LOWER SELWAY RIVER SUBBASIN ASSESSMENT

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EXECUTIVE SUMMARY

The Selway Subbasin is about 2,013 square miles of predominantly undeveloped forest land and free flowing streams. The Selway River is designated as a Wild and Scenic River and most of the subbasin upstream of Selway Falls is part of the Selway Bitterroot Wilderness Area. Selway Falls, at 1,730 feet elevation, is a barrier that separates the 166 square miles of the lower Selway subbasin from the upper areas. All the stream segments that are assessed in this document are in this lower subbasin. The subbasin is above 9,100 feet elevation at its eastern end and its waters join to form the Selway River that flows west about 99 miles to its mouth at about 1,400 feet.

Dynamic, high-energy processes have formed and continue to shape the subbasin. The uplift that formed the mountains accelerated surface erosion and exposed underlying rocks. Most of the subbasin is underlain by granitic rock of the Idaho batholith and Precambrian metasedimentary rocks. These rocks weather rapidly at the surface to loose, crumbly particles and form sandy soils that are susceptible to erosion and landslides. The streams in the subbasin typically erode their channels along less resistant joints or faults in the rock. The streams appear to incise their channels into these weaker zones and create narrow valleys with very steep valley walls. The Selway River channel is relatively straight and has not developed a wide flood plain. Its tributary streams often enter the river as cascades and waterfalls descending the steep valley walls suggesting that the river is exploiting a weaker zone and eroding downward at a faster rate than the smaller tributary streams are able. Numerous geothermal springs in the subbasin suggest a connection to hot rock below.

Climatic extremes occur in the subbasin. The northern, eastern, and southern subbasin boundaries generally have elevations of 6,000 feet or more and snow-dominated weather typical of the northern Rocky Mountains. Average air temperatures are below freezing in winter and approach ninety degrees in the summer months. Annual precipitation is close to forty inches with more than fourteen feet of snow in the head of the subbasin. The western end of the subbasin receives relatively warm and moist Pacific maritime weather. When the warm, moist air from the west meets the cold air of the higher mountains, intense storms can develop. Rain from these storms can fall on and melt accumulated snow causing rapid runoff and extreme flood flows as happened in 1933, 1948, 1964, 1974, and 1995/1996.

Large and intense forest fires are known to have swept 93 percent of the lower subbasin from 1884 to 1934. Especially large fires burned in 1910, 1919, and 1934 and may have occurred regularly before records were kept. The hot, intense fires stripped the area soils of protective vegetation and exposed them to erosion. Many burned and eroded areas have not yet been reforested largely because of these fire damaged soils.

The combination of loose soils, steep slopes, and intense rain-on-snow precipitation events produces landslides that dissect the subbasin with steep valleys and periodically deliver sediment to its streams. The subbasin landforms and the historic record confirm that these dynamic, high-energy processes occur repeatedly and define the normal subbasin condition.

1.0. SUBBASIN CHARACTERIZATION

The lower Selway River subbasin is in the east central region of Idaho (see Figure 1, p. 6) Various publications define the lower subbasin as either the portion of the Selway River basin watershed that drains to the mouth of Moose Creek and downstream (i.e., all of HUC 17060302), or only the portion below Selway Falls. This document will describe the lower subbasin in relation to the larger Selway River subbasin where appropriate, but will focus on the portion below Selway Falls because all the stream segments considered in this subbasin assessment are there. This section summarizes the physical, biological, and cultural characteristics in the subbasin. Extensive physical and biological data are available for the subbasin because it is almost entirely composed of managed public lands. This summary focuses on those data that are most useful to understanding the subbasin's surface water quality compliance with Idaho's sediment criterion.

1.1. Physical Characteristics

This section summarizes the geology, soils, topography, climate, and hydrology, with emphasis on how these characteristics relate to the parameter of concern, sediment, in the subbasin.

1.1.1. Lower Selway Area Geology

The Lower Selway subbasin is a mature dissected upland forming part of the Clearwater Mountains of the Bitterroot range. Elevations in the Selway Subbasin rise from about 1,400 feet at the mouth of the Selway River and increase eastward to more than 9,100 feet. The river drops about 6,000 feet in the first 75 miles from its mouth to Magruder Crossing. Selway Falls, at 1,730 feet elevation, is a barrier that separates the lower Selway Subbasin from the upper areas. Surficial geology is represented in Figure 2 (p. 4); a general geologic cross-section of the area is shown in Figure 3 (p. 5).

Upper Jurassic to Cretaceous age plutonic rocks intrude and are bordered by Precambrian metasedimentary rocks. Intrusive igneous rocks of granitic to granodioritic composition are the dominant lithology; most of these rocks are associated with the Idaho Batholith that underlies most of central Idaho (Alt and Hyndman, 1972). The Cretaceous Coolwater Ridge tonalite is a conspicuous elongate body in the lower subbasin that comprises most of the north valley wall and spans the Selway River. The south valley wall is mostly Precambrian schists, but the ridge tops and eastern part of the lower subbasin have Cretaceous intrusive rocks. Miocene-age basalt flows and dikes occur in the far northwestern portion of the Selway watershed.

The Spruce Creek mylonite zone strikes north-south and dips west and may be the western flank of the Bitterroot dome described by Hyndman (1980). Northeast to north-south trending high angle normal faults are present across the map area, but are less densely spaced in the subbasin interior. Many of these faults have controlled the emplacement of Eocene dikes and dike swarms (Lewis, et.al., 1992). The Yakus, O'Hara Creek, and less extensive subparallel faults that cut through the southern valley wall of the lower subbasin appear to control about three miles of O'Hara Creek and the lower five or so miles of the Selway River. The Coolwater Ridge tonalite of the northern valley wall is notably free of faulting, except at its very northwestern and western end. Day (*in* IDWR, 1980) identified large linear features across the area from high altitude U-2 and satellite photos. These linears are often associated with geothermal springs suggesting that faults or fractures may penetrate to depths where magma has intruded and heats meteoric waters well above the normal geothermal gradient.

The lower Selway River valley has several peculiar geomorphological characteristics. Terraces are scarce and inconspicuous. The valley wall gradient abruptly steepens from about 3,400 feet to the river. Minor tributaries enter the Selway River, particularly from the Coolwater Ridge tonalite, as steep cascades and waterfalls. These characteristics suggest the lower Selway River is rapidly (in geologic time) entrenching its bed. The angulate stream pattern suggests joint and/or fault control. Exploitation of more erosive rock on joints and faults may be one reason for the lower Selway River's incision.

