
| Bank fines export (tons/yr) | 20.5 | 0.9 | 0.0 | 21.4 |
| Bank cobble export (tons/yr) | 13.7 | 1.3 | 0.0 | 15.0 |
| Total fines export tons/yr) | 326.9 | 56.4 | 5.0 | 388.4 |
| Total cobble export tons/yr) | 419.3 | 77.8 | 7.6 | 504.6 |
| | | | | |
| Natural Background (tons/yr) | 627.7 | 126.9 | 12.6 | |

**Latour Ck County and Private Roads**

| name | county/pr | miles | width | grade (%) | % gravel | slope lgth | cut/fill | base mat. | oil textur | cut slope | live water | t/ac/yr | acres | tons/year |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Latour Ck | county | 3.85 | 30 | 1 | 10 | 200 | 25/75 | native | silt loam | vered/sta | 00'; crosse | 4.7 | 0.55 | 2.6 |
| Dudley Ck | county | 0.5 | 30 | 1-2 | 10 | >500 | 20/80 | native | silt loam | vered/sta | crosses | 13 | 0.28 | 3.6 |
| | | | | | | | | | | | | | Total | 6.2 |

**Fourth of July, Willow and Thompson Creeks Sediment Budgets**
**Watershed Land Use**

| Sub-watershed | 4th of July | Willow | Thompson |
|---|---|---|---|
| Pasture (ac) | 1,548 | 453 | 618 |
| Forest Land (ac) | 16,193 | 3,386 | 1,868 |
| Unstocked forest (ac) | 165 | 36 | 80 |
| Highway (ac) | 336 | 0 | 0 |
| Double Fires (ac) | 906 | 0 | 0 |

**Road Data**

| | | | |
|---|---|---|---|
| Forest roads (mi) | 77.6 | 22.5 | 21 |
| Ave. road density (mi/sq mi) | 2.8 | 3.7 | 5.4 |
| Road crossing freq. | 1.2 | 1.5 | 2.2 |
| Road crossing number | 76 | 16 | 23 |
| County and private unpaved road crossings | 1 | 0 | 0 |
| CWE score | 20.2 | 24.6 | 17.3 |
| Unpaved county and private roads (mi) | | | |
| Paved county roads (mi) | - | - | - |
| Yielding Forest roads (mi) | 5.8 | 1.2 | 1.7 |
| Yielding County and Private Roads (mi) | 0.08 | - | - |
| Encroaching Forest Roads | 0.4 | 0.9 | 1.3 |
| Encroaching County and Private Roads (ml) | 0 | 0 | 0 |

Fourth of July, Willow and Thompson Creeks Sediment Yield and Export Budget from Land Use Types

| Watershed | 4th of July | Willow | Thompson | Yield Coeff. (tons/ac/yr) | | |
|---|---|---|---|---|---|---|
| Pasture (tons/yr)(fine) | 46.4 | 18.1 | 24.7 | 0.03 | 0.04 | 0.04 |
| Conifer Forest (tons/yr)(fine) | 223.5 | 46.7 | 25.8 | 0.023 | | |
| (course) | 149.0 | 31.2 | 17.2 | | | |
| Unstoched Forest (tons/yr)(fine) | 2.7 | 0.6 | 1.3 | 0.027 | | |
| (course) | 1.8 | 0.4 | 0.9 | | | |
| Highway (tons/yr)(fine) | 3.8 | 0.0 | 0.0 | 0.019 | | |
| (course) | 2.6 | 0.0 | 0.0 | | | |
| Double Fires (tons/yr)(fine) | 2.2 | 0.0 | 0.0 | 0.004 | | |
| (course) | 1.4 | 0.0 | 0.0 | | | |
| Total Yield (tons/yr)(fine) | 278.6 | 65.4 | 51.8 | | | |
| Total Yield (tons/yr)(course) | 154.8 | 31.5 | 18.0 | | | |

County, Forest and Private Road Sediment Yield

| Watershed | 4th of July | Willow | Thompson |
|---|---|---|---|
| Forest road | | | |
| Surface fine sediment (tons/yr) | 51.8 | 12.1 | 13.9 |
| Road failure fines (tons/yr)* | 0.8 | 0.0 | 0.0 |
| Road failure course (tons/yr)* | 0.5 | 0.0 | 0.0 |
| Encroachment fines (tons/yr)# | 1.3 | 2.9 | 4.2 |
| Encroachment course (tons/yr)# | 0.9 | 1.9 | 2.8 |
| County and private roads | | | |
| Surface fine sediment (tons/yr) | 3.6 | 0.0 | 0.0 |
| Road failure fines (tons/yr)* | 0.0 | 0.0 | 0.0 |
| Road failure course (tons/yr)* | 0.0 | 0.0 | 0.0 |
| Encroachment fines (tons/yr)# | 0.3 | 0.0 | 0.0 |
| Encroachment course (tons/yr)# | 0.2 | 0.0 | 0.0 |
| Total fine yield (tons/yr) | 57.7 | 15.0 | 18.1 |
| Total course yield (tons/yr) | 1.5 | 1.9 | 2.8 |

* Fill failure rated as zero because crossings are bridges or on flat grade.

Yield Coeff. (tons/mi/yr)

| | | | |
|---|---|---|---|
| 9 | 10 | 8 | |
| Soil Percent Fines | | from weighted avearge of fines and stones in soils grou| | |
| 0.6 | 0.6 | 0.6 | Fines |
| 0.4 | 0.4 | 0.4 | Cobble |

# Assume: one -quarter inch from three feet banks; density = 2.6 g/cc

0.020833 0.25"yr/12"

48591972 l19*2*3*5280'*28317cc/ft3*2.6 g/cc = g/yr

908000 454g/lb* 2000 lb/t

53.51539 t/yr/mile

* Uses mass failure and delivery rates developed from CWE protocol pro-ratec

Fourth of July, Willow and Thompson Creeks Watershed Sediment Export

| Sub-watershed | 4th of July | Willow | Thompson |
|---|---|---|---|
| Land use fine export (tons/yr) | 278.6 | 65.4 | 51.8 |
| Land use course export (tons/yr) | 154.8 | 31.5 | 18.0 |
| Road fine export (tons/yr) | 57.7 | 12.1 | 13.9 |
| Road course export (tons/yr) | 1.5 | 0.0 | 0.0 |
| Bank fines export (tons/yr) | 1.5 | 2.9 | 4.2 |
| Bank course export (tons/yr) | 1.0 | 1.9 | 2.8 |
| Total fines export tons/yr) | 337.9 | 80.4 | 69.9 |
| Total course export tons/yr) | 157.3 | 33.5 | 20.8 |
| | | | |
| Natural Background | 419.6 | 89.1 | 59.0 |

# 3.0 Total Maximum Daily Loads for the Water Quality Limited Water Bodies of the Coeur d'Alene Lake and River Sub-basin (17010303)

## 3.1 Wolf Lodge Creek Watershed Total Maximum Daily Load

### *3.1.1 Introduction*

Wolf Lodge Creek and its tributaries Marie and Cedar Creeks are listed as water quality limited on the 1998 section 303(d) CWA list. The sub-basin assessment (section 2.0) indicates that Wolf Lodge Creek is impaired by excess sedimentation. The model used estimated 237 tons/year above the background sedimentation rate. However, the sediment loading of streams in the northern Rocky Mountains is not continuous nor does it occur on a yearly basis. The majority of the sediment resident in the bed and affecting the beneficial uses is loaded in large discharge events which have a return period of 10 - 15 years. The model accounts for this fact by dividing mass failure and road encroachment sediment estimates by ten. Wolf Lodge Creek could possibly have 2,370 tons of sediment resident in its bed from the 1996 flood event. This amount added to any residual sediment from the 1974 and earlier flood events. Marie Creek is listed for habitat alteration. Habitat alteration is not a characteristic, which can realistically be addressed with a TMDL. A TMDL addressing the excess sedimentation of Wolf Lodge Creek will require that sediment loads from Marie and Cedar Creek as well as its other tributaries be addressed.

The Wolf Lodge Creek watershed has the ownership pattern outlined below:

| Ownership | Acreage | Percentage |
|---|---|---|
| Federal | 32,592 | 82 |
| State | 386 | 1 |
| Private | 6,742 | 17 |
| Total | 39,720 | 100 |

The land use pattern has the pattern outlined below:

| Land Use | Acreage | Percentage |
|---|---|---|
| Forest Use | | |
| USFS | 32,592 | 82.1 |
| State & Private | 5,382 | 13.5 |
| Agriculture & | | |
| Residential Subdivision | 1,746 | 4.4 |
| Total | 39,720 | 100.0 |

Stream frontage on agricultural bottom lands is divided as follows:

| Stream Frontage Use | Footage | Percentage |
|---|---|---|
| Working ranch | 25,872 | 48.5 |
| Ranchette | 27,456 | 51.5 |
| Total | 53,328 | 100.0 |

*3.1.2 TMDL Authority*

Section 303(d)(1) of the Clean Water Act requires states to prepare a list of waters not meeting state water quality standards in spite of technology based pollution control efforts and the application of best management practices for nonpoint sources. This list must include a priority ranking "... taking into account severity of the pollution and the uses to be made of such waters." The prescribed remedy for these water quality limited waters is for states to determine the total maximum daily load (TMDL) for pollutants "... at a level necessary to implement applicable water quality standards with seasonal variations and a margin of safety ..." A margin of safety is included to account for any lack of knowledge about how limiting pollutant loads will attain water quality.

