Priest River Subbasin Assessment and Total Maximum Daily Load

Idaho Department of Environmental Quality

October 2001

3.3.B.7 Status of Beneficial Uses

The 1995 BURP MBI results for the lower and middle sites are Needs Verification. Examining the DEQ - RIBI fish assemblage questions (IDEQ 1996), the RIBI result for Kalispell Creek is NV due to the dominance of the introduced brook trout and reduced numbers of native cutthroat trout. Continuing with the Determination Flow Chart (Figure 2-10), the 1995 HIs were <100, so the status call remains NV. The 1997 MBIs for the lower and middle sites were Full Support, as well as the 1998 upper site.

Based on the USFS and DEQ electro-fishing surveys, along with the array of habitat evaluations, the data strongly suggests that cold water biota beneficial use is impaired as reflected by the continued decline of cutthroat populations along with a relative low density of brook trout. This condition is in part due to an excess of sand bedload, along with other factors identified in this section. The status call becomes Not Full Support.

The USFS and DEQ fish data shows Full Support for salmonid spawning beneficial use using brook trout for juveniles and two older age classes, and the assumption that the minor presence of 4-6 inch cutthroat trout equates to spawning of the resident population.

Sufficient fecal coliform bacteria samples were collected to assign FS to primary contact recreation. Domestic water supply use of Kalispell Creek is isolated to single family residences, so the turbidity criteria does not apply. The toxic substance criteria was Not Assessed.

There is insufficient temperature data in July to judge the Standards cutthroat spawning and incubation criteria. Temperature data for August and September shows exceedance of the EPA bull trout criteria.

3.3.B.8 Data Gaps

A continuous recording temperature sensor needs to be placed within the main stem of Kalispell Creek beginning in spring to evaluate the Standards cutthroat spawning and incubation criteria.

Habitat surveys were conducted by USFS in 1992 and 1993 within Kalispell Creek and several tributaries. A selected set of parameters is presented in Table 3-9 (USFS 1998c). Individual residual pool volume (IRPV) for Kalispell main stem averaged 30.4 m^3, excluding beaver created pools, and this seems to be well above average compared to other west side streams of similar wetted width. Beavers create the largest pools in the Kalispell watershed averaging between 67 - 217 m^3 IRPV. These large beaver pools offer good over-wintering and rearing habitat for fish (USFS 1998c). While the main stem IRPV may be good, BURP data shows a very low frequency of pools, so when extrapolated to Residual Pool Volume/km, available volume per length drops substantially. Note that in some the of tributaries such as Kalispell headwaters, Chute, Nuisance, and Bath Creeks, IRPV is less than 2 m^3, substantially less than measured within Hungry Creek and Mush Creek.

Various factors were used by USFS to rate pool quality, and qualitative ratings showed overall a very low percentage of high quality pools except for Hungry and Mush Creeks (Table 3-9). USFS evaluation of the Kalispell Creek data is that a stream the size of Kalispell Creek should have more high quality pools (USFS 1998c). Percent fines data for Kalispell Creek C and B channel type again indicates that spawning habitat is not of high quality, with highly covered or embedded gravel and cobble. Percent fines in tributary, B channel spawning habitat was low - moderate ranging from 17 - 38%, but note an embeddedness around 50% for Chute, Hungry, and Rapids Creek.

Table 3-9. Summary of Selected Habit Parameters from USFS Surveys within Kalispell Creek and Tributaries, 1992 and 1993.

	Individual Residual Pool Volume in cubic meters		Pool Quality Rating in Percent			Percent Fines in Pools, Tailouts, Runs, and Glides		
Stream	Mean w/o beaver ponds	Range of all Pools	Low	Moderate	High	C Channel	B Channel	%Embed-dedness
Kalispell Main stem	30.4	16-119	33	54	13	54	40	--
Kalispell Headwaters	1.5	1-2	80	20	--	--	--	--
Nuisance Crk	1.7	1-3	96	2	2	--	--	--
Chute Creek	1.8	1-3	97	--	3	--	31	53
Bath Creek	5.7	2-153	80	12	8	--	--	--
Hungry Creek	116.3	63-217	8	39	53	--	17	50
Virgin Creek	1.4	1-72	98	1	1	--	38	29
Rapids Creek	0.6	0.1-3	100	--	--	--	26	47
Mush Creek	88.5	55-122	9	33	58	--	--	--

Table 3-8. Electro-Fishing Results by USFS within Kalispell Creek and Tributaries, 1996 and 1998; and by DEQ BURP in 2000.

Data in fish/100 m²	USFS 1996 Kalispell Creek[a]			USFS 1998 Tributaries				DEQ 2000 - Main Stem BURP Sites[b]	
	Site F1	Site F2	Site F3	Rapid Creek	Virgin Creek	Bath Creek	Hungry Creek	1995 Lower Site	1997 Middle Site
Cutthroat trout	0	0.1	0.1	0	0	0	0	0	0.3
Brook trout	3.7	2.1	3.3	0	0	11.4	5.3	0.9	1.4
Sculpin	2.0	0.6	0.6	0	0	0	0	5.5	0.6

a = Refer to Figure 3-15a for locations of 1996 electro-fishing sites
b = Refer to Figure 3-15a for locations of 2000 electro-fishing sites

In 1992 another USFS electro-fishing survey was documented by narrative notes, in the vicinity of Hungry Creek confluence with Kalispell Creek. Shocking downstream of the confluence, mainly in pools, brook trout were present and numerous, ranging from fry to 10 inches. Cutthroat trout distribution was spotty, mostly found only in high quality pools. Cutthroats were in the 4-6 inch range, with no fry sampled. Sampling was also conducted in Hungry Creek, with a dominance of brook trout and a few cutthroat sampled.

The 1992 - 2000 fish sampling results have been compared to USFS sampling in 1983 and 1984, and the conclusion is that cutthroat trout have diminished in both numbers and distribution (USFS 1998c). In earlier sampling, cutthroats were found in moderate density in main Kalispell Creek above Rapids Creek confluence.

The BURP Habitat Index scores from the two lower sites were: a poor HI=70 for 1995, and an adequate HI=95 for 1997 (both C channel). Parameters with below mid-point scores included: percent fines (44 - 52%), instream cover, embeddedness, and for the 1995 site, a very poor slow/fast ratio of 0.07.

BURP scores for the two middle sites were HI=74 for 1995 (C channel), and HI=92 for 1997 (B channel). The C channel site had a high 93% fines, high embeddedness, and poor lower bank stability. The B channel site had far less fines and degree of embeddedness. The right stream bank was impacted by the adjacent Forest Road 308. At both sites the slow/fast ratio was poor at 0.2. At all four BURP sites the wetted width/depth ratios were at or below the basin average, ranging from 16 - 27.

At the 1998 upper site, HI=77 (B channel). Below mid-point scores included: percent fines (53%), instream cover, embeddedness, a slow/fast ratio of 0.2, and a poor width/depth ratio of 37.

The 1992 DEQ Use Attainability survey gave a similar picture of below average habitat conditions. A lower reach site east of Hwy 57 was rated overall as "fair" for habitat score, with poor instream cover and pool complexity. While pool frequency was low at 1.3 pools/100 m, volume was above average for the 3 - 5 m wetted width group, with RPV = 695 m^3/km. A middle reach site, downstream of the 1997 middle BURP site, was rated overall as "poor-fair" for habitat score, with similar characteristics as above. Here though, pool frequency was good with 6.4 pools/100 m (lateral scour pools), and volume was just below average at RPV = 220 m^3/km.

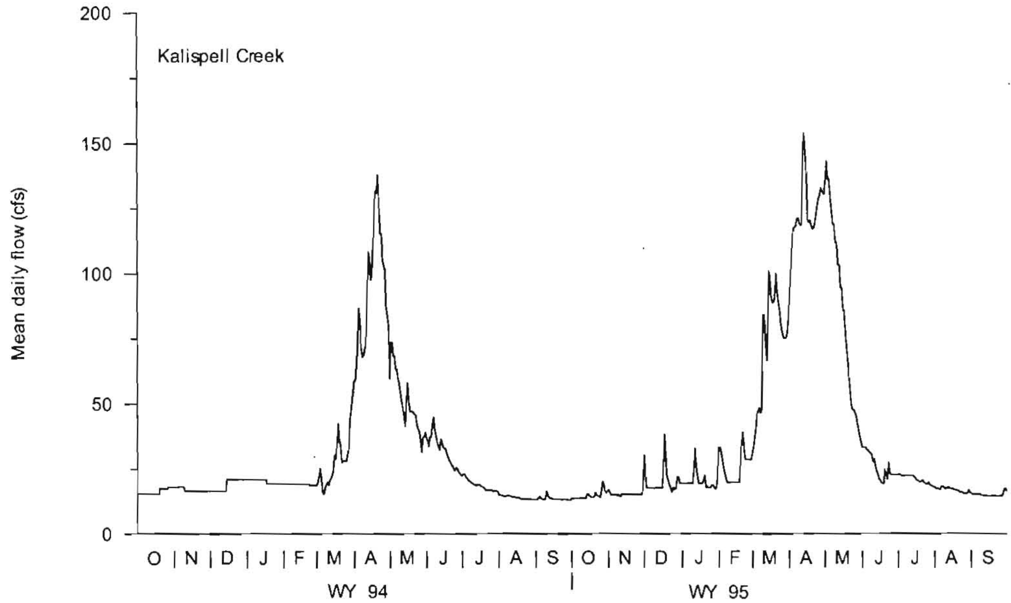


Figure 3-16. Mean daily flow rate for Kalispell Creek, water years 1994 and 1995.

Numerous instream measurements were taken of pH and DO with no numeric criteria exceedances. Highest instantaneous temperature recorded was 12.3°C. DEQ placed a temperature sensor near the mouth of Kalispell Creek from August 8 - October 25, 1997. Mean daily temperature over this period was 10.3°C, highest daily mean was 12.5°C, and maximum hourly temperature was 14.8°C. For the entire period of August through the end of September, the EPA bull trout criteria was exceeded.

Fourteen samples were taken for fecal coliform bacteria. The maximum bacteria count was 90 FC colonies/100 ml, and all other results ranged between <1 - 28 FC/100 ml.

The BURP MBIs for 1995 were 3.1 at a lower site and 3.3 at a middle site (Needs Verification, see Figure 3-15a for localities). BURP was repeated in 1997 with MBI=4.4 at a lower site, and MBI=4.0 at a middle site (Full Support). Averaged together the MBIs are 3.7 (FS) at both lower and middle reaches. For a single upper BURP site sampled in 1998, MBI=4.0.