Figure 1. Selway subbasin location map

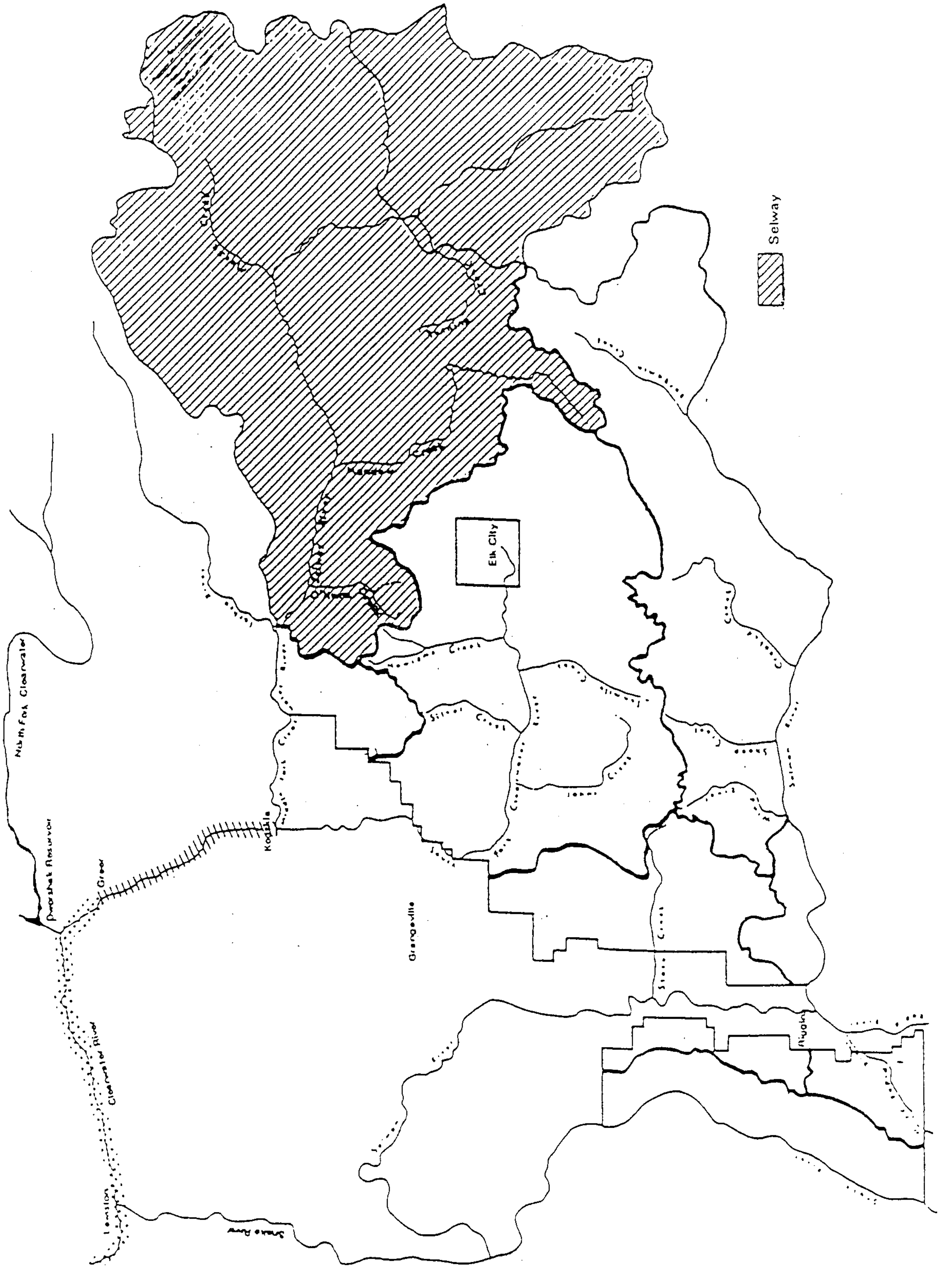
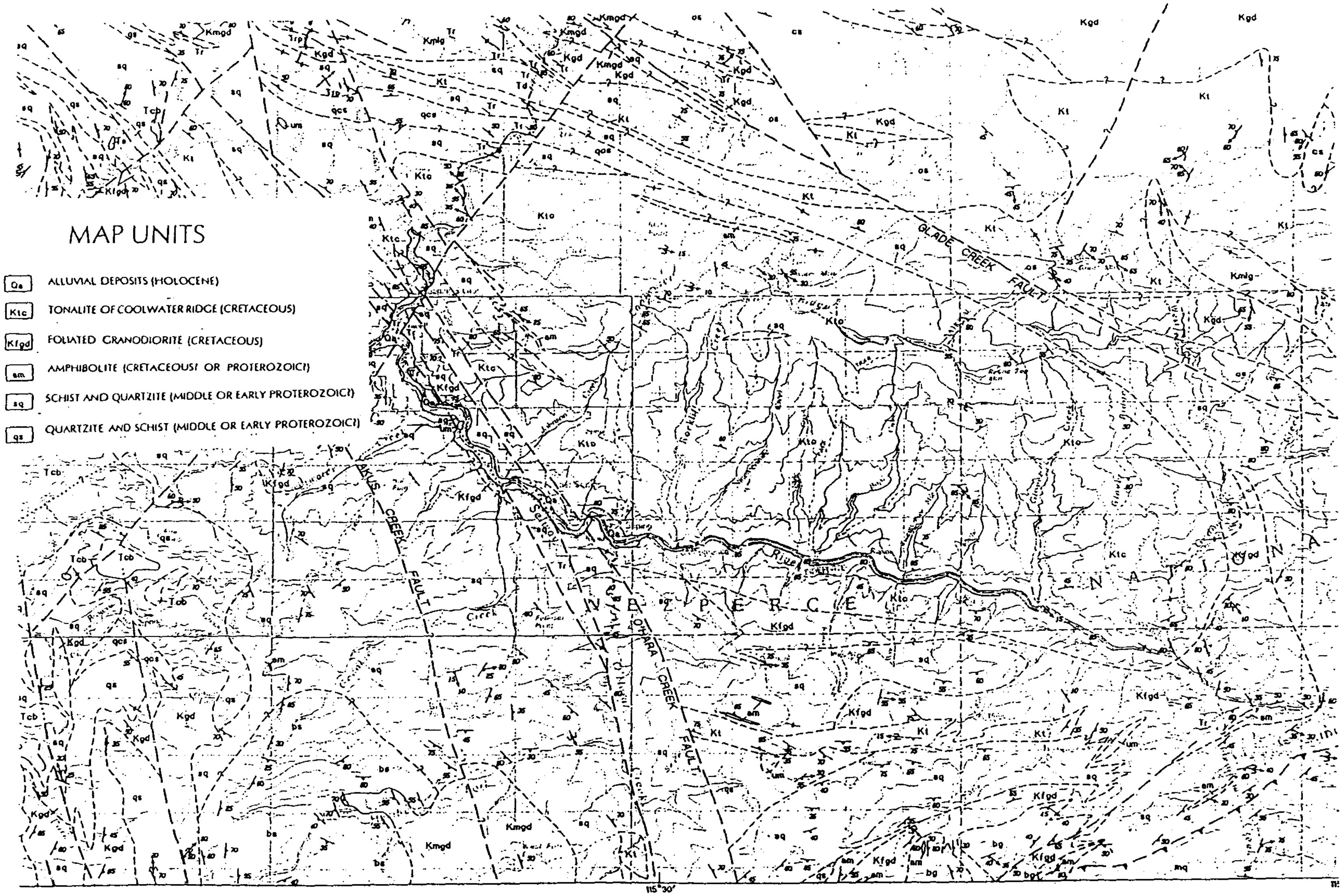
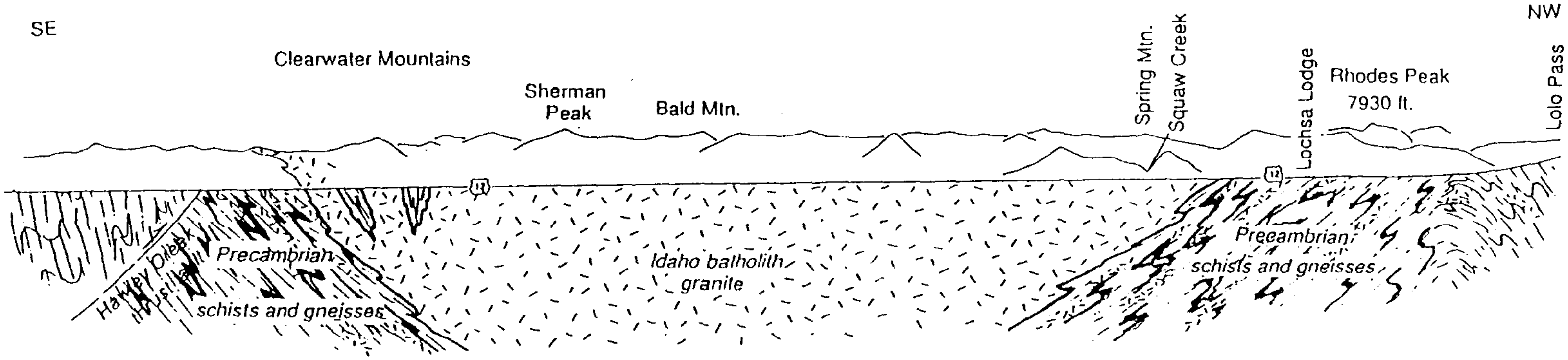