Section 303(d)(2) requires both the list and any total maximum daily loads developed by the state be submitted to the Environmental Protection Agency (EPA). The EPA is given thirty days to either approve or disapprove the state's submission. If the EPA disapproves, the agency has another thirty days to develop a list or TMDL for the state. Both the list and all TMDLs, either approved or developed by EPA, are incorporated into the state's continuing planning process as required by section 303(e).

*3.1.3 Loading Capacity*

The load capacity for a TMDL designed to address a sediment caused limitation to water quality is complicated by the fact that the State's water quality standard is a narrative rather than quantitative standard. In the waters of the Wolf Lodge Creek watershed, the sediment interfering with the beneficial use (cold water biota) is most likely large bedload particles. Adequate quantitative measurements of the effect of excess sediment have not been developed. Given this difficulty a sediment loading capacity for the TMDL is more difficult to develop. This TMDL and its loading capacity is based on the following premises:

: natural background levels of sedimentation are assumed to be fully supportive of the beneficial uses, cold water biota.

: the stream system has some finite yet unquantified ability to process (attenuate through export and/or deposition) a sedimentation rate greater than background rates.

: the beneficial use (cold water biota) in-stream will be fully supported when the finite yet unquantified ability of the stream system to process (attenuate) sediment is met.

: care must be taken to control factors which may interfere (fish harvest) with the quantification of beneficial use support.

The natural background sedimentation rate from the Wolf Lodge Creek Watershed is 910 tons per year. (Background sediment yield = 39,553 acres x 0.023 tons/acre/yr). This calculation assumes the entire watershed would be vegetated by coniferous forest, if undisturbed. This value is the interim loading capacity.

### *3.1.4 Margin of Safety*

The model employed to estimate sedimentation rates has several conservative assumptions, which are documented in Section 2.0, Appendix B. Applied to the Belt terrane of the Wolf Lodge watershed, the model provides an inherit margin of safety of 231%. This is a sufficient margin of safety.

### *3.1.5 Appropriate Measurements of Full Beneficial Use Support*

Sediment load reduction from the current level towards the interim sediment reduction goal is expected to attain an as yet unquantified sediment load at which the beneficial use (cold water biota) will attain full support. This sediment load will be recognized by the following appropriate measures of full cold water biota support:

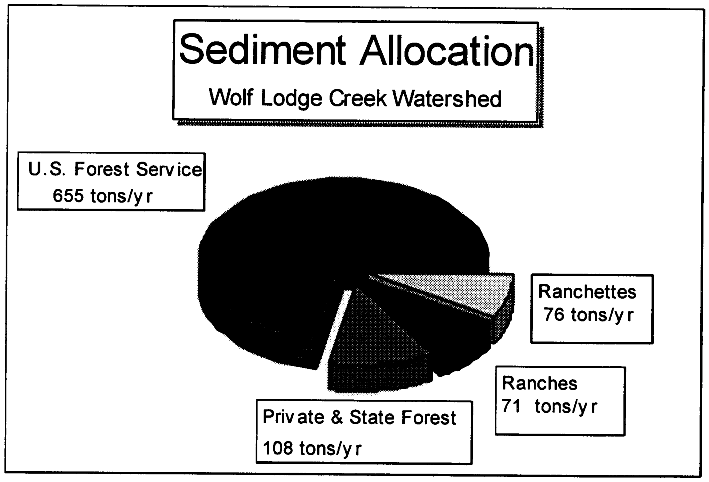
: three or more age classes of trout with one young of the year.
: trout density a reference levels (0.1-0.3 fish/yd$^2$/hour effort).
: presence of sculpin and tailed frogs.
: macro invertebrate biotic index score of 3.5 or greater.

When the appropriate sediment loading capacity is determined by these appropriate measures of full cold water biota support, the interim load capacity will be revised to the appropriate load capacity.

### *3.1.6 Sediment Load Allocation*

The current estimate of the sediment load capacity of the watershed is 910 tons per year. Model estimates indicate that 40 tons (16.2%) are from agricultural land and that 217 tons (83.8%) has its origin from forest land. The sediment load allocated to the forest lands is 763 tons per year (910 t/yr x 0.838). The sediment load allocated to agricultural lands is 147 tons per year (910 t/yr x 0.162). The U.S. Forest Service is allocated 655 tons per year (763 t/yr x 0.858), while the private and State forest land is allocated 108 tons per year (763 t/yr x 0.142). The ranches along the stream are allocated 71 tons per year (147 t/yr x 0.485), while the ranchettes are allocated 76 tons per year (147 t/yr x 0.515).

**Figure 1**




*3.1.7 Sediment Load Reduction Allocation*

*3.1.7.1 Current Sediment Yield from Forest and Agricultural Bottom Lands.*

The current estimate of sediment yield from the watershed is 1,157 tons per year (section 2.3.2.8; table 15) It is estimated that 83.8% has its origin from forest land, while 16.2% has its origin from agricultural lands along the stream. The sediment load reduction sought from forest lands is 207 tons per year ([1,157 - 910] x 0.838). The sediment load reduction sought from agricultural lands is 40 tons per year ([1,157 - 910] x 0.162).

*3.1.7.2 Forest Lands*

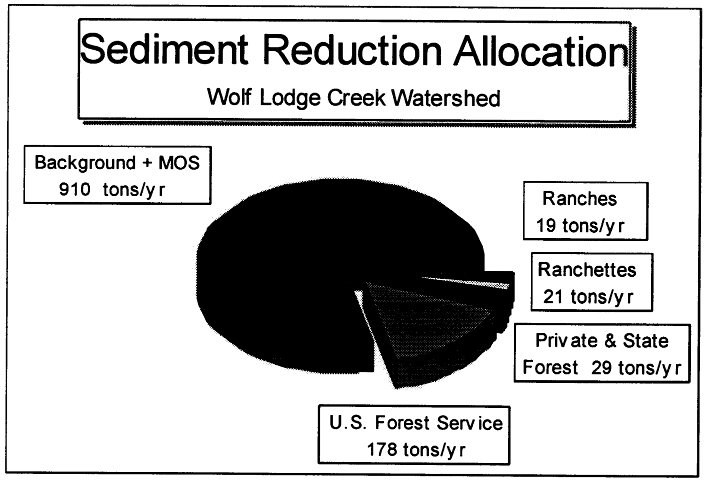
Sediment sources from forest lands are primarily associated with the road systems. Prime sediment sources are roads located in stream flood plains, road crossings of streams and erosion from road surfaces channeled directly to streams.

The U.S. Forest Service manages 85.8% of the forest lands and is allocated a sediment load reduction target of 178 tons per year (207 x 0.858) from its lands. Private and State forest owners manage 14.2% of the forest lands and are allocated a sediment load reduction target of 29 tons per year (207 x 0.142) from these lands.

*3.1.7.3 Agricultural Lands*

Agricultural lands or those agricultural lands converted to small ranchettes are located in the lower Marie and lower Wolf Lodge Creek areas of the watershed. Ranchettes are land holdings of a few to forty acres. The primary mechanism of sedimentation from the agricultural and converted lands is stream bank erosion. Bank erosion is the result of riparian vegetation loss and channelization on working ranch lands and ranchettes. Ranchettes are allocated a sediment load reduction of 21 tons/ year (40 x 0.515). The two ranches are allocated a sediment load reduction of 19 tons/ year (40 x 0.485).

**Figure 2**




*3.1.8 Monitoring Provisions*

In-stream monitoring of the beneficial use (cold water biota) support status during and after the sediment abatement project implementation will establish the final sediment load reduction required by the TMDL. In-stream monitoring, which will detect the thresholds values identified in section 3.1.4, will be completed every year on a randomly selected 1% of the watershed's Rosgen B and C channel types. Data will be complied after five years. The yearly increments of random testing, which sum to 5% of the stream after five years should provide a data base not biased by transit fish and macroinvertebrate population shifts. Based on this data base the beneficial use support status will be determined. Monitoring will assess stream reaches 20 times bankfull width in length. These reaches will be randomly selected from the total stream channel in B and C types until at least 5% of these channels have been assessed after five years. Identical measurements will be made in appropriate reference streams, in which beneficial uses are known to be supported.

*3.1.9 Feedback Provisions*

Data from which the problem assessment and TMDL for the Wolf Lodge Creek watershed were developed are often crude measurements. As more exact measurements are developed during implementation plan development or subsequent to its development these will be added to a revised TMDL as required.

When beneficial use (cold water biota) support meet the full attainment level, further sediment load reducing activities will not be required in the watershed. The interim sediment loading capacity will be replaced in a revised TMDL with the ambient sediment load. Best management practices for forest and agricultural practices will be prescribed by the revised TMDL with erosion abatement structure maintenance provisions. Regular monitoring of the beneficial use will be continued for an appropriate period to document maintenance of the full support of the beneficial use (cold water biota).