Results of USFS electro-fishing in 1996 at three sites in Kalispell Creek, and 1998 surveys in selected tributaries, are presented in Table 3-8. As cautioned before, these surveys were primarily meant as presence/absence sampling, but with stream length and width recorded the data could be converted to fish densities. Also presented are DEQ BURP results from electro-fishing in 2000 at 2 main stem sites.

Brook trout captured included young-of-the-year and older age classes. Brook trout density within the main stem is considered low. Cutthroat trout were absent or extremely low in numbers. The densities from Kalispell Creek USFS sites F2 and F3 represent only 1 cutthroat at each site, and only 2 cutthroat were captured by DEQ at the 1997 BURP site. USFS field notes also mention 1996 electro-fishing surveys in other tributaries besides those listed in Table 3-8 (inventory sheets could not be found). Cutthroat trout distribution was found restricted to steeper gradient headwater reaches, or reaches above natural and man made barriers, in Chute, Kalispell, Deerhorn, Bath, and Nuisance Creeks (USFS 1998c).

Agriculture - Impact of agriculture is minor in this watershed. Conversion of the lower section of Bismark Meadows to hay cropping, through cross drainages, eliminated some historic meandering and floodplain effectiveness. There are only a few head of cattle that have direct access to the stream. Sediment delivery has been observed when drainage channels are mechanically re-deepened, and the spoils are piled on top of the ditch bank. Rain storms wash the loose soil back into the ditch where it is then delivered to the stream.

Urbanization - There is residential development surrounding the mouth of Kalispell Creek. There have been observations of sediment laden stormwater runoff from access roads, driveways, and home lot development being delivered into the stream. West of Hwy 57 there is development of rural homesteads off Kalispell Creek Road. The IDL - CWE inventory reported several driveways in this stretch that were in poor condition and eroding badly. Near the corner of Hwy 57 and Road 308, a gravel mining operation has recently begun, very close to Kalispell Creek. Erosion control measures have been mandated as part of the mining permit, but compliance will have to be closely monitored.

Watershed Sediment Load Calculations - As developed in Section 4, the natural or background sediment load into Kalispell Creek has been estimated at 722 tons/year (assuming 100% delivery). When calculating current sediment load from forested acres, the total road network, stream crossing failures, road prism mass failures, and hay land, the estimated load of 1,070 tons/year is 48% above background, the lowest increase of the five watersheds calculated for sediment load in these categories (Table 4-1). Keeping the sediment yield at a relative low level for Kalispell Creek drainage was a moderate road density and stream crossing frequency, and minor occurrences of road failures based on USFS road maintenance experiences of the past 10 years (Janecek Cobb *pers comm*). When adding an instream bank erosion estimate of 225 tons/yr over 12 miles of gradual gradient main stem, the percent increase over background jumps to 84% (with no estimate of natural stream bank erosion).

3.3.B.4 Summary of Past and Present Pollution Control Efforts

See Section 2.4.2, page 60 for Forest Plan of the Idaho Panhandle National Forests.

3.3.B.5 Water Quality Concerns & Status

Refer to Table A-4 for the history of DEQ §305(b) and §303(d) listings for Kalispell Creek; Table 2-6 for designated and existing beneficial uses; and Table 2-12 for determined support status of designated and existing beneficial uses.

3.3.B.6 Summary and Analysis of Existing WQ Data

A daily hydrograph was established for Kalispell Creek for WY 94 and 95 from stream gauging and numerous flow measurements (Rothrock and Mosier 1997). Peak flow for WY 95 was from early April to early May at 130 - 150 cfs (Figure 3-16). Peak runoff was associated with maximum air temperatures between 60 - 75 °F and spring rains. A late winter peak of around 100 cfs occurred in March associated with initial warming and rains. Summer base flow is around 15 - 20 cfs. The annual volume of water delivered from Kalispell Creek in WY 95 was estimated at 27,460 ac-ft.

A total of 32 water quality sampling runs were conducted between 1993 - 1995, in addition to 15 ISCO samples taken during spring runoff of 1995. During peak flow there can be relatively high (for the lake basin) suspended sediment concentrations. Maximum TSS sampled was 65 mg/L (25 NTU turbidity) with an associated maximum total phosphorus of 120 *ug*/L. Mean TP for spring runoff was 35 *ug*/L, highest in the lake basin. In base flow conditions with low suspended material, TP is also relatively high for lake basin streams, averaging 17 *ug*/L. Total nitrogen is moderate, averaging 120 *ug*/L.

21 miles of road were surveyed. Overall sediment delivery was rated as "low", but 3 localities of Significant Management Problems were recorded along the upper Forest Road 308, and 1.5 miles of upper Road 308 received moderate CWE road sediment scores (Figure 3-15c).

Stream crossing density of the total road network is 0.8 crossings/mile of stream (43 total crossings), which is below average compared basin-wide. The majority of crossings are over perennial streams.

Based on the sediment load calculations presented in Section 4, the total road network including failures along the road prism, is estimated to increase sediment load over the natural forested land yield by 47% (assuming 100% delivery to streams).

Encroaching and Riparian Roads, and Instream Erosion - Forest Road 308 (Kalispell Creek Road) travels up the valley floor of the middle segment of Kalispell Creek, west of Hwy 57, and 3.3 miles of this road is within a 200 ft zone from the stream, and 0.9 miles is within the 50 ft encroaching zone (Figure 3-15c). Historically this was the rail route for salvage logging. Road 308 is a well traveled and maintained transportation road with a surface of compacted aggregate. Undoubtedly, there is sediment produced from the road surface, cut banks, and ditches delivered to the stream, but more importantly, the road constricts the stream and reduces the effective floodplain and riparian area of the reach. USFS is considering obliterating this road stretch and relocating it along a more northerly route (USFS 1998c). For the Kalispell Creek subwatershed, the length of total road network within a 200 ft zone of watershed streams equals 13.8 miles, or 0.3 mi/mi of stream, and density of active roads is 0.2 mi/mi of stream.

Sediment load calculations may take into account instream erosion related to the length of floodplain encroaching roads (within 50 ft of the stream), as the road can interfere with the stream's natural tendency to seek a steady state gradient (Harvey 2000a). During high discharge periods the stream may erode at the road bed or fill slope, or if the road is sufficiently armored, the confined stream energy may erode the stream banks and the stream bed. Using the calculation method presented in Section 4 from the Coeur d'Alene basin TMDL (Harvey 2000a), produces 165 tons/yr for the 0.9 mile stretch of encroaching Road 308 (erosion from two stream banks and the streambed).

The stream bank erosion survey conducted in 2000 (methods described in Section 4), assessed 1.1 miles of mid Kalispell Creek along Road 308, in which a portion of the assessment reach was adjacent to the 50 ft encroaching road segment. Of the total stream reach assessed, 14% of the length was found to have either one stream bank or both with evidence of a recent eroded condition. A statistical work-up of the survey data leading to an estimate of lateral recession (data analysis by the NRCS, Sampson *pers comm*), produced a moderate erosion rate of 18 tons/stream mile/yr for the 1.1 mile assessed.

A downstream, 1.7 mile segment of Kalispell Creek east of Hwy 57 was also assessed for bank erosion, and the length of eroding bank was 8% of the total reach assessed. Data analysis produced a stream bank erosion rate of 20 tons/stream mile/yr (a greater composite score of erosion rating factors than the upper segment).

It is uncertain how the estimates of current instream erosion relates in degree to factors such as incoming watershed sediment load, peak flows, hydrologic disequilibrium, riparian condition, or the historic stream bed load of sand deposits.

Canopy Cover and Peak Flows - The IDL - CWE assessment was unable to produce a canopy cover map and canopy removal index due to an incomplete set of available aerial photographs and ortho-photoquads. Current estimates by USFS is that 38% of the watershed is still not reforested.

Mass Wasting - The IDL - CWE inventory did not report any occurrences of mass failures. While mass failures have occurred in the watershed, their frequency rate appears very low.

cropping, but also a minor amount of cattle grazing. Private timber industry owns 370 acres total, the biggest block located west of Hazard Creek.

USFS manages 23,850 acres and much of this land is managed for timber production. But federal land also includes: non-forested brush fields and wet meadows; the Potholes Research Natural Area; a portion of the Priest Lake Recreation SMA near the mouth; and a Grizzly Bear Management Unit.

The Kalispell Creek watershed has had a significant disturbance history over the past 100 years. Besides the multiple major fires from 1890 - 1939, there was major salvage and green timber logging. Railroad lines were constructed up the main stem and its many tributaries, and chutes were built to transport logs down the stream. Large stretches of riparian area were encroached upon and conifers removed. Various levels of road building and harvesting has continued in the watershed.

3.3.B.3 Pollutant Source Inventory

Point Source Discharges
No point source discharges exist in the Kalispell Creek watershed.

Nonpoint Sediment Sources

Fire and Historical Timber Harvesting - The 1926 wildfire burned within the headwater lands of the southern and western streams (Figure 2-6). The fire did not completely consume conifers and downed woody debris within floodplains and over stream channels, thus there was material in place to help maintain channel stability and fish habitat (USFS 1998c). The Diamond Match timber company, aided by the CCC, followed the fire by salvage logging, and logging of unburnt white pine, spruce and hemlock. This post-1926 harvesting was done by building a narrow gage railroad, plus chutes, trestles, tow paths, and some roads. Some of the transportation structure was built in riparian zones and adjacent to streams. Also, there was logging within the riparian zones.

Another major fire occurred in 1939 throughout the upper one-third of the watershed as well as near the lake, reburning much of the 1926 fire area. The 1939 fire covered 9,300 acres (USFS 1998c). This was a heat intensive fire with most trees consumed along with downed woody debris, including trees and debris within riparian zones. After this fire another round of salvage logging began, along with construction of a road network.

Based on the degree of hydrologic openings created by fire and logging, the likely erosion and failures of cut and fill slopes upon which the railroad was built, and erosion from the early road network, there undoubtedly was a tremendous sediment yield to watershed streams, and the sediment load exceeded the streams capacity to transport it (USFS 1998c). Many of the low quality habitat parameters measured today, such as high width to depth ratios, and high percent fines and embeddedness, are thought to in part reflect this early to mid century history. Additionally, there was significant fire and human disturbance within the riparian zone which affected stream canopy closure, stream bank stability, and recruitment of woody debris to aid in channel stabilization and pool formation.

Current Timber Harvesting, Roads, and Stream Crossings - Since the 1950s about 19% of the Kalispell Creek drainage has been harvested (USFS 1998c). Data presented here from the GIS analysis of the road network is for the Kalispell Creek 6th order subwatershed (19,844 acres), excluding the Diamond Creek upper subwatershed. There are 93.4 miles of total roads (Figure 3-15c), for a moderate density of 3.0 mi/mi^2. This includes closed roads and spurs in which some are vegetatively stabilized, and it excludes documented obliterated roads. Active roads that are either open or have access controls total 59 miles, or 1.9 mi/mi^2, well below the basin-wide average. An IDL - CWE assessment was conducted in 1998, and major reaches that meet the above general description, but there are also B channels with decent pool quality and dense hemlock and cedar overstory. Beaver dams and pools are common throughout the stream.