Figure 2. Lochsa River subbasin geologic map



after **R.S. Lewis, R.F. Burmester, R.W. Reynolds, E.H. Bennett, P.E. Meyers, and R.R. Reid, 1992**

Figure 3. Section drawn along Highway 12 betwen Lowell and Lolo Pass



Section drawn along Highway 12 between Lowell and Lolo Pass. Broad border zones of metamorphic rocks embrace the granite batholith.

1.1.2. Soils

The igneous and metamorphic rocks that underlie most of the subbasin weather to grus. The soils derived from the grus tend to be sandy, well drained, and cohesionless. The gneiss, schists and quartzite weather to soils with similar properties, but also with important differences. These rocks are often described generically: the igneous as "Idaho batholith" and the metamorphic as "border zone" rock. The Idaho batholith is composed of several plutons emplaced over a long period and these are further intruded by dikes of other rock types. Similarly, the metamorphic rocks vary in minerology and texture. For these reasons, the soils and sediments formed from them can vary in properties like grain size. Consequently, the sediment characteristics in the drainages can vary beyond two basic conditions.

1.1.3. Topography and Landforms

The lower Selway subbasin relief is approximately 6,000 feet, rising from about 1,400 feet at the Selway River's mouth to more than 7,400 feet near Chimney Peak in The Crags on the north side of the river. Iron Peak, at 6,815 feet, is the highest point on the southern side of the river. The subbasin divides typically have elevations of 6,000 feet or more on the north side and 5,600 feet on the south side of the river. During the Pleistocene ice age, alpine glaciation formed cirques and tarns on the sides of the higher Clearwater peaks. Effects of alpine glaciation, including some broad u-shaped valleys and expansive alpine meadows, can be seen in the uppermost part of the Gedney Creek watershed, but are very evident just over that watershed divide in the adjacent Crags. The headwaters of East Fork O'Hara Creek have been mapped as a glaciated landform. The larger stream valleys were not glaciated. Middle elevations in the Clearwater mountains are characterized by more gentle terrain with broad rounded ridges. Lower elevations display deeply dissected breaklands with high drainage densities and oversteepened slopes. For example, the valley wall gradient changes from about 12 degrees above about 3,400 feet to about 25 degrees down to the river. Tributary streams that flow across the Coolwater Ridge tonalite form an extreme parallel drainage pattern.

The Nez Perce National Forest classes about 70 percent of the landforms in the subbasin as breaklands and steep slopes. The soils are generally highly erodible on the 40 to 80 percent breaklands slopes. Surface erosion is generally confined to the steepest southern aspects with shallow soils (USDA Forest Service, 1995).

1.1.4. Climate

General

At lower elevations, along the mainstem Selway River, the subbasin climate has mild wet winters and hot dry summers. At elevations above about 4,000 feet, most of the winter precipitation falls as snow. The winter snowpack water content usually peaks in early April and snowmelt contributes much of the summer stream flow. Little precipitation may fall from July through September. For example, in August 1994 near the end of a decade-long drought, no precipitation was recorded at the Natural Resources Conservation Service Twin Lakes snow telemetry

(SNOTEL) station near the head of the subbasin. Summer high temperatures regularly exceed 90°F and mid-July through August is generally the critical period for stream high temperature.

The official weather reporting station in the lower Selway River subbasin is at Fenn Ranger Station at an elevation of 1,480 feet, five miles up the Selway from its confluence with the Lochsa. Daily weather observations began at the Fenn station downstream in August 1948. The Powell Ranger Station at an elevation of 3,409 feet, about one and one-half miles below the Lochsa River headwaters, can be used for weather conditions characteristic of higher subbasin elevations. Daily weather records at Powell begin 1 August 1962.