## 3.2. Cougar, Kidd, and Mica Creek Watersheds Sediment Total Maximum Daily Loads

### *3.2.1. Introduction*

Cougar, Kidd, and Mica Creeks are listed as water quality limited on the 1998 section 303(d) CWA list. The sub-basin assessment (section 2.0) indicates that these creeks are impaired by excess sedimentation. Mica Creek is additionally limited by bacteria. A separate TMDL will be developed for this pollutant of Mica Creek.

Sediment model results indicate that Cougar, Kidd and Mica Creeks exceed the natural background sedimentation rate by 60, 34.3 and 80.1 tons per year, respectively. However, the sediment loading of streams in the northern Rocky Mountains is not continuous nor does it occur on a yearly basis. The majority of the sediment resident in the bed and affecting the beneficial uses is loaded in large discharge events, which have a return period of 10 - 15 years. The model accounts for this fact by dividing mass failure and road encroachment sediment estimates by ten. Cougar Creek could possibly have 600 tons of sediment resident in its bed from the 1996 flood event, while Kidd and Mica Creek would have 343 and 801 tons, repectively. These amount added to any residual sediment from the 1974 and earlier flood events.

The Cougar, Kidd and Mica Creek watersheds have the ownership pattern outlined in Table 1:

Table 1: Land ownership pattern of the Cougar and Mica Watersheds

| Watershed | BLM (acres) (%) | State (acres) (%) | Private (acres) (%) |
|---|---|---|---|
| Cougar | -- (0) | 423 (4) | 10,229 (96) |
| Kidd | -- (0) | -- (0) | 3,738 (100) |
| Mica | 331 (2.2) | 646 (4.3) | 13,964 (93.5) |

The land use pattern has the pattern outlined in Table 2a and b.

Table 2: Land use patterns of Cougar, Kidd and Mica Creeks

a) Cougar Creek

| Land Use | Acreage | Percentage |
|---|---|---|
| State Forest | 423 | 4.0 |
| Private Forest | 7,620 | 71.5 |
| Agricultural field/pasture /ranchettes | 2,609 | 24.5 |

b) Kidd Creek

| Land Use | Acreage | Percentage |
|---|---|---|
| State Forest | 0 | 0 |
| Private Forest | 1,965 | 52.6 |
| Agricultural field/pasture /ranchettes | 1,772 | 47.4 |

b) MicaCreek

| Land Use | Acreage | Percentage |
|---|---|---|
| BLM Forest | 331 | 2.2 |
| State Forest | 646 | 4.3 |
| Private Forest | 11,358 | 76.1 |
| Agricultural field/pasture /ranchettes | 2,606 | 17.4 |

### *3.2.2. TMDL Authority*

Section 303(d)(1) of the Clean Water Act requires states to prepare a list of waters not meeting state water quality standards in spite of technology based pollution control efforts and the application of best management practices for nonpoint sources. This list must include a priority ranking "... taking into account severity of the pollution and the uses to be made of such waters." The prescribed remedy for these water quality limited waters is for states to determine the total maximum daily load (TMDL) for pollutants "... at a level necessary to implement applicable water quality standards with seasonal variations and a margin of safety ..." A margin of safety is included to account for any lack of knowledge about how limiting pollutant loads will attain water quality.

Section 303(d)(2) requires both the list and any total maximum daily loads developed by the state be submitted to the Environmental Protection Agency (EPA). The EPA is given thirty days to either approve or disapprove the state's submission. If the EPA disapproves, the agency has another thirty days to develop a list or TMDL for the state. Both the list and all TMDLs, either approved or developed by EPA, are incorporated into the state's continuing planning process as called for in section 303(e).

### *3.2.3 Loading Capacity*

The load capacity of a TMDL designed to address a sediment caused limitation to water quality is complicated by the fact that the State's water quality standard is a narrative rather than quantitative criterion. In the waters of the Cougar and Mica Creeks watersheds, the sediment interfering with the beneficial use (cold water biota) is primarily moderate to fine grain sands. Quantitative measurements of the impact of excess sediment have not been developed. Given this difficulty a sediment loading capacity for the TMDL is more difficult to develop. The load capacity used in this TMDL is based on the following premises:

: background levels of sedimentation are assumed to be fully supportive of the beneficial use, cold water biota.

: the stream system has some finite yet unquantified ability to process (attenuate) a sedimentation rate greater than background rates.

: the beneficial use (cold water biota) in-stream will respond to a level of full support, which can be quantified when the finite yet unquantified ability of the stream system to process (attenuate) sediment is met.

: care must be taken to control factors which may interfere (fish harvest) with the quantification of beneficial use support.

The background sedimentation rates for Cougar, Kidd and Mica Creeks watersheds are provided in Table 3.

Table 3: Background sedimentation rate and interim loading capacity and margin of safety application

| Water body | Acres | Sediment load capacity (tons/year) | Modeled sediment yield to stream (tons/yr) |
|---|---|---|---|
| Cougar | 10,711 | 407 | 467.0 |
| Kidd | 3,738 | 142 | 176.3 |
| Mica | 14,941 | 568 | 648.1 |

The natural background sediment rates are the interim loading capacities for the three watersheds..

### *3.2.4. Margin of Safety*

The model employed to estimate sedimentation rates has several conservative assumptions, which are documented in Section 2.0, Appendix B. Applied to the Kaniksu granetic terrane of the Cougar, Kidd and Mica watersheds, the model provides an inherit margin of safety of 164%. This is a sufficient margin of safety.

### *3.2.5. Appropriate Measurements of Full Beneficial Use Support*

Sediment load reduction from the current level towards the interim sediment reduction goal is expected to attain an as yet unquantified sediment load at which the beneficial use (cold water biota) will attain full support. This sediment load will be recognized by the following appropriate measures of full cold water biota support:

: three or more age classes of trout with one young of the year.
: trout density at reference levels 0.1 - 0.3 trout per square meter [1].
: presence of sculpin..
: macro invertebrate biotic index score of 3.5 or greater.

When the appropriate sediment loading capacity is determined by these appropriate measures of full cold water biota support, the interim load capacity will be revised to the appropriate load capacity.

### *3.2.6. Sediment Load Allocation*

The current estimate of allocatable sediment load capacity of the watershed is provided in table 4. The sediment loads allocated to the forest lands and to agricultural/residential lands based on the acreage values of Table 2 are provided in Table 4.

Table 4: Allocation of sediment load capacity between land uses in the Cougar, Kidd and Mica Creeks Watersheds

| Water body | Sediment load allocated to Forest Lands (tons/yr) | Sediment Load allocated to agricultural/residential lands (tons/yr) |
|---|---|---|
| Cougar | 307 | 100 |
| Kidd | 75 | 67 |
| Mica | 469 | 99 |

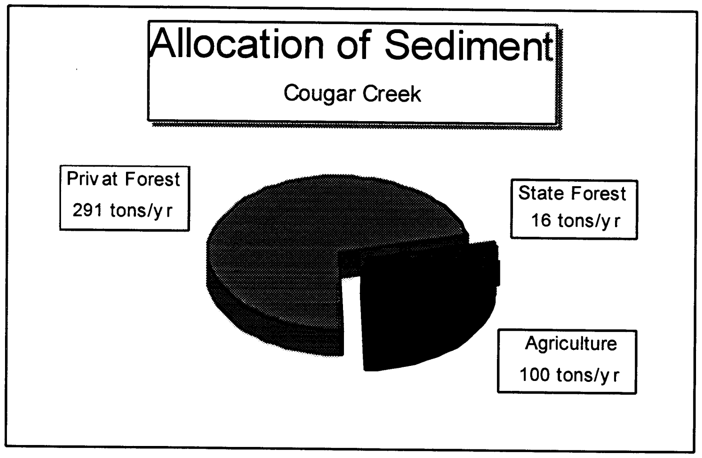
Forest Land can be further subdivided into federal, state and private forest land. The further allocation of sediment load capacity to these land uses is provided in Table 5 and figure 1 based on acreage provided in Tables 1 and 2.

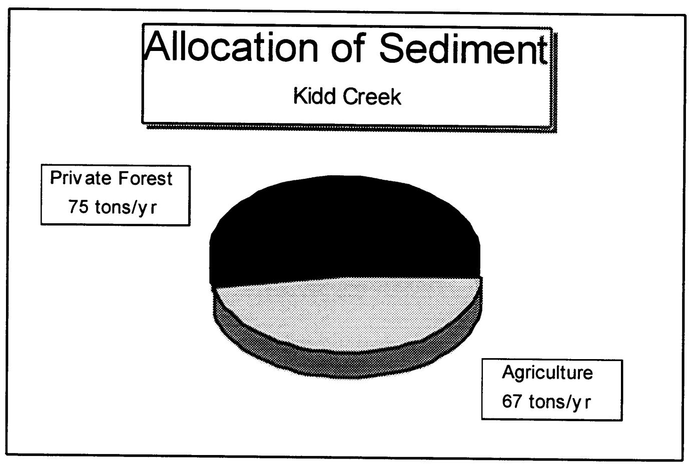
Table 5: Allocation of sediment load capacity based on subdivision of land use types.