Overall, the headwaters of Kalispell Creek and tributaries to the main stem offer better rearing and spawning habitat, in part because of a higher percentage of B channel type with fewer sand depositional zones, a greater percentage of pools formed by large woody debris, and more abundant gravels and cobbles (USFS 1998c). Still, much of this spawning habitat was found to be highly embedded (USFS 1998c).

There has been a history of large stand replacing fires in the Kalispell drainage over the past 100 years or so. An 1890 fire burnt the western and northern mountains, as well as the eastern lands near the lake (Figure 2-6). Another major fire occurred in 1926, and then a subsequent reburn in 1939. Following the fires and salvage logging, a large area of approximately 9,000 acres was planted with ponderosa pine and white pine, with also some Douglas-fir and spruce. The ponderosa pine seedlings were from a seed source not suited to the area, and the white pine seedlings were not from blister rust-resistant stock. These plantations have suffered high mortality due to insects and diseases, and the USFS is proposing a major timber rehabilitation/watershed restoration project in the drainage (USFS 1998c).

Several electro-fishing efforts by USFS have been conducted in Kalispell Creek since 1990, along with DEQ electro-fishing in 2000. In upper reaches of the main stem and within tributaries, there are brook trout, cutthroat trout, and sculpin, with brook trout dominating the numbers. In mid to lower reaches of the main stem only brook trout and sculpin were sampled by USFS, but DEQ electro-fishing did capture two cutthroats in a middle main stem reach. Historically, cutthroat trout displayed two life histories in the Kalispell drainage, adfluvial below fish barriers, and resident above barriers (USFS 1998c). Bull trout once inhabited Kalispell Creek, but the last reported observation of a bull trout was in 1984 (USFS 1998c). In the Priest Lake Bull Trout Assessment, Kalispell Creek is considered as supporting sub-adult and adult rearing and is considered of high importance to bull trout (Panhandle Basin Bull Trout TAT 1998a).

In a 1956 Priest Lake basin fish survey (Bjornn 1957), a significant proportion of the stream beds west of Hwy 57 were reported to have high amounts of sand covering the spawning beds, and this was in part attributed to the 1926 and 1939 fires. The 3 mile reach beginning at the mouth was found to have several sections of suitable gravel and cobble beds to support spawning, and numerous small cutthroat trout (up to 9 inches) were found in this stretch, as well as a few adfluvial spawners. A few bull trout were also reported.

At the public meeting for the draft SBA and TMDL (January 31, 2001), a long-time resident of the Kalispell Creek area gave an account of IDFG Rotenone treatments conducted in the 1950s and 1960s. This would have been done to eliminate brook trout. According to IDFG file memorandums, a Rotenone treatment within the main stem was conducted in August 1960, and IDFG subsequently planted 135,000 cutthroat fry (Fredericks *pers comm*). Another citizen's account was given of USFS chemical treatments on vegetation (Silvisar) along stream courses in the 1970s. There was speculation that the chemical might have leeched into streams leading to fish toxicity. These public comments were given as factors that might partially relate to the current low salmonid densities within Kalispell Creek.

3.3.B.2 Cultural Characteristics

Kalispell Creek watershed is a mixture of federal lands and private ownership (Figure 3-15b). Private lands total 1,360 acres (5.3% of the watershed), and private land uses include: residential areas surrounding the mouth, and increasingly, home lots developed along the stream corridor west of Hwy 57; Non-industrial Private Forest timber harvesting which includes conversion of forested land to commercial and residential properties; and a 200 acre agriculture zone within Bismark Meadows for primarily hay

Figure 3-15c. Roads in the Kalispell Creek watershed.

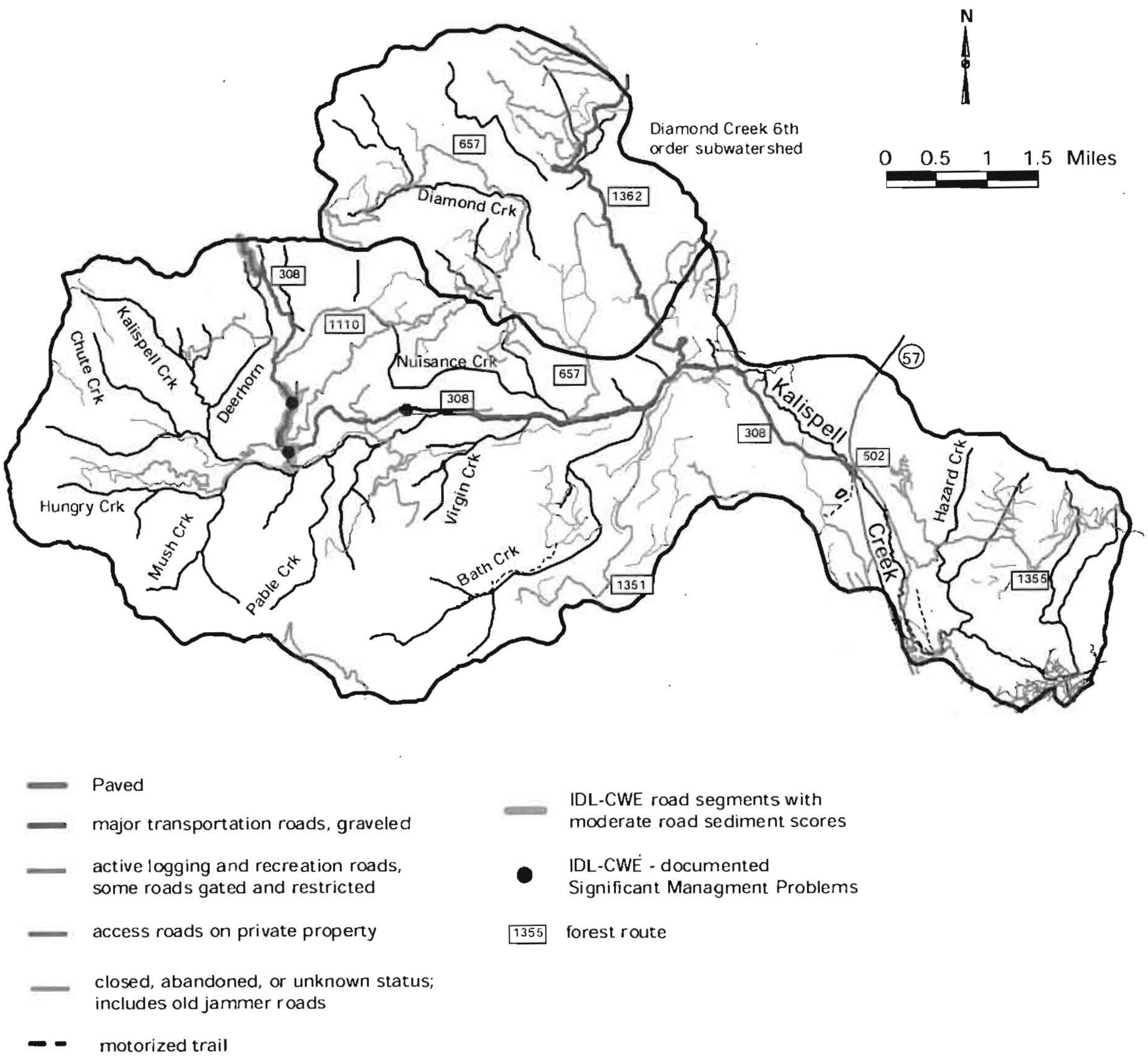


Figure 3-15a. Kalispell Creek Watershed: streams, BURP sites, and gradients.