Air Temperature

For the period of record, the lower elevation Fenn station's mean annual temperature has been 49.2 °F as compared with Powell's mean of 42.7 °F. Figure 4 (p. 9) shows the average monthly air temperatures at the Powell and Fenn Ranger Stations. Note that the subbasin temperatures range from approximately 23 °F and 15 °F mean January minimums to approximately 88°F and 82°F mean July maximums at the Fenn and Powell stations respectively.

The long term records provide a datum for measuring warm years and cool years. Figure 5.a. (p. 10) shows annual mean temperatures as the departure from the long term (1895-1999) mean for all reporting stations in Idaho climatic division 4. Climatic division 4 consists of the mountainous region of central Idaho, north of the Snake River plain and south of the Clark Fork River, excluding the valleys and ranges of eastern Idaho. Figure 5.a. shows that 70 percent of the years from 1942 to 1975 were cooler than the long term average and 83 percent of the years after 1975 have been warmer than the long term average in this region of Idaho. These changes have had important effects on sedimentation and will be discussed further in sections 1.1.5. and 3.0. below.

Precipitation

Precipitation at Fenn has averaged 38 inches annually, with 53 inches of snowfall. Annual precipitation at Powell averages about an inch more, but with cooler temperatures, snowfall more than triples to 178 inches. Figure 6 (p. 11) shows that the maximum precipitation at both stations occurs during the winter. About 45 percent of the annual precipitation falls as snow at Powell. At the Fenn station, only 14 percent of the annual total comes as snow; even in the winter most of the precipitation is rain.

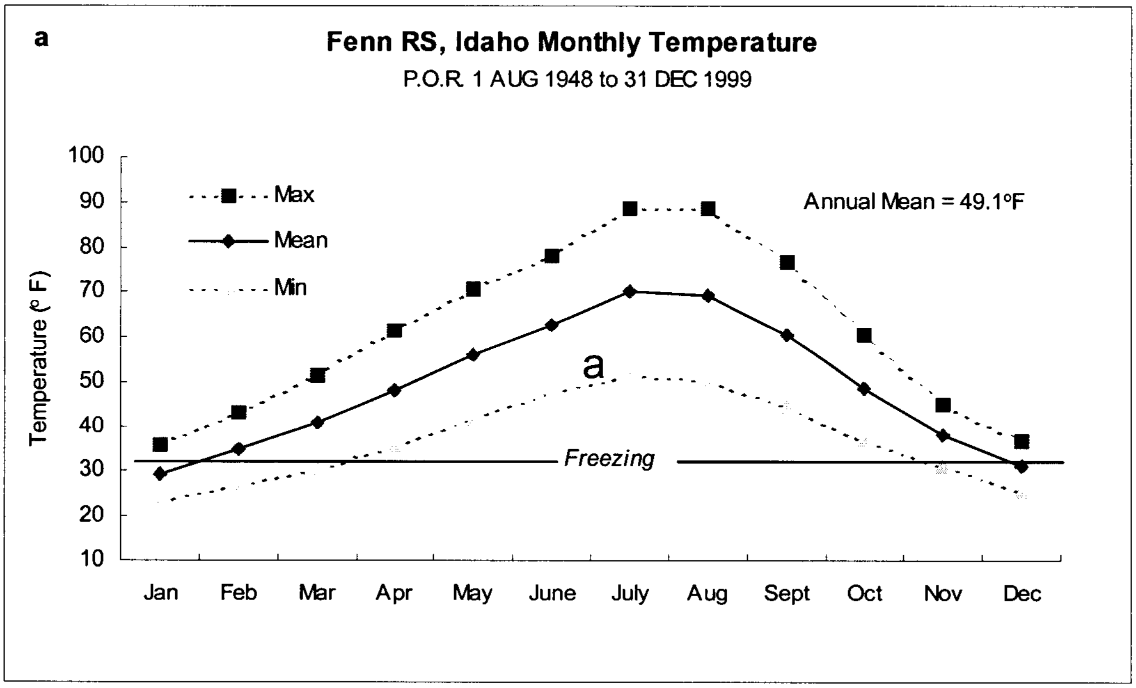
Precipitation increases markedly with elevation in the mountains. The SNOTEL station nearest Powell, at the head of the contiguous Lochsa River subbasin (elevation 5,235 feet), has averaged more than 48 inches precipitation per year since its 1983 inception. The Twin Lakes SNOTEL station near the head of the Selway subbasin (elevation 6,400 feet) averaged more than 64 inches precipitation per year during the same period (Table 1, p. 12). Higher peaks to the east and west receive as much as 80 inches per year making them among the wettest of any area in Idaho (NRCS, 1998). The winter snowpack is vital to sustaining summer flows in the subbasin.

The region has experienced an extended drought (above-average temperatures and below-average precipitation) that has broken only since 1995 (Figures 5.a. & b., p. 10). Figure 7 (p. 13) shows that the drought included less than average snowpack for 15 of 20 recent years. Snowpack data perhaps provide an even better indication of the drought than rainfall at lower elevations, particularly regarding summer stream flow. The 1981 snow water equivalent (yield of water when melted) peaked at 27.9 inches, far below the 1997 peak snow water equivalent of 60.4 inches (see Table 1, p. 12).

Occasionally mild Pacific air masses meet cold continental air masses producing heavy rainfall combined with rapid snowmelt; this phenomenon is called a rain-on-snow event. These events often occur outside the normal spring snowmelt and trigger mass wasting (e.g., landslides) through soil saturation. Middle elevations, between about 3,000 and 5,000 feet, are most susceptible to rain-on-snow in the subbasin. Two rain-on-snow events occurred recently, one in late November 1995 followed closely by another in early February 1996. The Selway River discharge reached 28,400 cfs during the November event and 16,600 cfs during the February event. For comparison, the peak daily discharge for November 1997 was 3,630 cfs and for February 1998 was 1,580 cfs. The contiguous Clearwater National Forest conducted an extensive study of these events. Both events caused flooding and landslides in the Clearwater River drainage below about 4,000 feet. For example, the large (~100,000 cubic yards) No-see-um Creek slide wiped out some of U.S. Highway 12, deposited a large amount of sediment in the Lochsa River, and created a new rapid. (McClelland and others, 1997).

The climatic variables discussed above, air temperature, precipitation as rain and snow, and weather patterns and timing, are important components in the generation of periodic landslides, which are a natural source of sediment for streams in the subbasin. The Nez Perce National Forest believes that "rain on snow events are probably the most critical scenario for management induced sediment in the lower Selway River" as well, but has difficulty quantifying the relative contributions because its NEZSED sediment model does not estimate sediment yield from large (greater than 10 cubic yards) mass wasting events (USDA, 1995). Drier than normal weather and less than average snowpack would be expected to reduce stream flows and thus stream competence (the ability of the stream to transport its sediment load), but may also concurrently reduce sediment delivery to stream channels resulting in a net sedimentation decrease. Wetter than normal weather may produce converse effects. These ideas will be discussed further in sections 1.1.5. and 3.1. below.