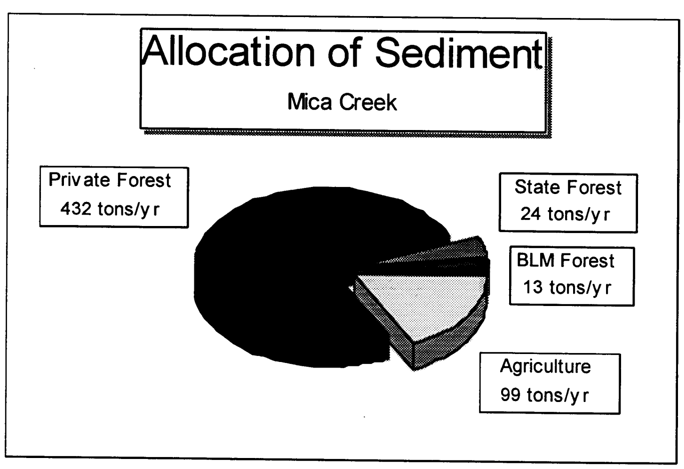
| Water body | Cougar | Kidd | Mica |
|---|---|---|---|
| BLM forest (tons/yr) | - | - | 13 |
| State forest (tons/yr) | 16 | - | 24 |
| Private forest (tons/yr) | 291 | 75 | 432 |
| Agriculture (tons/yr) | 100 | 67 | |

[1] Reference streams, Two Mouth and Trapper Creeks above development.

**Figure 1**




3.2.7. Sediment Load Reduction Allocation

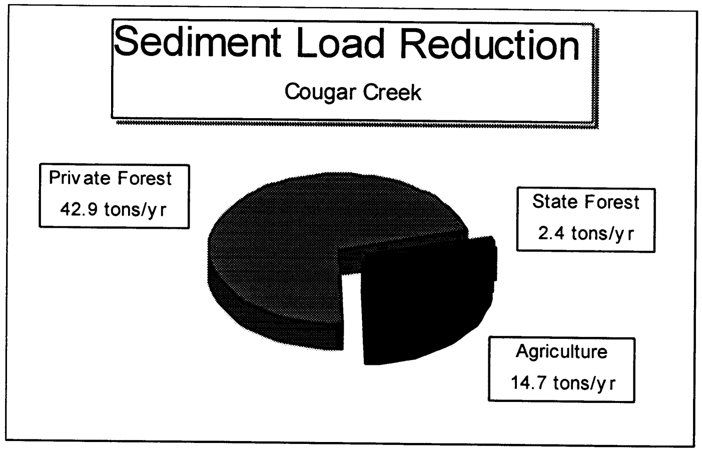
3.2.7.1. Current Sediment Yield from Forest and Agricultural Bottom Lands.

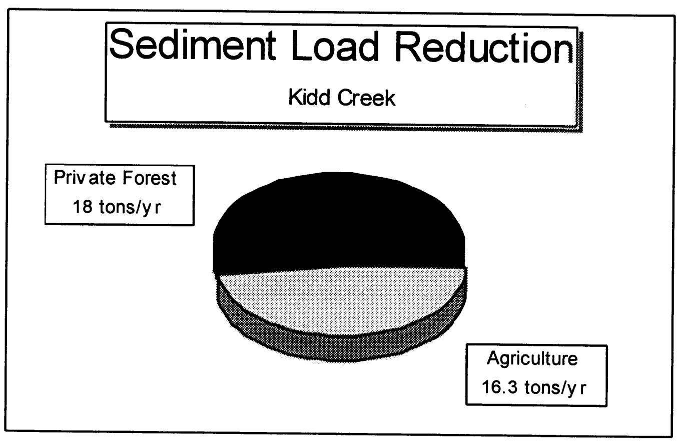
The current estimate of sediment yield from each watershed is provided in Table 3. Based on the acreage values provided in Tables 1 and 2, the sediment load reduction required of each land use is provided in Table 6 and Figure 2.

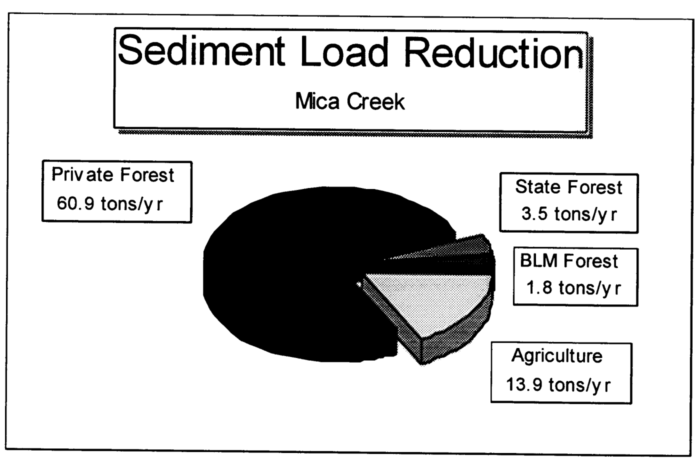
Table 6: Allocation of sediment load reduction required of each land use type.

| Water body | Cougar | Kidd | Mica |
|---|---|---|---|
| BLM forest (tons/yr) | - | - | 1.8 |
| State forest (tons/yr) | 2.4 | - | 3.5 |
| Private forest (tons/yr) | 42.9 | 18.0 | 60.9 |
| Agriculture (tons/yr) | 14.7 | 16.3 | 13.9 |

**Figure 2**


Sediment Load Reduction
Cougar Creek
Private Forest
42.9 tons/yr
State Forest
2.4 tons/yr
Agriculture
14.7 tons/yr


Sediment Load Reduction
Kidd Creek
Private Forest
18 tons/yr
Agriculture
16.3 tons/yr


Sediment Load Reduction
Mica Creek
Private Forest
60.9 tons/yr
State Forest
3.5 tons/yr
BLM Forest
1.8 tons/yr
Agriculture
13.9 tons/yr

*3.2.7.2. Forest Lands*

Sediment sources on forest lands are primarily associated with the road systems. Prime sediment sources are roads located in stream flood plains, road crossings of streams and erosion from road surfaces channeled directly to streams.

*3.2.7.3. Agricultural Lands*

Agricultural lands or those agricultural lands converted to small ranchettes are located in the Cougar Creek watershed. Ranchettes are land holdings of a few to forty acres. The primary mechanism of sedimentation from the agricultural and converted lands is stream bank erosion along these streams. Bank erosion is the result of riparian vegetation loss and channelization on working ranch lands and ranchettes.

*3.2.8. Monitoring Provisions*

In-stream monitoring of the beneficial use (cold water biota) support status during and after the sediment abatement project implementation will establish the final sediment load reduction required by the TMDL. In-stream monitoring, which will detect the thresholds values identified in section 3.2.4, will be completed every year on a randomly selected 1% of the watershed's Rosgen B and C channel types. Data will be complied after five years. The yearly increments of random testing, which sum to 5% of the stream after five years should provide a data base not biased by transit fish and macroinvertebrate population shifts. Based on this data base the beneficial use support status will be determined. Monitoring will assess stream reaches 20 times bankfull width in length. These reaches will be randomly selected from the total stream channel in B and C types until at least 5% of these channels have been assessed after five years. Identical measurements will be made in appropriate reference streams, in which beneficial uses are known to be supported.

*3.2.9 Feedback Provisions*

Data from which the problem assessment and TMDL for the Cougar, Kidd and Mica Creeks watersheds were developed are often crude measurements. As more exact measurements are developed during implementation plan development or subsequent to its development these will be added to a revised TMDL as required.

When the appropriate measurements of beneficial use (cold water biota) support status meet the full attainment level, further sediment load reducing activities will not be required in the watershed. The interim sediment loading capacity will be replaced in a revised TMDL with the ambient sediment load. Best management practices for forest and agricultural practices will be prescribed by the revised TMDL with erosion abatement structure maintenance provisions. Regular monitoring of the beneficial use will be continued for an appropriate period to document maintenance of the full support of the beneficial use (cold water biota).

## 3.3. Latour Creek Watershed Sediment Total Maximum Daily Loads

### *3.3.1 Introduction*

Latour, Larch, and Baldy Creeks are listed as water quality limited on the 1998 section 303(d) CWA list for sediment. The sub-basin assessment (section 2.0) indicates that Latour Creek is impaired by excess sedimentation, while this does not appear to be the case for Baldy and Larch Creeks. A sediment TMDL addressing Latour Creek will of necessity address Baldy and Larch Creeks.

The model used estimated 126 tons/year above the background sedimentation rate. However, the sediment loading of streams in the northern Rocky Mountains is not continuous nor does it occur on a yearly basis. The majority of the sediment resident in the bed and affecting the beneficial uses is loaded in large discharge events which have a return period of 10 - 15 years. The model accounts for this fact by dividing mass failure and road encroachment sediment estimates by ten. Latour Creek could possibly have 1,260 tons of sediment resident in its bed from the 1996 flood event. This amount added to any residual sediment from the 1974 and earlier flood events.