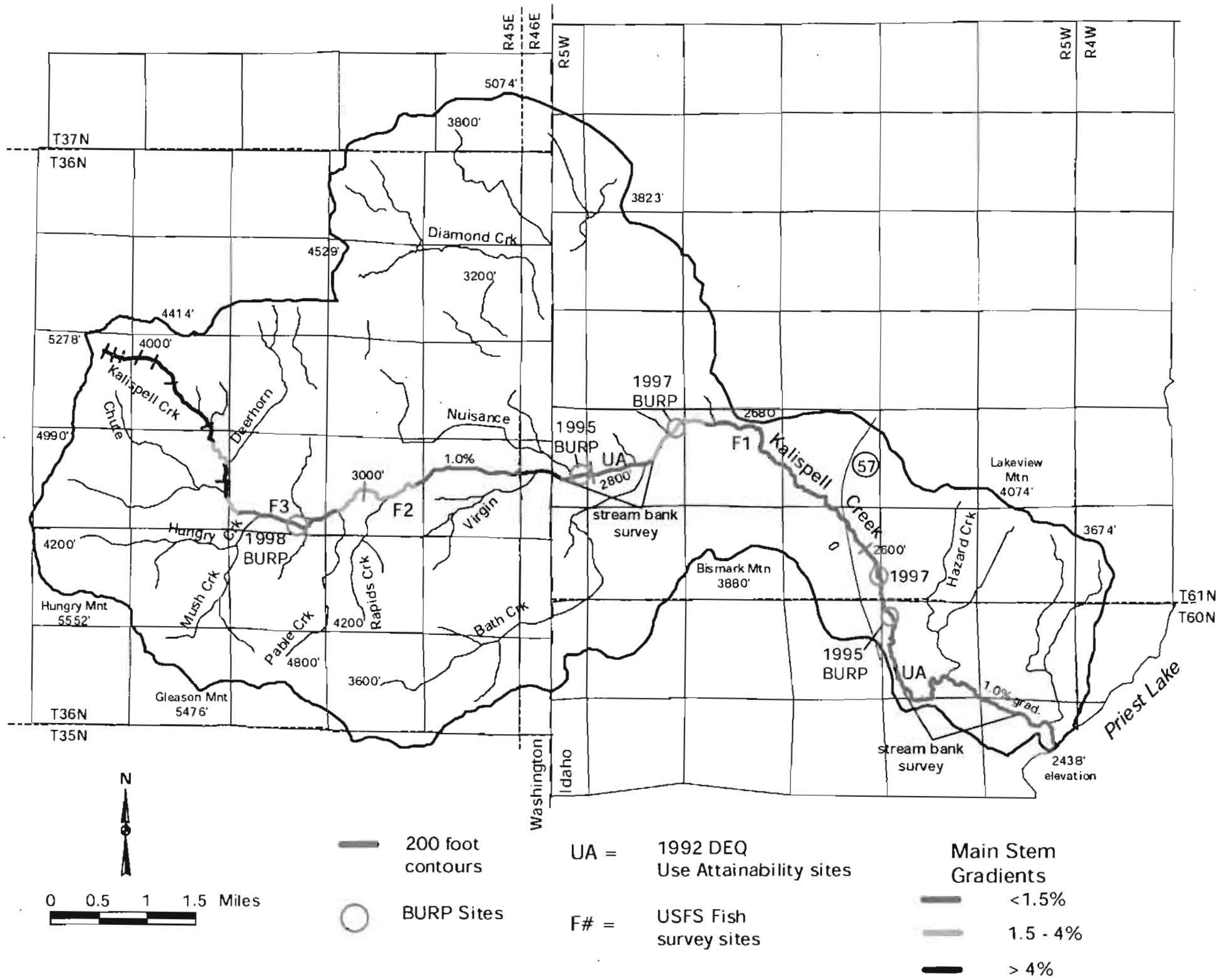
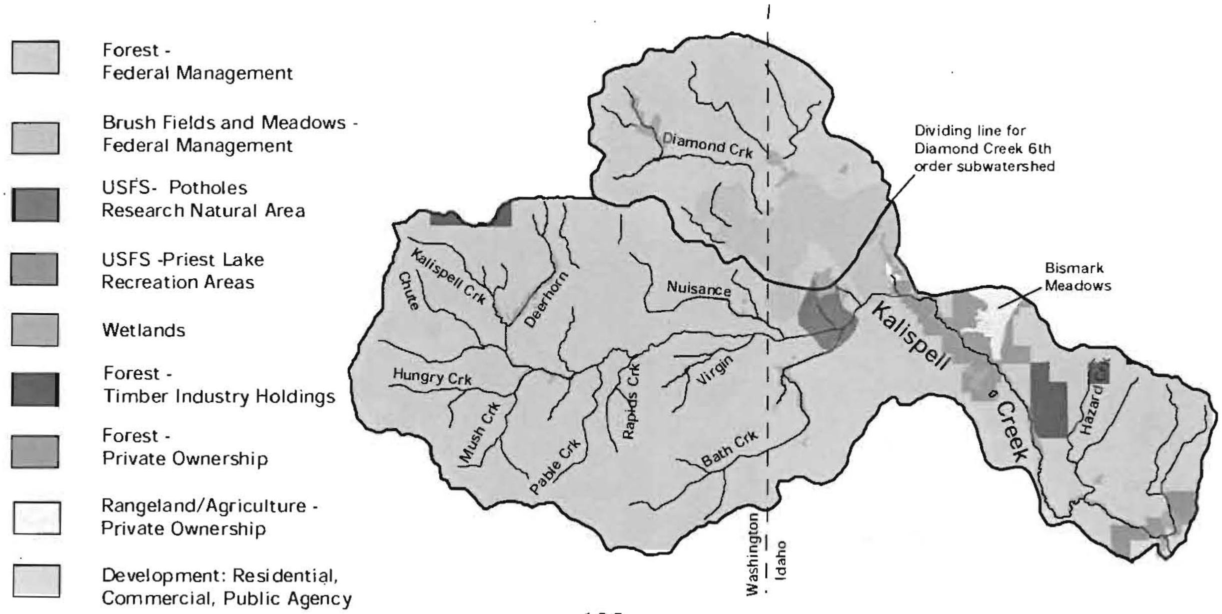


Figure 3-15b. General land use and ownership in the Kalispell Creek watershed.



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3.3.B.1 Physical and Biological Characteristics

Kalispell Creek is a 4th order tributary on the west side of Priest Lake (Figure 2-2), flowing east from the headwaters and then southeast to the lake. Main stem length is 14.6 miles and watershed size is 25,210 acres (Table 2-2). There are approximately 64 miles of perennial streams.

For descriptive purposes the watershed is divided into 3 sections. East of Highway 57 the low gradient channel meanders 4.4 miles south then southeast to the lake (Figure 3-15a). This lower stream course has floodplains with riparian vegetation a mixture of alders, other shrubs, and sometimes a dense conifer overstory. Mountains to the north create tributary streams to Kalispell Creek, including Hazard Creek. Elevation reaches 4,057 at Lakeview Mountain.

The middle main stem section is between the confluence of Hungry Creek downstream to Hwy 57. Kalispell Creek in this segment is mostly low gradient C channel, but there are two lengthy B channel sections, 1.5 - 3.5% gradient. Mountains to the south produce several perennial tributaries (Pable, Rapids, Virgin, and Bath Creeks), and Nuisance Creek flows from the north. Elevation reaches 5,476 at Gleason Mountain. From a sediment management standpoint for Kalispell Creek, the subwatershed section to the north needs to be considered. The mountains and streams in the surrounding area of Diamond Creek, north of Nuisance Creek (Figure 3-15a), are mostly disconnected (surface water) from Kalispell Creek's main stem. They either go subsurface or flow into the Potholes Research Natural Area. There are two small streams flowing from the Potholes wetlands to Kalispell Creek, but it is believed that the majority of surface runoff and sediment produced from this northern subwatershed is not delivered to Kalispell Creek. An approximate dividing line (Figure 3-15b) gives an upper subwatershed size of 5,366 acres, and the size of the Kalispell Creek drainage reduces to 19,844 acres.

The third watershed section is the headwaters of Kalispell Creek, with 2.5 miles of B and A channel, and tributaries flowing in from the western mountains (Mush, Hungry, Chute and Deerhorn Creeks). Elevation reaches 5,552 ft at Hungry Mountain.

Average annual precipitation increases from 32 inches at the mouth to approximately 40 inches at high elevations. Precipitation is about 25 - 50% snow with a snowmelt dominated runoff pattern. Peak flow is during the period of mid-March through early May (Figure 3-16). Rain-on-snow events in mid to late winter produce only minor hydrograph spikes.

Higher elevation lands surrounding the watershed are granitic batholith, and valley hillslopes and stream bottom lands are glacial outwash, till and alluvial deposits (Figure 2-4 and Figure 4-2). There are some areas of belt rock along the northern slopes. The upper half of the drainage was glaciated, the lower half was unglaciated (USFS 1998a). The general soil map of west side Priest Lake basin only extends to the Idaho - Washington line (Figure 2-5). Lower bottom lands are Bonner soil, and granitic mountainsides are Hun - Jeru soils (Table 2-3). Valley terraces and hillslopes of glacial till are likely Priestlake-Treble soils. The IDL - CWE rating of overall surface erosion hazard is high, and the mass failure hazard rating is moderate.

The lower-most reach of Kalispell Creek east of Hwy 57 is described by the USFS as primarily C channel type with habitat composed of pools, runs and glides (USFS 1998c). The overall habitat quality is considered low - marginal because of the lack of adequate cover, habitat complexity, and depth to support large numbers of fish. Major sections have thick sandy bottoms. Alder/shrub bottoms are a very common riparian type, along with associated beaver influenced areas. There are some sections of conifer forest immediately adjacent to the stream. Recruitment of large woody debris is low, in part because of historic fire and timber removal. There are sections of riffles, glides and pool tailouts with gravel and cobble suitable for spawning, but percent fines and cobble embeddedness is high. West of Hwy 57 there are

3.3 §303(d) Listed Streams Evaluated as Impaired for Cold Water Biota Beneficial Use, and Recommended for Sediment TMDL Development

B. Kalispell Creek

Summary

Kalispell Creek was added to the 1996 §303(d) list as a result of Idaho Panhandle National Forest analysis. The listed pollutant is sediment. Kalispell Creek was retained on the 1998 §303(d) List (DEQ 1999).

Kalispell Creek has been assessed by 5 BURP sites. MBI results at a lower and middle site in 1995 resulted in Needs Verification for cold water biota beneficial use. MBI results at nearby lower and middle sites in 1997 produced Full Support, and an upper site in 1998 was FS. There have been numerous fish surveys throughout the Kalispell drainage in the last eight years, and while there are resident populations of cutthroat trout primarily in headwater reaches, densities are low, and very few cutthroats have been captured within the main stem. Brook trout are the dominant salmonid species, but even their population numbers appear low in relation to other comparable streams. BURP, DEQ Use Attainability, and USFS stream surveys show mostly poor to medium habitat values. Also, USFS rates the watershed system overall as a Not Properly Functioning Condition (USFS 1999).

The conclusion of this SBA is that the fish sampling data suggests an impaired salmonid fishery, or Not Full Support of the cold water biota beneficial use. USFS attributes an impaired fishery, in part, to a stream bedload of sand that exceeds the stream's capacity to transport it, with a result of filling in of pools and covering of spawning gravels, and also other habitat features such as sparse instream cover and insufficient recruitment of large woody debris which form pools (USFS 2000c). There is also the factor of significantly suppressed adfluvial cutthroat populations within Priest Lake that historically spawned in Kalispell Creek, and the competition factor of the introduced brook trout over the native cutthroat.

In the USFS comment package to the draft Subbasin Assessment (July 2000), USFS stated that there has been extensive surveys of the streams, road networks and timbered units, and with a few exceptions, identified sediment sources have been addressed (USFS 2000b). The DEQ sediment calculations presented in Section 4 and summarized in this section seem to show that the current sediment load from the road network is relatively low. One road impact is Forest Road 308 which for about 4 miles parallels closely Kalispell Creek within its floodplain. A large scale proposed project, detailed in an upcoming Kalispell timber regeneration/watershed restoration draft EIS, includes a plan to relocate this road to higher ground and restore riparian characteristics along this channel stretch (USFS 2000b).

The conclusion of the USFS watershed assessment is that the current habitat conditions seem largely a reflection of historic fire and legacy land use rather than recent sediment loading, and to some degree a reflection of the predominant granitic geology. Large stand replacing fires in the late 1800s and early to mid 1900s, intermixed with salvage logging and green timber logging, with related construction of a transportation network, clearly led to a historically high sediment delivery and water yield.

The draft SBA and TMDL (December 2000), agreed with the USFS in that the current level of watershed sediment load to Kalispell Creek has not likely impaired cold water biota beneficial use below Full Support, or prohibits recovery to Full Support. Kalispell Creek was thus proposed for §303(d) de-listing with sediment as the listed pollutant of concern. However, the Priest Lake Watershed Advisory Group (WAG) in their consideration of the draft SBA and TMDL, recommended that the current status call of Not Full Support for cold water biota warrants that Kalispell Creek not be de-listed, and that a sediment TMDL be prepared. This is the same conclusion and recommendation stated in the EPA comment package (EPA 2001). This final SBA and TMDL adopts the recommendation of the WAG and EPA and presents a TMDL for Kalispell Creek in Section 4.