Figure 4. Air Temperature at a) Powell and b) Fenn RS, Idaho



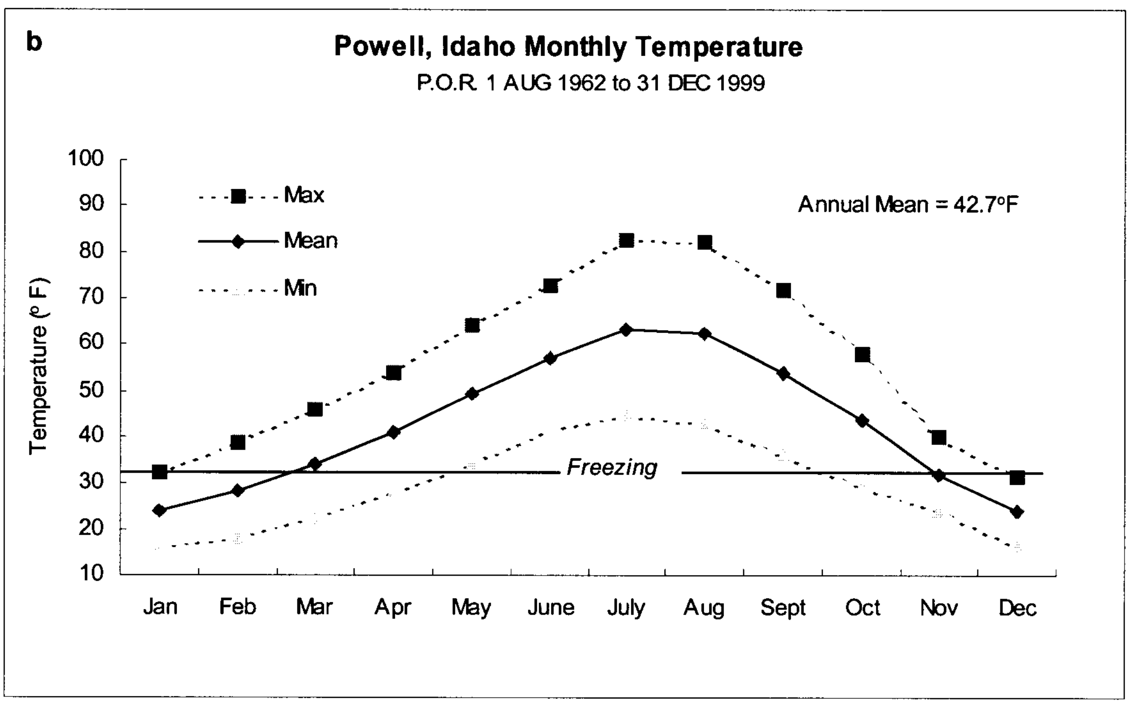
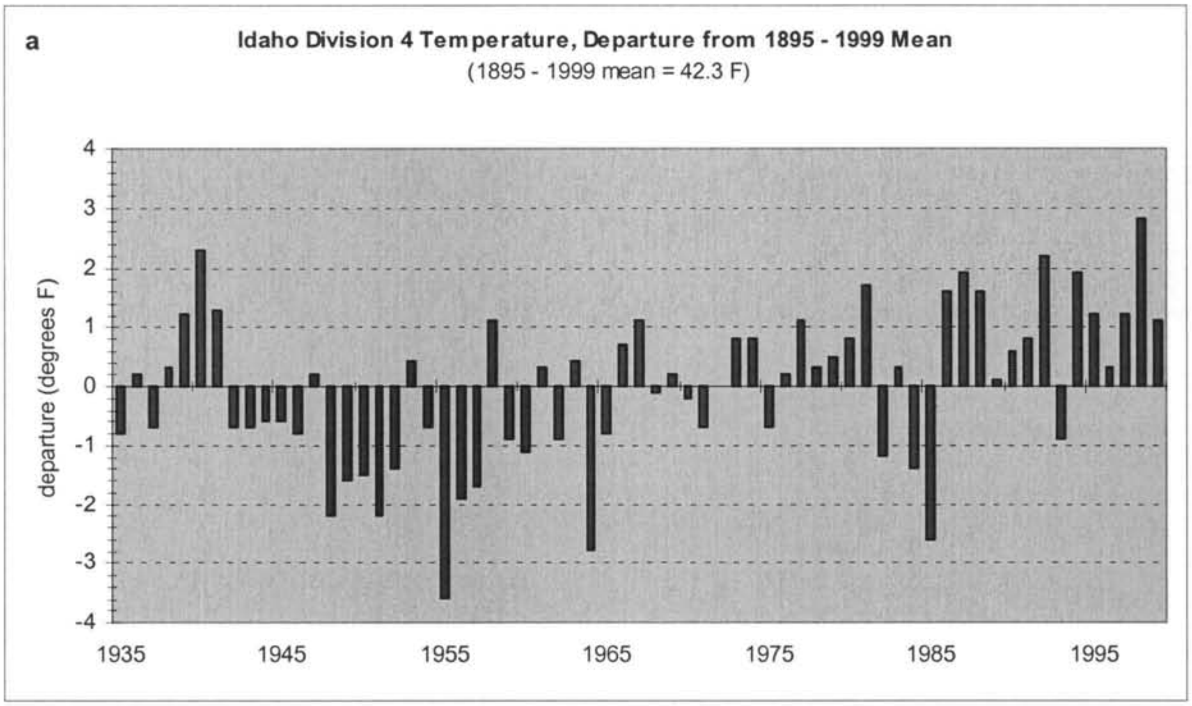


Figure 5. Long-term a) temperature and b) precipitation presented as departure from period-of-record mean