The Latour Creek watershed has the ownership and land use pattern outlined in Table 1:

Table 1: Land use patterns of Latour Creek

| Land Use | Acreage | Percentage |
|---|---|---|
| BLM forest | 8,370 | 25.1 (25.3) |
| Forest Service forest | 1,117 | 3.3 (3.4) |
| Tribal forest | 1,078 | 3.2 (3.3) |
| State Forest | 8,427 | 25.4 (25.4) |
| Private Forest | 14,109 | 42.3 (42.6) |
| Ag/ Residential subdivision | 257 | 0.8 |

Note: Values in parenthesis are percentage of forest land.

### *3.3.2 TMDL Authority*

Section 303(d)(1) of the Clean Water Act requires states to prepare a list of waters not meeting state water quality standards in spite of technology based pollution control efforts and the application of best management practices for nonpoint sources. This list must include a priority ranking "... taking into account severity of the pollution and the uses to be made of such waters." The prescribed remedy for these water quality limited waters is for states to determine the total maximum daily load (TMDL) for pollutants "... at a level necessary to implement applicable water quality standards with seasonal variations and a margin of safety ..." A margin of safety is included to account for any lack of knowledge about how limiting pollutant loads will attain water quality.

Section 303(d)(2) requires both the list and any total maximum daily loads developed by the state be submitted to the Environmental Protection Agency (EPA). The EPA is given thirty days to either approve or disapprove the state's submission. If the EPA disapproves, the agency has another thirty days to develop a list or TMDL for the state. Both the list and all TMDLs, either approved or developed by EPA, are incorporated into the state's continuing planning process as called for in section 303(e).

*3.1.3. Loading Capacity*

The load capacity for a TMDL designed to address a sediment caused limitation to water quality is complicated by the fact that the State's water quality standard is a narrative rather than quantitative standard. In the waters of the Latour Creek watershed, the sediment interfering with the beneficial use (cold water biota) is most likely large bedload particles. Adequate quantitative measurements of the effect of excess sediment have not been developed. Given this difficulty a sediment loading capacity for the TMDL is more difficult to develop. This TMDL and its loading capacity is based on the following premises:

: natural background levels of sedimentation are assumed to be fully supportive of the beneficial uses, cold water biota.

: the stream system has some finite yet unquantified ability to process (attenuate through export and/or deposition) a sedimentation rate greater than background rates.

: the beneficial use (cold water biota) in-stream will be fully supported when the finite yet unquantified ability of the stream system to process (attenuate) sediment is met.

: care must be taken to control factors which may interfere (fish harvest) with the quantification of beneficial use support.

The natural background sedimentation rate from the Latour Creek Watershed is 767 tons per year. (Background sediment yield = 33,359 acres x 0.023 tons/acre/yr). This calculation assumes the entire watershed would be vegetated by coniferous forest, if undisturbed. This value is the interim loading capacity.

*3.1.4. Margin of Safety*

The model employed to estimate sedimentation rates has several conservative assumptions, which are documented in Section 2.0, Appendix B. Applied to the Belt terrane of the Latour watershed, the model provides an inherit margin of safety of 231%. This is a sufficient margin of safety.

Table 2: Background sedimentation rate (interim loading capacity) and modeled sediment yield of Latour Creek

| Waterbody | Acres | Background sedimentation rate (tons/year) (Acres x 0.023 tons /acre/ year) | Modeled sediment yield to stream (tons/yr) |
|---|---|---|---|
| Latour | 33,359 | 767 | 893 |

### *3.3.5. Appropriate Measurements of Full Beneficial Use Support*

Sediment load reduction from the current level towards the interim sediment reduction goal is expected to attain an as yet unquantified sediment load at which the beneficial use (cold water biota) will attain full support. This sediment load will be recognized by the following appropriate measures of full cold water biota support:

: three or more age classes of trout with one young of the year.
: trout density a reference levels (0.1-0.3 fish/yd$^2$/hour effort).
: presence of sculpin and tailed frogs.
: macro invertebrate biotic index score of 3.5 or greater.

When the appropriate sediment loading capacity is determined by these appropriate measures of full cold water biota support, the interim load capacity will be revised to the appropriate load capacity.

### *3.3.6. Sediment Load Allocation*

The current estimate of allocatable sediment load capacity of the watershed is provided in table 2. The sediment load allocated to the forest lands and to agricultural/residential lands based on the a 90% forest and 10% agriculture/ residental lands assumption (Table 3). The agriculture/ residential lands are provided a higher allocation than would be expected from the 0.8% land base in these uses. The higher assumed allocation is based on the presence of bank erosion adjacent to these properties.

Table 3: Allocation of sediment load capacity between land uses in the Latour Creek Watershed

| Waterbody | Sediment load allocated to Forest Lands (tons/yr) | Sediment Load allocated to agricultural / residential lands (tons/yr) |
|---|---|---|
| Latour | 690 | 77 |

Forest Land can be further subdivided into Forest Service, BLM, State, Tribal and private forest land. Stream bottom pasture land is completely divided into residential (ranchette) lands. The further allocation of sediment load capacity to these land uses is provided in Table 4 and figure 1 based on acreages provided in Tables 1.

Table 4: Allocation of sediment load capacity based on subdivision of land use types.

| Waterbody | Latour |
|---|---|
| Forest Service (tons/yr) | 23 |
| BLM (tons/yr) | 175 |
| Tribe (tons/yr) | 23 |
| State (tons/yr) | 175 |
| Private forest (tons/yr) | 294 |
| Ag / residential (tons/yr) | 77 |

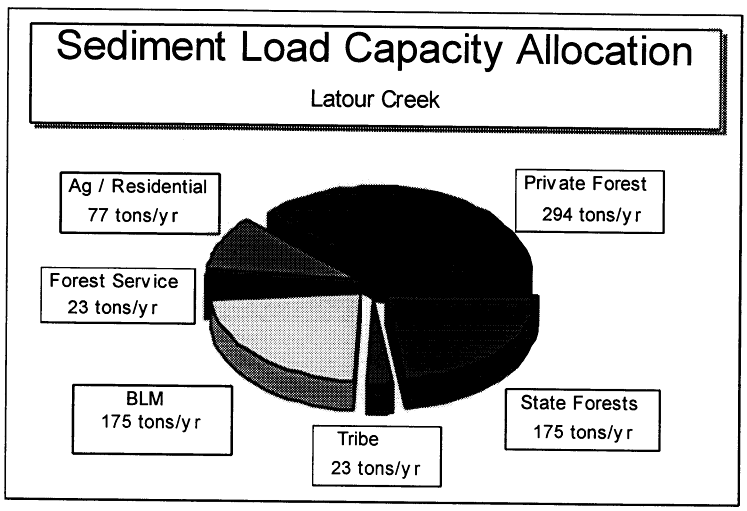



**Figure 1**

3.3.7. Sediment Load Reduction Allocation

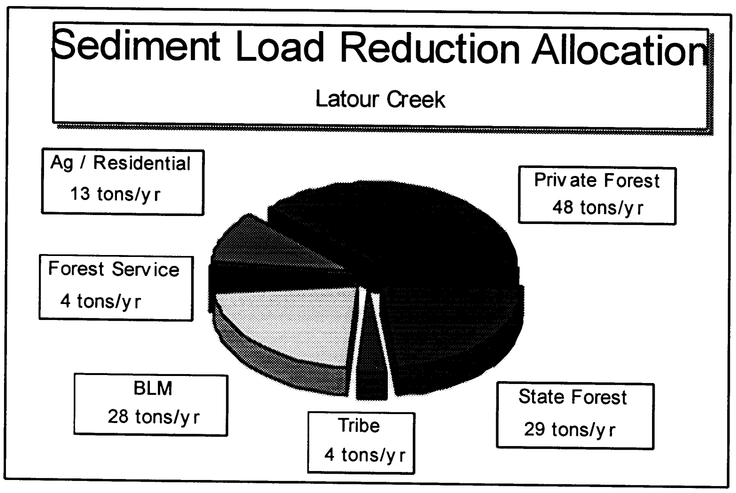
3.3.7.1. Current Sediment Yield from Forest and Agricultural Bottom Lands.

The current estimate of sediment yield for the watershed is provided in Table 2. The sediment reduction required is 126 tons per year ( 893 t/yr - 767 t/yr). Based on the acreage percentages provided in Tables 1, the sediment load reduction required of forest lands is 113 tons per year (126 t/yr * 0.9) and 13 tons per year (126 t/yr * 0.1) from agriculture land. The sediment reduction required of each owner group is provided in table 5 and figure 2.

Table 5: Allocation of sediment load reduction required of each land use type.

| Waterbody | Cougar |
|---|---|
| Forest Service (tons/yr) | 4 |
| BLM (tons/yr) | 28 |
| Tribe (tons/yr | 4 |
| State forest (tons/yr) | 29 |
| Private forest (tons/yr) | 48 |
| Ag / residential (tons/yr) | 13 |

**Figure 2**



*3.3.7.2. Forest Lands*

Sediment sources from forest lands are primarily associated with the road systems. Prime sediment sources are roads located in stream flood plains, road crossings of streams and erosion from road surfaces channeled directly to streams.