Table 2-8. Available Data Sources for §303(d) Listed Streams in the Priest River Basin

Period of Record	Sampling and Monitoring Programs	Trapper Creek	Two Mouth Creek	East River			Tango Creek	Reeder Creek	Kalispell Creek	Lamb Creek	Binarch Creek	Lower WB Priest River	Lower Priest River
				Main Stem	Middle Fork	North Fork							
1994-2000	DEQ BURP: habitat and macroinvertebrates	2 sites	2 sites	1 site	3 sites	2 sites	1 site	3 sites	5 sites	4 sites	3 sites	4 sites	1 site
1994-2000	DEQ BURP: electro-fishing		Y		Y	Y		Y	Y	Y	Y	Y	
1986-1999	IDFG, USFS, IDL,USGS snorkel or electro-fishing	Y	Y	Y	Y	Y	Y		Y	Y	Y	Y	Y
1997-2000	DEQ, IDL temperature monitoring (HOBO®)	Y	Y	Y	Y	Y			Y		Y	Y	
1990-1999	DEQ, USGS fecal coliform sampling		Y					Y	Y	Y		Y	Y
1997-1998	USFS R1/R4 fish habitat inventory									Y			
1990-1999	USFS Priest Lake Ranger District: field surveys, notes and measurements.						Y	Y	Y	Y	Y	Y	
1993-1995	DEQ Priest Lake study: water column chemistry, physical measurements, water flow	Occass. samples, measur., & flow	Routine samples, measur., & flow				Occass. samples, measur., & flow	Routine samples, measur., & flow	Routine samples, measur., & flow	Routine samples, measur., & flow			
1991-1994	DEQ Stream Segment of Concern assessments:	Y	Y										
1992	DEQ Use Attainability assessments: habitat	Y	Y	Y	Y			Y	Y	Y	Y	Y	
1995-2000	IDL Cumulative Watershed Effects assessments: habitat	Y	Y	Y	Y	Y		Y	Y	Y	Y	Y	
1990-1998	USGS flow and water column chemistry												Y
2000	Stream bank erosion survey: KSSCD			Y	Y				Y	Y		Y	Y

Table 2-6. **Designated and Existing Beneficial Uses for §303(d) Listed Streams in the Priest River Basin**

	Aquatic Life		Water Supply			Recreation			
Stream Name	**Cold Water Biota**	**Salmonid Spawning**	**Dom.**	**Agri.**	**Ind.**	**Pri-mary**	**Sec-ondary**	**Wildlife Habitats**	**Aesthet-ics**
Trapper Creek	D*	E		D^	D^	D*		D^	D^
Two Mouth Creek	D*	E		D^	D^	D*		D^	D^
East River									
Mainstem	D*	E	E	D^	D^	D*		D^	D^
Middle Fork	D*	E	E	D^	D^	D*		D^	D^
North Fork	D*	E	E	D^	D^	D*		D^	D^
Tango Creek	D*	E		D^	D^		D*	D^	D^
Reeder Creek	D*	E		D^	D^	D*		D^	D^
Kalispell Creek	D*	E	E	D^	D^	D*		D^	D^
Lamb Creek	D*	E	E	D^	D^	D*		D^	D^
Binarch Creek	D*	E		D^	D^		D*	D^	D^
Lower West Branch Priest River	D*	E	E	D^	D^	D*		D^	D^
Lower Priest River	D	E	D	D^	D^	D		D^	D^

D = "Designated" in 58.01.02.110.06 of Idaho Water Quality Standards and Wastewater Treatment Requirements.
D* = "Default Designation" of Undesignated Surface Waters as established through 58.01.02.101 of Standards.
D^ = Designation applies to all surface waters of the state.
E = "Existing use" identified as result of Beneficial Use Reconnaissance Project monitoring or observation.

following designated beneficial uses: domestic water supply, cold water biota, primary and secondary contact recreation, and as a special resource water. The remaining §303(d) listed streams do not have specific beneficial use designations in IDAPA 58.01.02.110. These water bodies are assigned interim designations of cold water biota and primary contact recreation or secondary contact recreation (IDAPA 58.01.02.101.01). For non-designated uses of a particular water body, an "existing use" such as salmonid spawning may be assigned based on the results of the DEQ - BURP monitoring, or other documented data and observations. Existing beneficial uses are those uses that existed on or after November 28, 1975, the effective date of the CWA. Designated and existing uses for Priest River basin §303(d) listed streams are presented in Table 2-6.

2.2.2.2 Criteria for Protecting Beneficial Uses

Beneficial uses are protected by a set of criteria, which include *narrative* criteria for sediment and nutrients, and *numeric* criteria for toxic substances, fecal coliform bacteria, dissolved oxygen, pH, chlorine, dissolved gas, ammonia, temperature and turbidity (IDAPA 58.01.02.250). Numeric criteria for those water quality parameters that would be applicable (potential violation of Standards) in the Priest River basin are listed in Table 2-7. The current version of the Standards, adopted April 5, 2000, contain upon. The IWRB and Avista are working on agreements to alter the autumn operating scheme to produce more gradual river flows during the annual lake drawdown of 3 feet.

Water appropriations are primarily nonconsumptive with water rights for recreation, aesthetics, fish and wildlife held by the State of Idaho. Appropriated consumptive uses of basin waters is small, approximately 20,000 ac-ft annually mainly for irrigation and domestic water supplies. No hydropower projects are located within the Priest River basin.

2.1.2.3 Regional History and Population

Accounts of the history, cultural resources, and archaeology of the Priest River area, along with published resource material, are presented by Bonner County (1989), Hudson (1983), IDPR (1988), IWRB (1995), and Rothrock and Mosier (1997).

Pertinent to the origins of timber land use in the basin was the Northern Pacific Railroad, which in the 1880s linked northern Idaho to the rest of the nation. Rail transportation provided access to markets that needed forest products. Government and industry surveys had recorded the abundance of large stands of timber in the Priest River basin. Midwestern lumber companies, such as Weyerhauser and Humbird, purchased land and began logging operations. The first large scale logging was conducted in the Lower West Branch watershed with selective harvesting of large and valuable trees (USFS 1999). In the Priest Lake area, railroad spurs, flumes and splash dams were built to move logs down major tributaries. Logs were transported across the lake to the outlet, and floated down Lower Priest River to mills at Priest River. These log drives continued until 1950 when the initial Priest Lake Outlet Dam was constructed.

National concern over conservation of natural resources led to the Forest Reserve Act of 1891, under which the Priest River Forest Reserve was established, in 1897. The Forest Homestead Act of 1906 provided for settlement of lands, primarily associated with agriculture, resulting in many privately owned tracts within the Forest Reserve. The Forest Reserve subsequently evolved into the Kaniksu National Forest, and later was combined with other forests to become the Idaho Panhandle National Forests. Excluded from federal ownership was the area east of Lower Priest River and Priest Lake which became Idaho state lands through indemnity land selection.

Estimated population of the Priest River basin for 1994 was 4,400 people (IWRB 1995). In 1994 the city of Priest River had a residential population of 1,680 (IWRB 1995). Population fluctuates widely within the Priest Lake basin, and this reflects the recreation based nature of the area. In 1994 the Bonner County Assessor's Office reported 1,707 single family residences in the Priest Lake area, about 72% of these on privately owned property (Bonner County Assessor's Recap, Priest Lake Area). Approximately 15% of these residences have year-round occupancy. During peak season (mid-summer), second homes and cabins become occupied by families. The average, weekend peak season resident population for Priest Lake (excluding resort lodging) was estimated by Bonner County at 4,945 persons.

2.1.2.4 Area Industry

Timber harvesting and lumber mill processing has long been and remains the most important industry in the Priest River basin. Over eighty-five percent of the basin's land is publicly owned, and these lands are managed primarily for sustained yield timber production in mostly second-growth stands. Exclusions from the timber base include Special Management Areas (SMA) such as the Upper Priest Lake Scenic Area and the Selkirk Crest SMA. Timber harvesting also occurs on private holdings.

The bulk of state owned property is considered commercial forest land and administered by IDL. These state lands are managed under the Idaho Constitution as endowment land where revenues generated from

Table 2-5. Ownership in §303(d) Watersheds of the Priest River Basin

	Ownership Categories in Acres, Percentages in Parenthesis						
	Federal		Private		Idaho	Open	
Stream	Idaho	Wash.	Idaho	Wash.	State	Water	Total
Trapper Creek	273 (2)	--	0	--	12,039 (98)	0	12,292
Two Mouth Creek	821 (5)	--	573 (4)	--	14,136 (91)	34 (0.2)	15,565
East River	3,552 (8)	--	1,975 (5)	--	37,637 (87)	0	43,163
Tango Creek	2,003 (100)	--	0	--	--	0	2,003
Reeder Creek	5,986 (72)	52 (0.6)	2,253 (27)	0	--	0	8,291
Kalispell Creek	8,670 (34)	15,179 (60)	1,286 (5)	74 (0.3)	--	3	25,210
Lamb Creek	10,470 (67)	2,850 (18)	2,199 (14)	98 (0.6)	--	0	15,616
Binarch Creek	6,517 (90)	715 (10)	0	0	--	0	7,232
Lower West Branch Priest River	24,473 (43)	18,270 (32)	11,233 (20)	2,132 (4)	727 (1)	0	56,835
Lower Priest River	62,301 (28)	48,637 (22)	38,041 (17)	2,296 (1)	67,885 (31)	820 (0.4)	219,980

Two Mouth Creek, Indian Creek, and the upper two-thirds of Lower Priest River are designated as State Recreational Rivers to preserve and protect fish and wildlife habitat, but with stream bed alterations allowed for maintenance and construction of bridges and culverts. In addition there are streams under the Northwest Power Planning Council Protected River Program for resident fish and wildlife, and these include the §303(d) listed streams, Tango Creek, Kalispell Creek, North and Middle Forks East River, and Moores Creek a tributary to Lower West Branch.

In 1951 the State of Idaho completed construction of the outlet structure at the mouth of Priest Lake, and the dam was reconstructed in 1978. A primary purpose for the dam was to stabilize summer lake levels for recreation use. Avista Utilities (formerly Washington Water Power Company) operates and maintains the outlet structure. Prior to completion of the dam, Lower Priest River summer flows were approximately 200 cfs greater than they are today (IWRB 1995). IDFG has listed a minimum recommended rearing flow for adult and juvenile cutthroat trout and adult rainbow trout in the river as 200 cfs from August 1 to October 31, with an optimum rearing flow of 400 cfs (IWRB 1995). Flows at the upper USGS gage site commonly fall well below 200 cfs during August and September. The IWRB has investigated spring - summer alternative operations of the outlet structure to enhance Lower Priest River flow, and conducted public hearings on this issue in 1995. But to date no changes in operation have been agreed

The majority of the basin's eastern side is owned by the State of Idaho with the northern boundary incorporating the Trapper Creek watershed. Most of this land is administered by the Idaho Department of Lands under the State Endowment Trust. Through the years, various property exchange agreements have transferred a substantial acreage of private industrial timber lands to the state, as well as to the National Forest. State land is primarily managed for timber production, but some state land is leased for lake cottages, and there are some state grazing allotments. The Idaho Department of Parks and Recreation manages a portion of state land as the Priest Lake State Park.