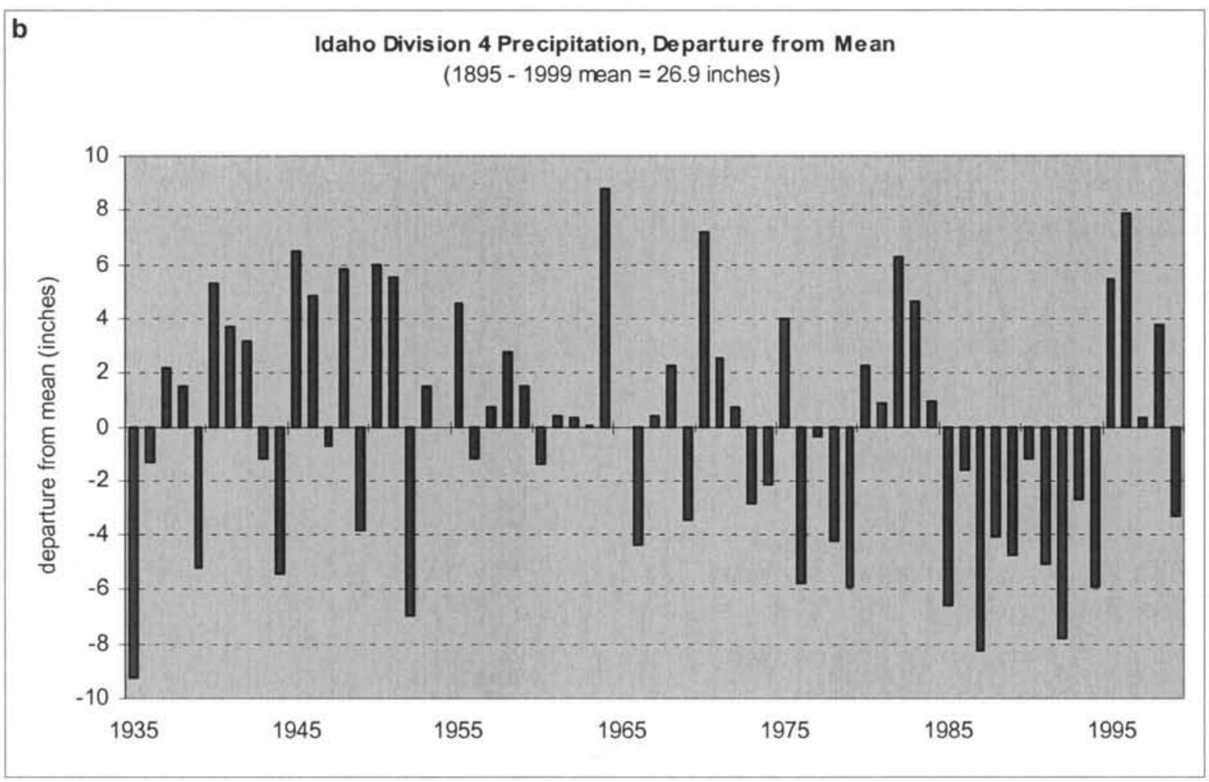
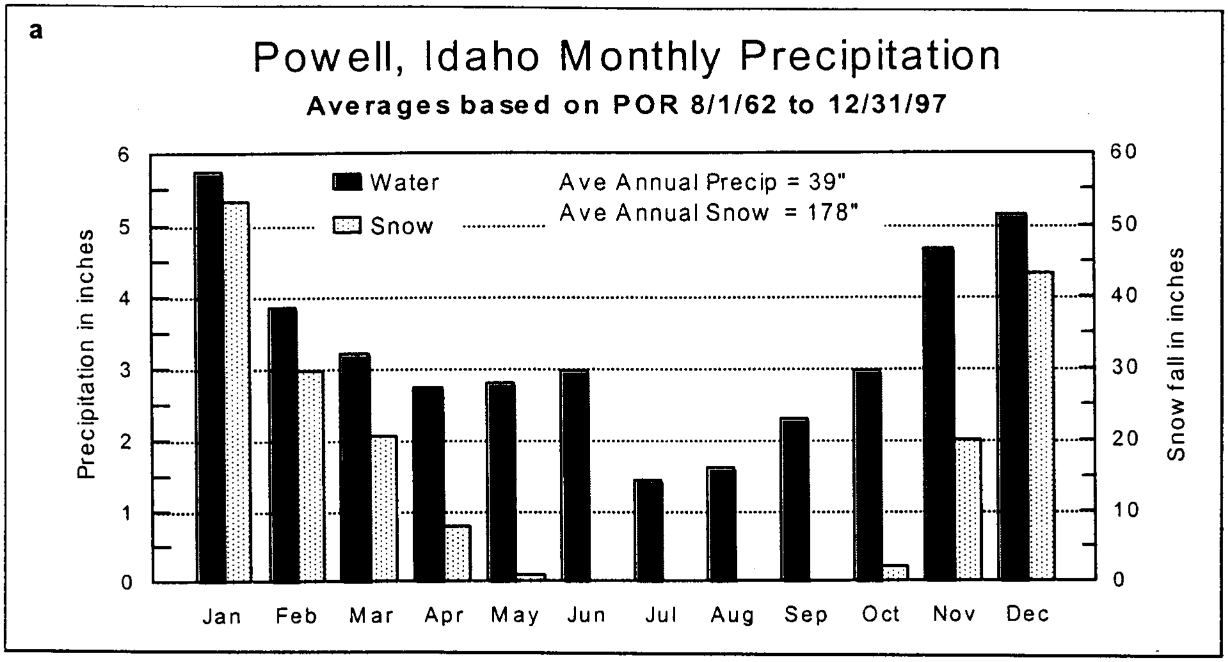