*3.3.7.3. Agricultural Lands*

Agricultural lands converted to small ranchettes are located in the Latour Creek watershed. Ranchettes are land holdings of a few to forty acres. The primary mechanism of sedimentation from the agricultural and converted lands is stream bank erosion along these streams. Bank erosion is the result of riparian vegetation loss and channelization on working ranch lands and ranchettes.

*3.3.8. Monitoring Provisions*

In-stream monitoring of the beneficial use (cold water biota) support status during and after the sediment abatement project implementation will establish the final sediment load reduction required by the TMDL. In-stream monitoring, which will detect the thresholds values identified in section 3.1.4, will be completed every year on a randomly selected 1% of the watershed's Rosgen B and C channel types. Data will be complied after five years. The yearly increments of random testing, which sum to 5% of the stream after five years should provide a data base not biased by transit fish and macroinvertebrate population shifts. Based on this data base the beneficial use support status will be determined. Monitoring will assess stream reaches 20 times bankfull width in length. These reaches will be randomly selected from the total stream channel in B and C types until at least 5% of these channels have been assessed after five years. Identical measurements will be made in appropriate reference streams, in which beneficial uses are known to be supported.

*3.1.9. Feedback Provisions*

Data from which the problem assessment and TMDL for the Latour Creek watershed were developed are often crude measurements. As more exact measurements are developed during implementation plan development or subsequent to its development these will be added to a revised TMDL as required.

When beneficial use (cold water biota) support meet the full attainment level, further sediment load reducing activities will not be required in the watershed. The interim sediment loading capacity will be replaced in a revised TMDL with the ambient sediment load. Best management practices for forest and agricultural practices will be prescribed by the revised TMDL with erosion abatement structure maintenance provisions. Regular monitoring of the beneficial use will be continued for an appropriate period to document maintenance of the full support of the beneficial use (cold water biota).

## 3.4 Mica Creek Watershed Bacteria Total Maximum Daily Load

### *3.4.1 Introduction*

Mica Creek and its North Fork exceed the current fecal coliform bacteria standard for the designated use secondary contact recreation (Table 1). The current standard is a geometric mean of 200 fecal coliform per 100 ml of water over a thirty-day period. The proposed *Escherichia coli* (E-coli) standard for recreational use will be a geometric mean over a thirty-day period of 126 E-coli per 100 ml water. The TMDL is written for both standards in the event it changes in the next year.

Table 1: Fecal and E coli form bacteria from two locations on Mica Creek

| Date | Mica Creek FC | Mica Creek EC | NF Mica Creek FC | NF Mica Creek EC |
|---|---|---|---|---|
| 7/23/99 | 5100 | 2900 | 400 | 180 |
| 7/23/99 | | 1300 | | 200 |
| 7/27/99 | 570 | 150 | 600 | 130 |
| 7/30/99 | 730 | 630 | 500 | 380 |
| 8/4/99 | 800 | 220 | 720 | 190 |
| 8/24/99 | 570 | 300 | 600 | 300 |
| Geometric Mean | 993 | 535 | 553 | 216 |

There are no point sources discharging bacteria to Mica Creek. Potential sources of bacteria to Mica Creek are residences and grazing animals. Seven residences are located along the creek. It is unlikely that these few residences are the source of the bacteria. Three ranches and one ranchette graze livestock along the stream. These grazing animals and particularly the cattle associated with the three ranches are the likely source of the observed bacteria exceedence.

### *3.4.2 TMDL Authority*

Section 303(d)(1) of the Clean Water Act requires states to prepare a list of waters not meeting state water quality standards in spite of technology-based pollution control efforts and best management practices applied to nonpoint sources. This list must include a priority ranking "... taking into account severity of the pollution and the uses to be made of such waters." The prescribed remedy for these water quality limited waters are for states to determine the total maximum daily load (TMDL) for pollutants "... at a level necessary to implement applicable water quality standards with seasonal variations and a margin of safety ..." A margin of safety is included to account for any lack of knowledge about how limiting pollutant loads will attain water quality.

Section 303(d)(2) requires both the list and any total maximum daily loads developed by the state be submitted to the Environmental Protection Agency (EPA). The EPA is given thirty days to either approve or disapprove the state's submission. If the EPA disapproves, the agency has another thirty days to develop a list or TMDL for the state. Both the list and all TMDLs, either approved or developed by EPA, are incorporated into the state's continuing planning process as called for in section 303(e).

### *3.4.3 Loading Capacity*

Measured discharge on Mica Creek was 2.5 cubic feet per second (cfs), while the North Fork was measured at 1.7 cfs. These are the only measurements available. These measurements were made during August 1995. For purposes of calculation the loading capacity a mean summer discharge of 4 cfs and 2.7 cfs were assumed for Mica Creek and its North Fork, respectively. These are conservatively high summer discharge estimates.

The loading capacity was based on the most stringent chronic standards, 200 fcu/ 100 ml for fecal coliform, the current secondary contact recreation standard (IDAPA 16.01.02.250.01.b.iii) and 126 ecu/100ml for E-coli, the proposed recreational use standard. Use of these standards employs the most conservative case for load capacity calculation. Load capacity for fecal coliform and E-coli are provided in Table 2. The mathematical calculations are provided in Appendix A.

Table 2: Loading Capacity and Loading Capacity with 20% Margin of Safety Applied

| Stream | fcu loading capacity (number/d) | ecu loading capacity (umber/d) | fcu loading capacity - MOS* (number/d) | ecu loading capacity - MOS* (number/d) |
|---|---|---|---|---|
| Mica Creek | $1.96 \times 10^{10}$ | $1.23 \times 10^{10}$ | $1.57 \times 10^{10}$ | $9.87 \text{ X } 10^{9}$ |
| NF Mica Creek | $1.32 \times 10^{10}$ | $8.32 \times 10^{9}$ | $1.06 \times 10^{10}$ | $6.66 \times 10^{9}$ |

* Note: MOS applied is 20%, which for these numbers would range from 1.6 to 3.9 billion coliform units.

### *3.4.4 Margins of Safety*

Three margins of safety are constructed into the TMDL. This is necessary because a very limited amount of discharge and coliform data is available on which to base the TMDL. Since only a single set of discharge values are available the assumed flow is placed at a high summer flow for a stream likely able to support secondary contact activities. The chronic standards are employed to construct the loading capacity. This is the most stringent standards of the three available. A twenty percent margin of safety is removed from the loading capacities in order to account for the limited number of coliform observations.

### *3.4.5 Current Coliform Loads*

Current coliform loads were developed using the geometric mean and the assumed flows provided in section 3.4.1 and 3.4.3. Current loads were estimated with the identical method as the loading capacity except the geometric means of the observed values were used (Table 3; Appendix A).

Table 3: Estimates of current coliform bacteria loads of Mica Creek and North Fork Mica Creek

| Stream | Fecal Coliform/d | E coli/d |
|---|---|---|
| Mica Creek | $9.72 \times 10^{10}$ | $5.41 \times 10^{10}$ |
| NF Mica Creek | $3.53 \times 10^{10}$ | $1.43 \times 10^{10}$ |

### *3.4.6 Coliform Reductions Required*

The coliform reductions required are provided in Table 4. These values are the subtraction of the loading capacity modified for the margin of safety (Table 2) from the estimates of current coliform loads (Table 3). The resulting numbers are very large and difficult to grasp. For this reason the percentage coliform reduction is expressed.

Table 4: Estimated coliform reductions for Mica Creek and North Fork Mica Creek and the percent reductions required

| Stream | Fecal Coliform/d Percent Reduction | E coli/d Percent Reduction |
|---|---|---|
| Mica Creek | $8.15 \times 10^{10}$ (83.9%) | $4.42 \times 10^{10}$ (81.8%) |
| NF Mica Creek | $2.47 \times 10^{10}$ (70.1%) | $7.64 \times 10^{9}$ (53.3%) |

Bacterial contamination is from nonpoint sources. The majority of the bacterial contamination is most likely from grazing animals. The majority of these animals are on three ranches. One ranch is on the North Fork Mica Creek while the other two are below the North Fork - South Fork confluence. The entire allocation for the North Fork and the reduction required for the North Fork can be ascribed to the ranch to the west of Highway 95. The additional reductions required for Mica Creek would come from the ranches to the east of the highway and the small amount of stock on the single ranchette.

### *3.3.7 Monitoring Provisions*

In-stream monitoring of the fecal coliform and E coli will be conducted after bacteria abatement project implementation. In-stream monitoring which should detect the bacteria reductions required in section 3.4.6 will be completed every two years at points of compliance at the Loff's

Bay Road Bridge and the Highway 95 Bridge. Two sample sets will be collected during the low discharge (summer) period. A sampling set will include at a minimum five integrated samples over a two week period. From these data geometric means can be developed.

*3.4.8 Feedback Provisions*

Data, from which the problem assessment and Mica Creek bacteria TMDL was developed, are often limited measurements. If more measurements are made during implementation plan development or subsequently to its development. These data will be used to revised the TMDL as required.