Private lands comprise about 9% of the basin. Around the Priest Lake shoreline 25% of the property is privately owned (Bonner County 1989), and it is there that the most concentrated residential and business development has occurred in the lake basin. The major private ownership block and residential center is the area surrounding the city of Priest River and the lower half of Priest River. In the land use map (Figure 2-8) substantial private acreage along Lower Priest River and Lower West Branch have been classified as agricultural. In these zones there has been a degree of land clearing followed by hay cropping and cattle grazing. Other private lands have been classified as timber, or Non-industrial Private Forest (NIPF). Land activities on NIPF have importance in regards to sediment yield to streams because results of forest audits have shown that NIPF land-owners generally have more departures from BMPs than found in other ownerships (IDL *et al.* 1993). The three categories of private ownership: residential, agricultural, and timber (excluding industrial timber), are meant only as general and approximate acreages and boundaries. Timber harvesting followed by road building and residential lot development occur throughout private lands; there are non-industrial forest practices on agricultural lands; and there are small grazing acreages with horses, cattle, sheep and llamas in rural-residential and forest lands.

There are also blocks of private industrial timber lands. These lands are owned by Burlington Northern Inc. Timber, DAW Forest Products, Crown Pacific, and Stimson Lumber Company.

Land ownership within watersheds of the §303(d) listed streams is presented in Table 2-5. Ownership acreage has been separated out between Idaho and Washington. The upper watershed portions of listed Kalispell Creek, Lamb Creek, Binarch Creek, and Lower West Branch, as well as non-listed Upper West Branch which is a major tributary to the listed Lower Priest River, and also the non-listed Granite Creek and Hughes Fork, reside in the state of Washington. The 1998 §303(d) List revised the boundaries of the first three streams above, listing them as segments beginning at the Washington line (IDEQ 1999). However, for effective reduction in sediment load when stipulated by a TMDL, land use and acreage in Washington must be considered. For the most part this should not be a jurisdictional problem for the State of Idaho because management of federal lands comes from the Priest Lake Ranger District. But jurisdiction is a problem on private lands engaged in timber production and agriculture in Washington.

Special Management Areas and Research Natural Areas (RNA) in the Priest River basin highlight unique resources (IWRB 1995). These include: Upper Priest Lake Scenic Area, Salmo-Priest Wilderness Area, Priest Lake Recreation Area on the western shoreline, the Selkirk Crest Special Management Area, Priest River Experimental Forest, Binarch RNA, and Potholes RNA. Upper Priest River is currently being proposed for Wild River designation under the national Wild and Scenic Rivers Act.

2.1.2.2 Protected River Designations, Minimum Stream Flow, Appropriated Water Use

There are state protected streams, as designated with legislative authority by the Idaho Water Resources Board (IWRB 1995). Upper Priest River, Upper Priest Lake, and The Thorofare are designated as State Natural Rivers with major restrictions on instream alterations to preserve their scenic and recreational values, and to protect fish and wildlife habitat. Hughes Fork, Granite Creek, Trapper Creek, Lion Creek, quality pools. IDFG believes that the presence of brook trout, with few or no cutthroat or bull trout present in a stream where they were historically present, is possibly an indication that water quality has declined (IDFG, 2001). Brook trout may also have a reproductive advantage over bull trout because they mature earlier, and hybridization of the two species can occur and may be a detriment to isolated bull trout populations (Panhandle Bull Trout TAT 1998a).

The expansion of lake trout in Priest Lake and also recently in Upper Priest Lake is believed to have suppressed bull trout and cutthroat throat populations due to predation on juvenile adfluvial fish (Panhandle Bull Trout TAT 1998a). The Priest Lake outlet dam built in 1950 also prevented migration upstream from Lower Priest River into the lake, but the reconstructed dam (1978) has radial gates opening from the bottom.

Prior to the federal listing of bull trout, a Bull Trout Conservation Plan was introduced by the office of Idaho Governor Philip Batt (State of Idaho 1996). The majority of the Priest Lake basin was identified as a key bull trout watershed, recommended for habitat protection and restoration. A bull trout Problem Assessment, and Conservation Plan have been completed for the Lake Pend Oreille key watershed (Panhandle Bull Trout TAT 1998b, and Lake Pend Oreille Bull Trout WAG 1999). These plans will be used as templates for development of assessments and conservation plans for Priest Lake. Plans for Priest Lake will not, however, be prepared prior to completion of this SBA and TMDL. Bull trout plans may be incorporated into the implementation phase of applicable TMDLs.

2.1.1.6 Stream Characteristics

Streams of the northern and eastern portion of the basin (starting north at Hughes Fork and Upper Priest River and moving down the east side to East River, Figure 2-2), have a high percentage of their stream length in B and A channel types, with long segments of moderate to steep gradients, 4 - 15% and steeper. Tributary streams are characterized by steep, highly confined, bedrock, boulder, 1st and 2nd order streams that combine into the main stem. Streams have falls and cascading rapids, and interspersed gravel-riffle, sand-silt, and boulder-bedrock bottom types. Conifer shade is plentiful except in areas where logging prior to the Idaho Forest Practice Act (FPA), adopted in 1974, eliminated large cedar and hemlock down to the stream bank. Log jams in the streams are common in these stretches. Within lower segments of the main stem streams, there are moderate gradient B channels (1.5 - 4%); and gradual gradient (<1.5%) segments that are either confined F channel or unconfined C channel types. Some segments have abundant gravel and cobble in riffles, runs and pool tailouts. In depositional zones there are also segments of thick granitic sand. In lower stream sections there are areas of floodplain development. Road construction up the stream valleys has in places restricted the effective function of the floodplains. There are several large areas of wetlands-wet meadows, such as Hughes Meadows.

On the western side of the basin, Granite Creek represents a transition from northern and eastern stream types to west and southwest types. Granite Creek is the single largest watershed in the basin at 64,024 acres, and spring high flow near the mouth typically nears 1,000 cfs. The extensive tributary system of the north and south forks are similar to northern streams in gradient, conifer cover and stream bed composition, except that mountain ridges are lower in elevation than the Selkirks. Logging activity and road density is greater in the Granite Creek watershed compared to drainages to the north.

Beginning at Reeder Creek and moving south down to Lower West Branch, these west side streams are significantly different in character than northern and eastern streams. These streams, flowing east, have a long, low profile with little increase in elevation between the mouth and headwaters. The U-shaped valleys are representative of the effects of continental glaciation (USFS 1989). From 50 - 80% of the main stem lengths are low gradient, less than 1.5%, and often less than 0.5%. Channel type can be confined F or G, unconfined C or E channel, or unconfined braided D channel. Considerable floodplain development

Early century logging patterns often related to the fire history, and in burned areas, logging practices may have hindered natural stream recovery after fire (USFS 1999). In burned watersheds there was mostly salvage logging operations, and this included the taking of burnt and toppled riparian conifers. Left in place, these riparian trees would have started the process of stabilizing stream channels by creating log steps, trapping bedload sediments and forming channel bars (USFS 1999). In watersheds not experiencing large fires between 1880 -1939, such as Lower West Branch, there was extensive early century logging where the target was large and valuable species such as white pine.

While there has been effective fire suppression in modern times, there were two large fires in 1967 which burned out of control: one in the Trapper Peak area northeast of Upper Priest Lake, and also the Sundance Mountain fire, east of Coolin (Figure 2-6).

2.1.1.5 Fisheries

Historically, four native salmonids have been reported in the Priest River basin: westslope cutthroat trout, bull trout, mountain whitefish, and pygmy whitefish. Other native fishes are northern pike minnow (*Ptychocheilus oregonensis*, formerly squawfish), largescale sucker, longnose sucker, slimy sculpin, shorthead sculpin, longnose dace, speckled dace, peamouth chub, and redside shiner (USFS 1999). Introduced species include brook trout, rainbow trout, brown trout, and in 1925 lake trout (mackinaw) were planted in Priest Lake. Kokanee salmon were introduced to the lake during the 1940s, and became an extremely popular fishery. But, for various postulated reasons including the introduction of mysis shrimp in the 1960s, the kokanee population declined in the 1970s and now there are only remnant populations in Priest Lake and Upper Priest Lake. Priest Lake also has largemouth bass and yellow perch. The fishery in Blue Lake (southeastern section of the basin) includes pumpkinseed, brown bullhead and channel catfish.

In 1998 the USF&WS listed bull trout (*Salvelinus confluentus*, a distinct species of char), as threatened under the federal Endangered Species Act (1973). The westslope cutthroat trout is considered a Species of Special Concern by the State of Idaho, and as a "sensitive species" by Region 1 of the USFS. Cutthroat trout can be found in most tributaries in the basin, but the current range of bull trout is limited, primarily found in streams of the northern one-third of the basin and Upper Priest Lake. Both species have stream resident populations, and migratory populations that are adfluvial (residing in Upper and Lower Priest Lakes), or fluvial (Lower Priest River). By historic accounts both species in all three life history strategies (resident, adfluvial, fluvial) were abundant in the basin system (Bjornn 1957), but now geographic range and population numbers are diminished. Cutthroat trout are mainly found as resident populations in headwater streams, although there is still a reasonably robust adfluvial population in Upper Priest Lake (Corsi *pers comm*). There is a diminished or depressed adfluvial cutthroat population in Priest Lake, and a diminished fluvial population in Lower Priest River.

The Idaho Department of Fish and Game has established several protective limitations: bull trout must be released if caught in any waters; tributaries to Upper Priest Lake and The Thorofare had been closed to fishing since 1945, but in 2000 regulations were changed to allow catch-and-release fishing; Upper Priest Lake is catch-and-release only; and there are restrictions on cutthroat trout fishing in tributaries to Lower Priest Lake. Tributaries to Lower Priest River are under general fishing regulations.

The decline in bull trout and cutthroat populations has been attributed to several factors. Both species have preferred instream habitat conditions of: cold and clear water; riffles, runs and pool tailouts with gravel beds of low percent fines for spawning; and deep pools with complex cover for feeding, resting and over-wintering. In many basin watersheds, a century of land use has led to some degradation of stream habitat. There also is the food and space competition factor of introduced brook trout which are now abundant in basin streams. Brook trout have less stringent environmental requirements than the native trout and do sufficiently well within the low gradient, depositional stream segments with sandy-silty bottoms and low expose the batholith. The batholith intrusion caused regional tectonic swelling which formed the Selkirk Mountains to the east of Priest Lake (Harvey 1994). Batholith is the predominant bedrock of the eastern side of Priest River basin, extending north to the Trapper Creek watershed. Areas of granitic formations are also found on the west side. Granitics weather to very fine gravel and sand sized particles (1 - 8 mm).