Figure 6. Precipitation by month at a) Powell and b) Fenn RS, Idaho



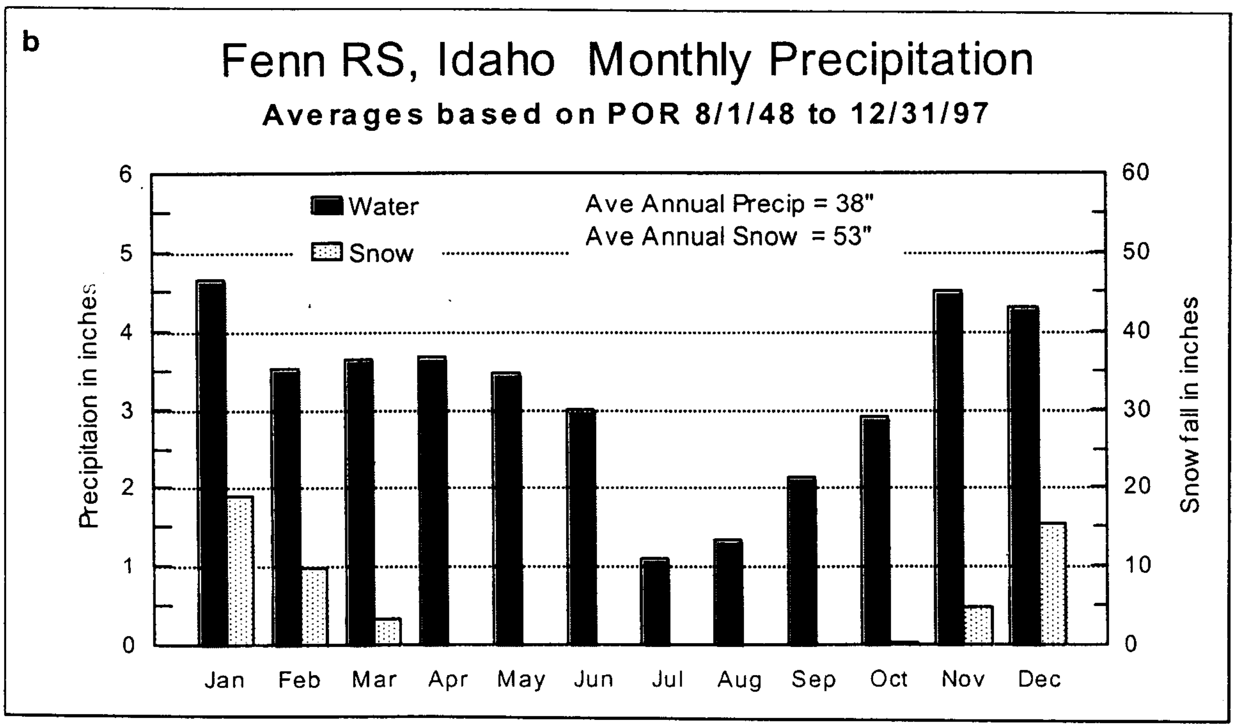
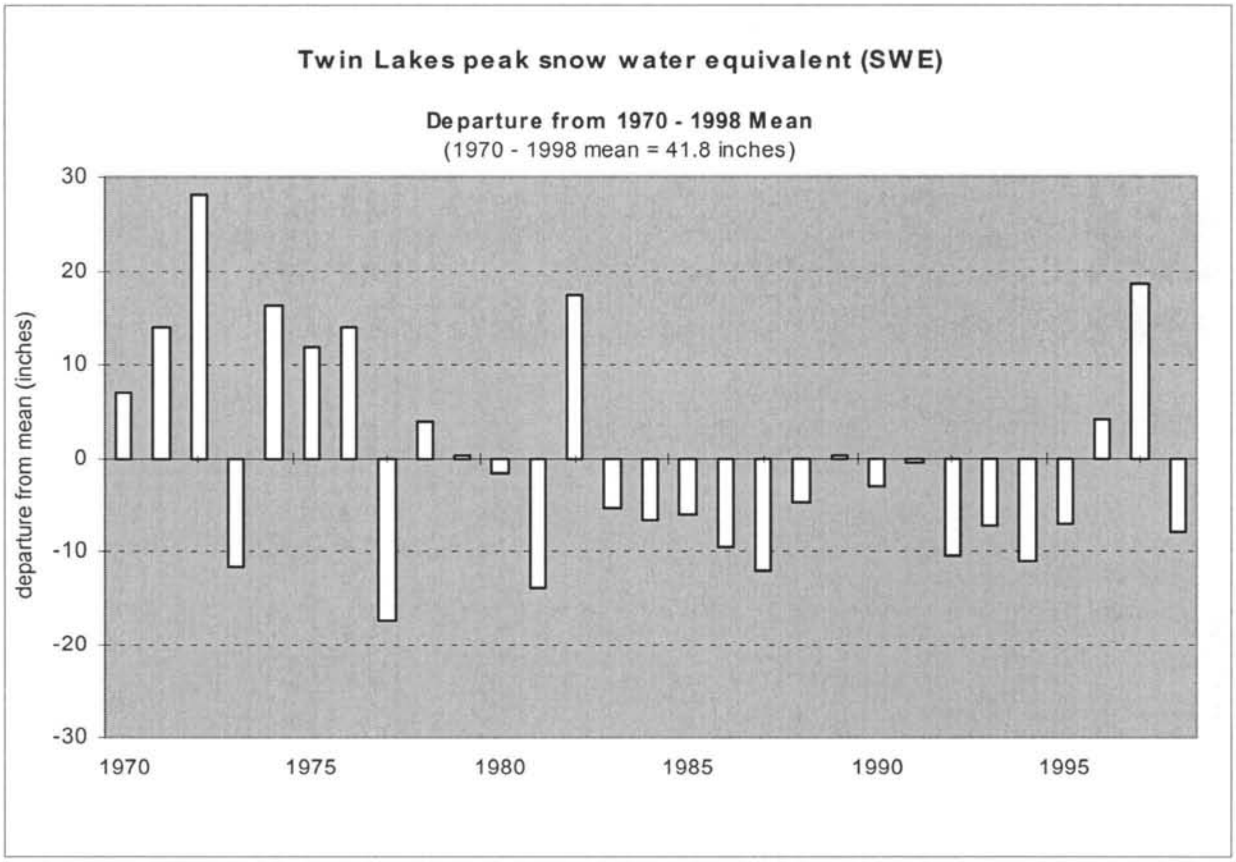


Table 1. Twin Lakes, Montana SNOTEL precipitation

Year	Precip. (inches)	------------ Snow water equivalent -------------				
		1 April	15 April	1 May	Peak	Date
1970	--	41.7	44.7	48.9	48.9	05/01
1971	--	54.4	55.0	53.4	55.7	04/21
1972	--	63.8	68.5	69.8	70.0	05/09
1973	--	28.6	28.6	28.7	30.2	04/21
1974	--	55.4	56.6	54.0	58.1	04/13
1975	--	47.3	49.1	52.6	53.8	05/07
1976	--	55.1	54.8	54.1	55.9	04/05
1977	--	24.3	22.8	17.1	24.5	04/02
1978	--	44.0	44.5	44.7	45.7	03/23
1979	54.1	39.0	42.1	39.3	42.1	04/15
1980	64.7	37.0	40.3	32.3	40.3	04/10
1981	64.9	24.6	27.6	24.6	27.9	04/17
1982	74.0	53.5	57.9	56.2	59.2	04/19
1983	62.0	35.2	36.4	33.2	36.4	04/10
1984	71.4	31.1	33.2	33.5	35.1	05/06
1985	63.6	34.6	32.9	32.6	35.8	04/06
1986	68.8	31.4	31.0	31.0	32.2	05/15
1987	46.5	29.5	29.2	22.3	29.8	03/28
1988	51.8	36.0	34.4	31.4	37.1	04/09
1989	67.6	40.3	40.7	34.7	42.2	04/07
1990	66.7	38.0	33.8	33.2	38.8	03/16
1991	64.1	38.4	40.2	41.0	41.2	04/30
1992	58.0	29.4	29.8	27.4	31.3	04/23
1993	63.6	31.5	33.3	34.3	34.5	04/30
1994	50.3	29.0	30.6	23.3	30.7	04/13
1995	70.4	32.1	34.1	32.7	34.7	04/09
1996	88.3	44.0	42.7	45.4	46.0	05/02
1997	79.4	55.0	57.1	59.9	60.4	04/27
1998	61.5	31.7	33.6	28.5	34.0	04/17
mean	**64.6**	**39.2**	**40.2**	**38.6**	**41.8**	**04/17**