When the coliform levels meet the appropriate standard and bacteria reduction, further bacteria load reducing activities will not be required in the watershed. Best management practices for agricultural practices will be prescribed by the revised TMDL with structure maintenance provisions. Regular monitoring of the bacteria levels will be continued for an appropriate period to establish maintenance of the full support of the coliform standard.

# 4. Draft Response to Comments on the Coeur d'Alene Lake and River Sub-basin Assessment and Wolf Lodge, Cougar, Kidd, Mica and Latour Creek TMDLs.

## 4.1. Introduction

Three letters of comment on the sub-basin assessment and TMDLS have been received. These letters contained twenty-three substantive and distinctive comments. In addition to the comments, the sediment modeling technical advisory group met to discuss the sediment model and to discuss any comment made concerning the sediment model. The sediment model advisory group is made up of hydrologist and sedimentologists from state and federal agencies (USFS, BLM, IDL, SCC, IDFG), an environmental group and the timber industry. The comments are addressed in the section following with the comment expressed, the source of the comment and the response to that comment. Responses included changes in the assessment and the TMDLs. If a comment was not accepted, the reason the comment was disregarded is expressed.

## 4.2. Substantive Comments and Response

Comment 1: The acute salmonid sight feeding turbidity standard was misstated in the sub-basin assessment, Table 3 and misapplied to Lake Creek. The text on Lake Creek indicates that this water body is not limited by sediment.

Comment from: Nickolas Bugosh, Division of Environmental Quality Lewistion Field Office

Response 1: The acute salmonid sight feeding turbidity standard was misstated in Table 3. This error has been corrected to make clear that both the acute and chronic standards are applied in reference to a measured appropriate background measurement. The Lake Creek section has been clarified to state that the turbidity increases reported are referenced to an upstream background site in the work of Bauer, Golden and Pettit (1998). Following these clarifications, it is still the conclusion of the sub-basin assessment that Lake Creek is water quality limited and requires a TMDL.

Comment 2: RUSLE was used to model the sediment yield of dirt and gravel roads. The comment expresses the opinion that this is an improper application of RUSLE, because RUSLE has not been verified for roads.

Comment from: Nickolas Bugosh

Response 2: On the advice of the State DEQ office and the local Natural Resource Conservation Service (NRCS), RUSLE was used to model dirt and gravel roads which are county and private roads. The newer versions of RUSLE are capable of modeling roads composed of native soils and covered with gravel. These roads should be in areas where NRCS Soils Surveys are complete. The model has been verified for this use. The sediment technical advisory group discussed this issue and was in agreement that it was appropriate to model county and private roads where Soil Surveys existed with the RUSLE model.

Comment 3: The margin of safety (MOS) discussion section in the TMDLs is not clear. It reads as if the MOS should be added to the natural background rate of sedimentation, even though it is subtracted in the tables. In addition the need for a 10% margin of safety was questioned. The comment noted that the model used to estimate sediment was repeatedly conservative in its assumptions. The comment suggested the conservatism of each assumption be quantified. It was suggested that this is an adequate MOS as specified by EPA TMDL guidance (EPA, April 1991).

Comment from: Nickolas Bugosh

Response 3: Based on this comment the 10% margin of safety was dropped. As a part of the revised Sediment Model Assumptions and Documentation section (Appendix B), the conservatism of each assumption was assessed as a percentage. These percentages were then added. For the Kaniksu granitic terrane, the model is 164% conservative; for the Belt Meta-sedimentary terrane, the model is 231% conservative. These percentages have been applied in the TMDLS as the MOS, dependent on the terrane type of the watershed in question.

Comment 4: The basic premise of the Wolf Lodge TMDL is weak because the temporal and spacial variability of fish and macro invertebrates make it difficult to measure a substantive improvement. The comment notes that no one to one or other relationship between biotic populations and sediment has been found. The monitoring plan should calculate sample size based on coefficients of variability. Reference streams cannot be used because of this variability. The comment suggests that particle size distribution and intergravel dissolved oxygen measurements would bolster the monitoring plan.

Comment from: Robert Sampson, Natural Resources Conservation Service, Boise Office

Response 4: The monitoring plan has been revised in the TMDLs to address temporal biotic variability. The 5% of the stream reach will be monitored, 1% per year over a five years period. This approach should address temporal variability of the biota. Monitoring by necessity will be limited to the low flow period during the warm summer months. This fact reduces seasonal variability.

The comment makes an excellent point. There is no one to one or other relationship between biota and sedimentation. This is the reason the approach is taken in the TMDLs. Despite all the issues of temporal and spacial variability, assessment of Beneficial Use Reconnaissance, Fish and Game, Forest Service and University of Idaho data on fish and macro invertebrates in the nearby North Fork Coeur d'Alene River watershed indicates a pattern (IDEQ, 1999a) Reference (low impact) streams consistently have a trout population of 0.1-0.3 fish/ $m^2$/hour effort electrofishing. This is a broad range 10 - 30 fish per 100 square meters per hour effort electrofishing. The reference streams assessed are of varying size. A similar range is found in reference streams in the Priest Lake watershed. Densities an order to two orders of magnitude lower are found on streams with sedimentation impacts. The use of qualitative indicators as young of the year, age classes and presence of other vertebrates rounds out the definition of full support.

The suggestion that coefficients of variability be developed and used to develop sample size is a good suggestion. Unfortunately, the current data base on any single watershed is insufficient to complete a sample size analysis. The TMDL implementation plans should specify that this analysis is completed as additional biotic community data is collected. The suggestion that particle size and intergravel dissolved oxygen would improve the monitoring plan is erroneous. Particle size is only very tangentially related to beneficial use support, while intergravel dissolved oxygen depletion is not an issue in any of the watersheds for which TMDLs were developed. Pool filling by cobble and course sand are the likely impacts to fish (IDEQ, 1999b), while the impact to macro invertebrates is less clear. Neither parameter can be directly related to the support status of the biotic communities.

Comment 5: The base sedimentation coefficient used are too low. The sedimentation rates used grouped around 15 (Belt) and 25 (Kaniksu granitic) tons per year. The comment cites considerable information to indicate that 60 - 100 tons per year is a more appropriate number.

Comment from: Robert Sampson

Response 5: The model uses the sediment yield coefficients of the WATSED model. This issue was raised with the sediment technical advisory group. The agency and private hydrologists on the group were satisfied with the WATSED values. The only explanation offered was that the values cited by the comment were those for total solids yield; sediment as well as dissolved solids. The WATSED values are actual measured values, which are calibrated to local conditions on the Clearwater Forest to the south. On the advice of the technical group the WATSED coefficients have been retained.

Comment 6: Road erosion is the primary source of sediment. The comment suggests county and private roads should have been considered.

Comment from: Robert Sampson

Response 6: The reviewer did not have benefit of the sub-basin assessment as the Wolf Lodge TMDL was reviewed and comment developed. The county and private roads were considered. Where these came into contact with the stream system, either as at a stream crossing or encroaching, their impact was modeled. The CWE assessment accounted for any mass failures from county and private roads.

Comment 7: The level of sedimentation attributable to bank erosion from agricultural lands along Wolf Lodge Creek is an order of magnitude too high. The correct values are around 30 (actually 33) tons per year.

Comment from: Robert Sampson

Response 7: The sediment delivery from banks placed in the earlier drafts of the TMDL were based on an earlier version of the model which generated higher sediment delivery rates and on the agricultural acreage. The model has been corrected and the bank erosion estimates supplied by the NRCS incorporated. The percentages assigned to agriculture and residences are now based on the estimated sediment delivery from these sources.

Comment 8: The reviewer after viewing the stream reach covering agricultural lands did not find bed load to be a problem in the stream. He did not find the statement on bed load impacts to be supported.

Comment from: Robert Sampson

Response 8: The reviewer was supplied with the TMDL alone and did not have benefit of the sub-basin assessment where many of these issues were discussed. The Coeur d'Alene Mountains are deeply dissected having relative long lower gradient valleys, which at their heads are very steep. The Wolf Lodge Valley is a remnant lake bed of an earlier Coeur d'Alene Lake. The result is that the agricultural lands are along a stream of fairly low gradient. Bed load deposition and interference with biota by this mechanism occur above this reach. The agricultural reaches of Wolf Lodge Creek and especially the spawning reach immediately above Interstate 90 are more likely affected by fine sediment from bank erosion.

Comment 9: Timber management is described as moderately intense with dense road development (p.5). The assessment should have a timber harvest inventory of the listed watersheds.

Comment from: Mike Mihelich, Kootenai Environmental Alliance

Response 9: The description in the cultural impacts section was generalized to the entire sub-basin. The comment is correct Wolf Lodge and Cedar Creeks have received heavy levels of timber harvest and road development. This change has been made in the text. It was not deemed necessary to develop a harvest history for each listed watershed. These data are imbedded in the CDASTDS (USFS) and Idaho Department of Lands (IDL) geographic information system (GIS) vegetation coverages. The purpose of the assessment, models and resulting TMDLs was to address sediment not clearcuts. The Horizon Environmental Impact Statement information quoted was more than ten years old, while the GIS coverages are updated on a constant basis.