Periods of glaciation and ice retreats left extensive surface deposits overlying bedrock in the basin (Figure 2-4), and had great influence on soil development. These deposits include mixes of boulders, gravels, sands, silts, and clays. Soil origin groups from ice are: glacial till soils on foot slopes and mountainsides formed from unconsolidated material deposited by glacial ice; and glacial outwash soils in lowlands deposited by ice meltwater in layers of clay, sand and gravel. Other soil origin groups are: alluvial soils formed from deposits along stream banks and in alluvial fans; lacustrine deposits of fine clay, silt, and sand, associated with glacial lakebeds; and organic soils derived predominantly from herbaceous plants. The geologies of the lower Priest River drainage are more weathered than those in the Priest Lake basin because the lower basin did not experience the ice flows of the last glaciation (USFS 1999).

A Bonner County soil survey conducted by the Soil Conservation Service (USDA-SCS 1982) provides detailed soil mapping (1:24,000 map scale) for the east side of the basin, on State and private land, from Trapper Creek down to the city of Priest River. Detailed SCS soil mapping does not exist for the west side of the basin on federally owned and private land. There is also a SCS General Soil Map (1:380,160 scale) constructed for the areas that have been soil typed and this map shows broad areas that have a distinctive pattern of soils, relief, and drainage (USDA-SCS 1982). The General Soil Map has been updated to include the west side of the Priest Lake basin to the Washington Border (Figure 2-5, unpublished data provided by the SCS Coeur d'Alene office). Descriptions of these soil groups are presented in Table 2-3. The USFS has supplied a base geology landtype map for the western half of the basin which was used for calculating natural sediment yield from forested land (see Figure 4-2, page 163). Landtype units are based on local geomorphology, hydrology, and soil characteristics. General soil types could be inferred from this map (Niehoff *pers comm*).

The soil profile of many undisturbed soils in the area begin with a surface layer of an organic duff mat of needles, leaves and twigs, and a highly decomposed organic layer beneath. Below is a mantle of volcanic ash and loess (wind-deposited silt). The volcanic ash cap of basin soils plays an important role because soil productivity is highest with a thick ash cap, and surface erosion is often low because of rapid water infiltration through the cap (Janecek Cobb *pers comm*). Most commonly, basin soils are deep and well drained with a high component of gravel and sand. Glacial outwash and till are extensive in the foothills and lowlands surrounding Priest Lake and the valley bordering Lower Priest River. Much of the material is coarse grained and deep, and around Priest Lake supports unconfined aquifers. Within these glacial deposits are pockets of lacustrine fine grained silts and clays, and organic soils. Moderately steep to very steep mountainsides of the basin have primarily residual soils, bedrock weathered in-place. Particularly in the higher elevations of Priest Lake basin there are extensive areas of rock outcrop.

Because of the predominance of granitic geology, a major sediment component to streams is sand sized particles. Also, lowland stream segments have entrenched themselves into outwash deposits. Assessment of basin streams in the lowlands of gradual gradient often shows extensive stream beds of thick sand. This is particularly true of §303(d) listed streams on the west side from Reeder Creek down to the city of Priest River. An important yet difficult part of the SBA and TMDL process is to partition this bedload into what would occur naturally and what has been accelerated by land use activities.

With land use disturbance there is a high inherent hazard for surface erosion in the basin because of the rather extensive landscape of moderate to steep slopes (15 to 65%), soils derived from granitics, and glaciated land (IDL 1997a). In general, the inherent mass failure hazard in the basin is rated as moderate. From the standpoint of road building and erosion, areas of belt rock geology are considered fairly stable against surface erosion (IDEQ 1997). Areas of glacial till and granitic residual soils are considered an unstable geologic condition for roads.

Table 2-3. Descriptions of General Soil Map Units in the Priest River Basin (USDA-SCS 1982)

Bonner County General Soil Map Units (USDA-SCS 1982)	**Soil description**
All general soil groups in the basin	Soils: a mantle of volcanic ash and loess. Rock outcrop: areas of exposed granite, gneiss, and schist on ridges and convex mountainsides.
Rock outcrop - Prouty-Jeru	Glacial till and residual origin. *Rock outcrop, and moderately deep and very deep, steep and very steep, moderately permeable soils; on mountains at high elevations.* Extensive areas of rock outcrop are found at the higher elevations of eastern Priest River basin. Prouty residual soils are on ridges and convex side slopes of mountains. The surface and subsoil are gravelly loam, and the substratum is extremely stony sandy loam. Jeru glacial till soils are on mountainsides. Soil strata are very stony sandy loam.
Hun-Jeru	Glacial till and residual origin. *Deep and very deep, rolling to very steep, moderately rapidly permeable soils; on mountains.* Jeru glacial till warm soils are on foot slopes and on steep and very steep mountainsides. Surface layer is very stony sandy loam, subsoil is gravelly sandy loam, and substratum is very cobbly sandy loam. Hun residual soils are on very steep slopes, with gravelly silt loam at the surface, a subsoil of very gravelly sandy loam, and a substratum of extremely cobbly loamy sand.
Priestlake-Treble	Glacial till origin. *Very deep, well drained, moderately steep to very steep soils: on foothills and mountainsides.* Priestlake soils are on the cooler, north-facing mountainsides. Surface layer is gravelly sandy loam, subsoil very gravelly sandy loam, and substratum is very gravelly loamy sand. Treble, high precipitation soils are at the lower elevations on foothills and the warmer south-facing slopes. Surface layer is gravelly sandy loam, subsoil very gravelly sandy loam, and substratum very cobbly loamy course sand. Klootch and Kruse soils are also common.
Pend Oreille-Rock outcrop-Treble	Glacial till and residual origin. *Very deep, well drained, rolling to very steep soils, and Rock outcrop; on foothills and mountainsides.* Pend Oreille soils are on the lower and cooler, north-facing foothills and mountainsides. Surface layer and subsoil are silt loam, and substratum is gravelly or cobbly sandy loam. Treble soils are on the warmer south-facing side slopes of foothills and mountains. Surface layer is gravelly sandy loam, subsoil very gravelly sandy loam, and substratum very cobbly loamy course sand. Of minor extent are poorly drained Hoodoo and Sagle soils, and deep Lenz, Ardtoo, Vay, and Bonner soils.
Vay-Ardtoo-Lenz	Residual origin. *Moderately deep to very deep, moderately steep to very steep, moderately permeable and moderately rapidly permeable soils; on mountains.* Ardtoo soils are on south-facing side slopes. Surface and subsoil layers are gravelly sandy loam or very gravelly coarse sandy loam. Substratum is weathered gneiss. Vay soils are on the colder and more moist, north-facing side slopes and in ravines. Surface layer is silt loam, subsoil very gravelly sandy loam, and substratum is weathered granite.
Bonner	Glacial outwash origin. *Very deep, level to undulating, well drained soils; on terraces.* Surface layer is silt loam, subsoil is gravelly silt or sandy loam, and the substratum is very gravelly loamy sand or very gravelly coarse sand. In the Priest River basin there are pockets within the outwash of very deep and poorly drained alluvial, lacustrine, and organic derived soils.
Mission-Cabinet-Odenson	Glacial silty lake-laid sediment. *Very deep, level to hilly, somewhat poorly drained to excessively drained soils; on alluvial fans, terraces, and dunes.* Mission soils are in higher areas of terraces. Shallow to a hardpan and somewhat poorly drained. Surface layer is silt loam, subsoil is silt and clay loam, and substratum is fine sand to silty clay. Odenson soils are in the lower, wetter areas on terraces. Soils are very deep and poorly drained. Surface layer is silt loam, subsoil is silty clay loam, and substratum very fine sandy loam to silty clay.

Evidence suggests that in some basin streams, sediment, which is largely sand sized particles related to a dominance of granitic geology, is excessive. This has resulted in a high percentage of fines within spawning beds, reduction of pool volume, and channel systems out of equilibrium with characteristics such as channel widening along with stream bank cutting and erosion. In the Priest River basin, excess sediment and channel disequilibrium has been linked to: historic large fires; historic logging practices and initial construction of a transportation network to bring timber to market; current timber activities and the existing road network; agricultural practices such as wet meadow draining through cross ditches, channel straightening, and cattle access to streams; urbanization with clearing and excavation in riparian areas and construction of substandard private roads; and lack of road maintenance. Confounding the analysis of sediment effect on the biotic community are the issues of: legacy land use, fire, and natural geological conditions versus sediment input from current land use activities; and effects from the introduction of non-native competing salmonids including brook trout in streams and lake trout within Priest Lake.

Determinations of cold water biota beneficial use status for this report took into account both the WBAG results and a best professional judgment of whether the additional information ("+" of WBAG) indicated that excess sediment has impaired beneficial uses. Status call judgments fell into several categories of decisions and debate. Trapper Creek, Two Mouth Creek, and Tango Creek (all northern basin streams), were clearly Full Support including viable populations of native cutthroat trout. On the other hand, mid-western streams draining into Priest Lake, and lower western streams draining into Lower Priest River were more difficult to access because of low numbers or absence of cutthroat trout.

The mid western basin streams Lamb Creek and the upper reach of Reeder Creek had abundant brook trout, but absence of cutthroat trout. These reaches are judged as Full Support and recommended for de-listing based on adequate MBIs and brook trout populations. This decision may be disputed based on a fisheries management objective for recovery of cutthroat trout. Sediment source load calculations for Lamb Creek are included in this report because of a high current sediment load, which apparently is not affecting brook trout, but the current load would likely have to be reduced for establishment of cutthroat trout. Kalispell Creek on the other hand, exhibits low numbers of both brook trout and cutthroat, and is judged Not Full Support. However, sediment load calculations and USFS assessments suggest that the current sediment load is not the impairment factor. Regardless of this assessment of current sediment load, the Priest Lake WAG recommends that for any stream segment exhibiting NFS, a de-listing is not warranted and the watershed should undergo a TMDL. This report follows the WAG recommendation.

The lower western stream, Lower West Branch Priest River, has overall suppressed salmonid populations (main stem), in combination with a high current sediment load. A TMDL has been prepared for this stream. While the Middle Fork and North Fork of East River (lower eastern streams) are judged as FS, there appears to be a suppression of cutthroat trout in lower reaches of the two forks as compared to upper reaches (although fishing pressure and elevated water temperature may be a factor). Sediment source load calculations are included in this report for the Middle and North Forks as a resource for any future fisheries management efforts to strengthen the cutthroat population. Sediment reduction efforts in the Middle Fork may also become a fisheries management planning objective because the Middle Fork is the only lower basin stream in which bull trout are found.

Table 1-1 presents a summary of beneficial use status calls and §303(d) List recommendations that are detailed in this Subbasin Assessment and TMDL report. Included are four listed segments in which there is a request for deferment of status calls. These segments are: Reeder Creek from the middle reach to the mouth; the 2.5 mile main stem of East River; Binarch Creek; and the entire §303(d) listed length of Lower Priest River. Reasons for request of deferral are given in Table 1-1, and judgement of beneficial use status for these segments would be presented in the 2002 DEQ §303(d) List. Also, the §303(d) list for East River includes dissolved oxygen (DO) as a concern. There have been no recorded DO measurements taken in this stream system. Therefore, East River remains on the §303(d) list for DO.

Table 2-2. Priest River Basin: General Characteristics of the §303(d) Listed Stream Segments

Stream Name	Watershed Size (acres)	Elevation Range (ft)	Stream Length (miles)	Stream Order	% Rosgen Channel Type and Gradient: C, F, D, E <1.5%	% Rosgen Channel Type and Gradient: B+A ≥1.5%	Summer Base Flow near mouth (cfs)
Trapper Creek	12,292	2438-6500	7.9	4th	14%	86%	9[b]
Two Mouth Creek	15,565	2438-7292	10.3	3rd	6%	94%	20[a]
East River							
Main stem	1,881	2230-2280	2.5	4th	100%	0%	55[b]
North Fork	19,494	2280-6706	10.0	3rd	40%	60%	13[b]
Middle Fork	21,788	2280-6706	8.9	3rd	20%	80%	24[b]
Tango Creek	2,003	2438-5200	3.3	1st	0%	100%	1[b]
Reeder Creek	8,291	2438-5074	7.7	2nd	63%	37%	5[a]
Kalispell Creek	25,210	2438-5552	14.6	4th	70%	30%	16[a]
Lamb Creek	15,616	2438-5476	12.8	3rd	56%	44%	6[a]
Binarch Creek	7,232	2420-4170	8.5	2nd	51%	49%	3[b]
Lower West Branch Priest River	56,835	2100-5600	25.3	4th	84%	16%	36[b]
Lower Priest River	219,980	2074-2300	35.3	5th	100%	0%	450[a]

a = flow determined from continuous gage height recorder station
b = flow determined from single BURP flow measurement, summer base flow

pacific maritime influence (average daily summer maximums are around 82°F). Winter temperatures also are relatively mild compared to areas east of the Rocky Mountains. Annual precipitation (rain and melted snow) averages 32 inches at the "control" weather station. Average precipitation within the peaks of the Selkirk Mountains can reach 60 inches (UI 1995). At elevations above 4,800 ft snowfall accounts for more than 50% of total precipitation (Finklin 1983). The wettest months normally are November, December, and January. The elevation zone between 2,000 ft and approximately 3,500 ft is subject to rapid snow melt from warm and moist mid to late-winter rain storms. The result is that some of the basin watersheds with a high percentage of sensitive snowpack acreage, in particular the lower half of the western side of the basin, can have high discharge rain-on-snow events.

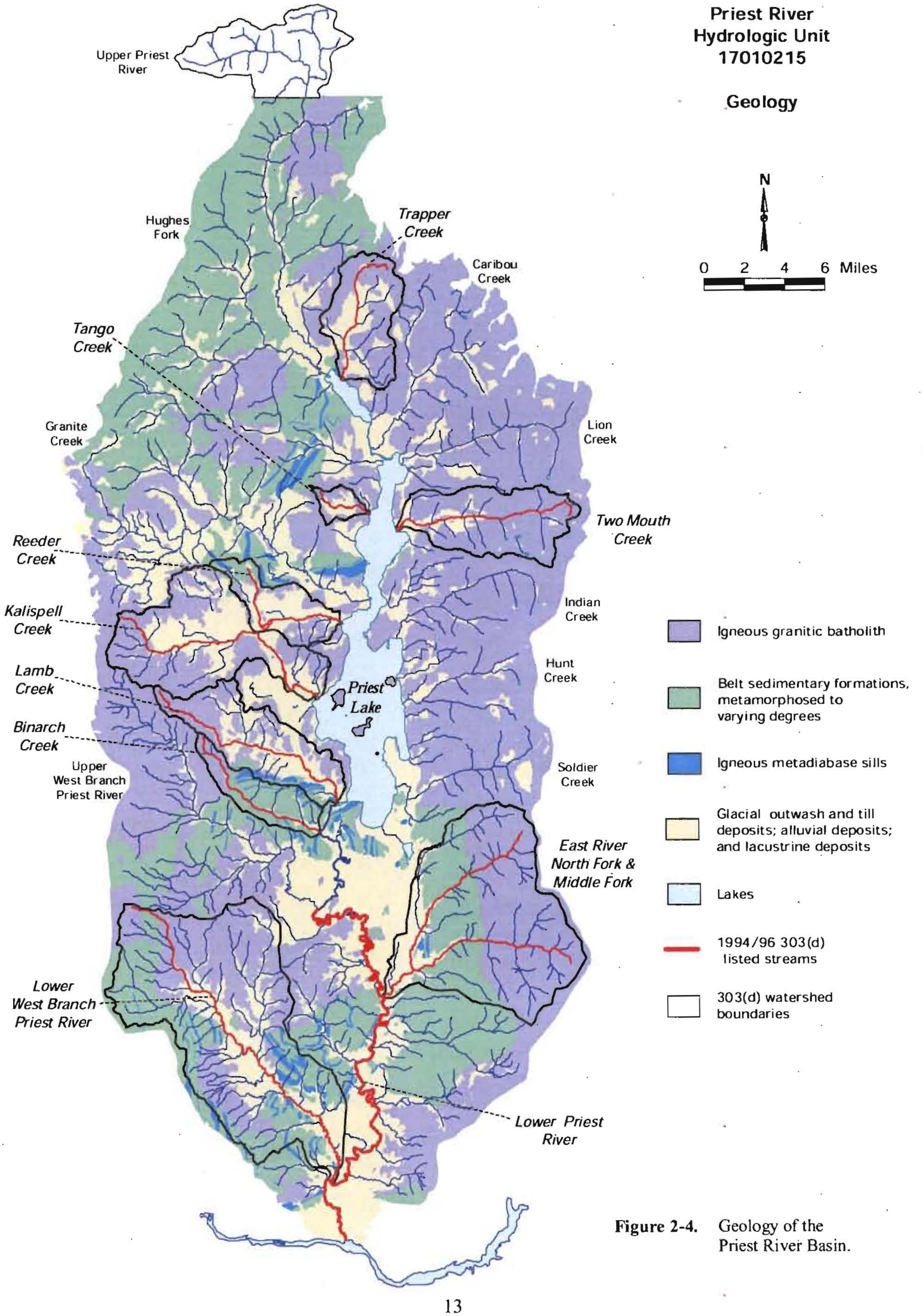

Figure 2-4. Geology of the Priest River Basin.

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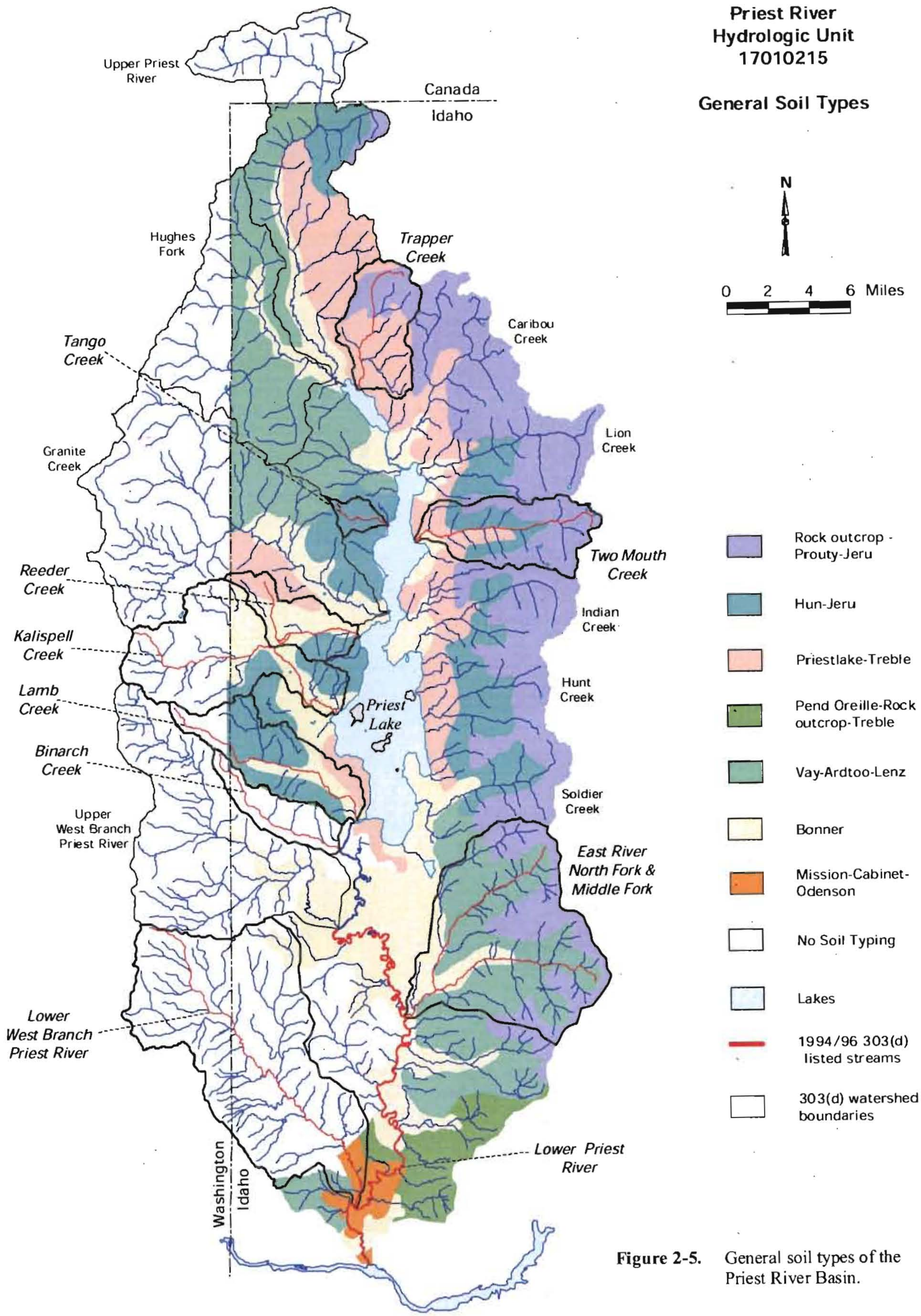

Figure 2-5. General soil types of the Priest River Basin.