Comment 10: Direct hill slope erosion from harvested lands is much higher than the values assigned. A Geomax report of 1988 indicates higher hill slope erosion. Water yield caused sedimentation is not addressed. The fishery in the watersheds has declined in recent years.

Comment from: Mike Mihelich

Response 10: The expert group assembled to advise in model development by consensus of those present believe the WATSED sediment yield coefficients, which are based on actual watershed measurements of sediment yield reflect the sediment yield of hill slopes after various land uses. The Geomax estimations sited are based on assumptions of water and sediment yield not on actual measurements. The Geomax estimates were made for Marie Creek are ten years old and prior to the harvest which arose from Horizon. When these estimates were made, the cutting was confined to the ridges. Current GIS data indicates the same situation exists in the Marie Creek watershed.

We agree that harvest increases flow. The existing literature indicates it is the base flow that is increased. Flow increases during high discharge periods are better associated with an increase in the stream capture area at stream road crossings. In any case no quantitative relationship between increased flow or "compression" of discharge events and sediment yield was identified by the expert group. Without a relationship quantitative modeling is not possible. The model does identify road crossings, which could be addressed in an implementation plan for road sediment, road failure and water capture.

Comment 11: Description of the fishery in the Coeur d'Alene River above Cataldo is questioned.

Comment from: Mike Mihelich

Response 11: The cutthroat trout and chinook salmon fishery of the upper segments of the Coeur d'Alene River is well known to Idaho Fish and Game and local fisherman. The large river BURP results indicate the health of the fishery. Unpublished expert witness reports from the metals natural resource damage case indicates 12,000 fish per mile in these segments.

Comment 12: RASI data for Skookum Creek should be applied to Wolf Lodge and Marie Creeks.

Comment from: Mike Mihelich

Response 12: Skookum Creek is a tributary to the Little North Fork Coeur d'Alene River. Riffle armor stability (RASI) data for this and several other water bodies in the North Fork Coeur d'Alene River has been assessed in the North Fork Coeur d'Alene River Sub-basin Assessment (17010301). High RASI values indicate stream bed stability, but are distinctive to the watershed where it is collected. The Skookum Creek data would not properly be extrapolated to Wolf Lodge Creek.

Comment 13: Residual pool volume data from the Horizon EIS should be considered.

Comment from: Mike Mihelich

Response 13: Residual pool volume data, where it is available from recent BURP surveys is assessed. The Horizon data is more than ten years old. Since it was developed, a major sediment loading event, the 1996 rain on snow event, and two channel forming flows, 1997 and 1999 discharges have occurred. Residual pool volume data of ten years ago plus is likely not indicative of in stream conditions, especially after the channel forming runoffs of 1997 and 1999.

Comment 14: Simply addressing the roads in Wolf Lodge Creek will not address sediment problems.

Comment from: Mike Mihelich

Response 14: We agree that timber harvest activities have impacted Wolf Lodge and Marie Creeks. The sediment technical advisory group identified only quantitative relationships between road features and sediment. The model used points back to the road features. Implementation of the TMDL will be outlined in an implementation plan. The TMDL does not in any way encumber the solutions in an implementation plan. Although the model points to roads and road impacts, logging cessation is not in any way ruled out by the TMDL. Such decisions are not appropriate for the load allocation.

Comment 15: Several comments refer to the use of the model, WATSED and its shortcomings. Comments speak to inadequate documentation of WATSED.

Comment from: Mike Mihelich

Response 15: The model assumptions and documentation (Appendix B) make it very clear that WATSED is not used to model sediment. It is made clear the WATSED sediment yield coefficients, both mean and range are used to model sediment from forest land use. The model is designed to look at the spectrum of land use, road impacts and stream bank erosion. It uses several data and model inputs to achieve this end.

The model does account for episodic sediment loading both as measured road bed failures and estimated encroaching roads sediment generation. The model does separate fine and course sediment yield to the streams. An estimation of the conservatism of the model is made in the model assumptions and documentation (Appendix B). Applied on the Belt terrane, the model is estimated to be 231% conservative.

Comment 16: The applied model underestimates sediment yield from harvested land and the amount of non-stocked land in the Wolf Lodge Creek watershed.

Comment from: Mike Mihelich

Response 16: As stated earlier, the model is driven by inputs from Forest Service and IDL GIS data bases. These data bases are made current on a regular basis. The source of the comment information is 5 - 10 years old and most likely out of date. As originally applied, all clearcut lands younger than ten years were given a higher sediment yield rate. The sediment technical advisory group identified this approach as in error and indicated that only non-stocked stands should have the higher coefficient applied.

Comment 17: The comment is addressed to section 2.4.1; Pollution Control Efforts to Date. The comment indicates that addressing roads alone will not recover Wolf Lodge Creek. The comment refers back to the arguments made earlier concerning flow.

Comment from: Mike Mihelich

Response 17: The section simply lists the pollution control measures put in place to date. Among these is road crossing and road obliteration. Comments about flow have been addressed earlier. The comment wants sedimentation associated with flows addressed. The model addresses sediment that can be addressed through quantitative measurements. No measured relationship has been identified for flow and sedimentation.

Comment 18: Similar comment to comment 17 made concerning section 2.4.2.; Pollution Control Strategies. The comment disagrees with a pollution credit trading system to address road problems.

Comment from: Mike Mihelich

Response 18: The section simply lays out approaches, but is not intended to exclude any approach to abating sedimentation. A TMDL implementation plan could identify harvest cessation as an approach on some or all of the watershed. A conflict in points of views is apparent between the sediment technical group and the individual making the comment. The group clearly believes roads are the major source of sediment, while clear cuts are believed by the individual commenting to be the major source of sediment. As the TMDL development agency, DEQ must base models on quantities of sediment loading. No measured relationship between sediment loading and flow is offered in the comment. The model depends on measured sediment yield rates, measured fine sediment yield from roads, measured road bed failures and delivery and measured encroaching road beds.

The individual commenting must also keep in mind that sediment is not delivered in large amounts to the stream monthly or even annually, but in episodic events, which recur every 10 - 15 years. Actual measurements must be annualized in order to develop a sediment load in tons per year. This does not mean the load from these episodes does not influence the beneficial uses after one year. It is in the bed and affecting uses for a number of years. The TMDLs make this point and provide estimates of how much material might be in the bed from the most recent (1996) large loading event.

Comment 19: The Clean Water Acts interim goal of protection of fish will not be met.

Comment from: Mike Mihelich

Response 19: The TMDL sets full support of the cold water biota as the goal. It defines full support in terms of age class distribution of trout, trout density, presence of other key vertebrates and a macro invertebrate index greater than 3.5. Since the amount of sediment impacting cold water biota has not been quantified for any stream and not for these streams this appears the most conservative approach to the state.

Comment 20: Timber sales are not addressed as point discharges.

Comment from: Mike Mihelich

Comment 20: This is currently a draft regulation. It is unclear whether it will be promulgated. For this reason it has not been addressed.

Comment 21: The comment disagrees with the assumptions stated on page 2 of the Wolf Lodge TMDL.

Comment from: Mike Mihelich

Response 21: The assumptions are 1)biota are fully supported at background levels of sedimentation; 2) the stream has some finite level of sedimentation above background at which the biota is fully supported; 3) the biota will respond to a level of full support when that as yet non-quantified level of sedimentation is met. The state, respectfully, believes these assumptions to be correct.

Comment 22: The comment disagrees with the background level of sedimentation estimated for the Wolf Lodge Creek watershed citing problems with the WATSED model.

Comment from: Mike Mihelich

Response 22: The background estimation is not based on WATSED, but on the sediment yield coefficient from WATSED, which is based on measured values. The estimate is clearly identified as the acreage of the watershed multiplied by the mean sediment yield coefficient for the Belt meta-sedimentary terrane type. The estimate assumes a totally forested, non-roaded watershed.

Comment 23: The comment indicates that the Forest Service uses feedback management approaches and that the reviewer has no faith in such approaches.

Comment from: Mike Mihelich

Response 23: As reviewed earlier, clear measures of full support of the beneficial use cold water biota are defined. These measures are based on reference streams primarily in the upper part of the North Fork Coeur d'Alene River watershed. Except for wild fires during the early part of the 20th century, few human caused impacts to these watersheds exist. The goal is based on measurable values not on value judgements.

## 4.3. References

Bauer, S.B., J. Golden and S. Pettit 1998. Lake Creek Agricultural Project, Summary of Baseline Water Quality Data. Pocketwater Incorporated, 8560 Atwater, Boise ID 83714. 138pp.

IDEQ, 1999a. North Fork Coeur d'Alene River Sub-basin Assessment. Idaho Department of Health and Welfare, Division of Environmental Quality, Coeur d'Alene Regional Office, 2110 Ironwood Parkway, Coeur d'Alene ID 83814. 44 pp.

IDEQ, 1999b. Coeur d'Alene Lake and River Sub-basin (17010303) Assessment. Idaho Department of Health and Welfare, Division of Environmental Quality, Coeur d'Alene Regional Office, 2110 Ironwood Parkway, Coeur d'Alene ID 83814. 37 pp.

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