Figure 7. Snow pack precipitation near head of Selway River subbasin



1.1.5. Hydrology

The Selway River is an eighth order stream, draining 2,013 square miles. Figure 8 shows the Selway subbasin, the Lower Selway subbasin, the river, and major tributary streams. The Selway River flows about 99 miles from its headwaters above 9,000 feet in the Bitterroot Mountains to its mouth at Lowell at more than 1,400 feet. The lower Selway reach, from Selway falls to the river's mouth, is about 18.5 miles long. The Selway River was designated as a "recreation river" when the Wild and Scenic Rivers Act passed in 1968. On 17 April 2000, the Idaho Board of Health and Welfare was petitioned to recommend to the Idaho legislature that the entire Selway River and five tributaries be designated as Outstanding Resource Waters.

The USGS calculates the Selway River annual mean flow for the period of record at its O'Hara Creek station as 3,749 cfs. The annual seven-day minimum discharge for 1998 was 629 cfs and the annual seven-day minimum discharge for the period of record, measured in 1937, is 210 cfs (Brennan, et.al., 1997). Its peak discharge of 48,900 cfs occurred on 29 May 1948. Peak discharge occurred between 20 April and 17 June during the period of record, with 24 May as the median date for peak discharge. The peak discharge occurred on the same date as the Lochsa River for 72 percent of the years from 1935 to 1995.

When the peaks did not coincide, the Selway River lagged behind the Lochsa River 71 percent of the years. Possible explanations for this tendency to peak after the Lochsa include natural conditions and management effects. Natural conditions that could contribute to the observed lags include: basin area, basin aspect, proportion of basin burned, proportion of basin at higher elevations, greater snowpack, later snowmelt, and channel configuration. Management effects could include logging, grazing, road building, and prescribed burns.

The timing of the peak has varied. Figure 9 (p. 16) displays the dates of peak discharge from 1935 through 1997. As the record progresses, peak flows come early, then after 24 May, and in recent years are coming earlier again. The peak flow occurred before 24 May during the first third of the record about 63 percent of the years, during the second third about 36 percent, and in the last third about 58 percent.

Figure 8. Lower Selway subbasin hydrologic map

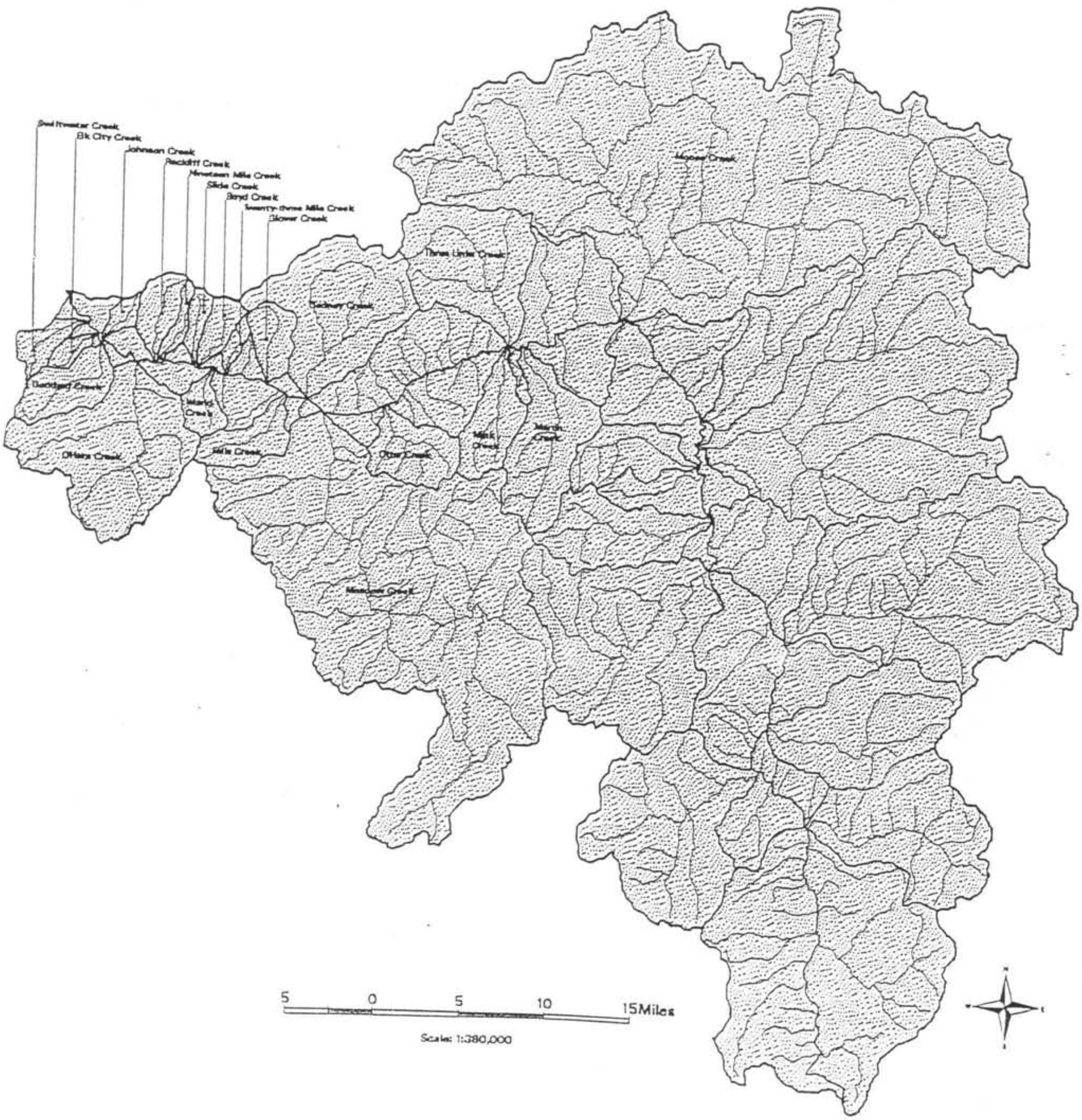
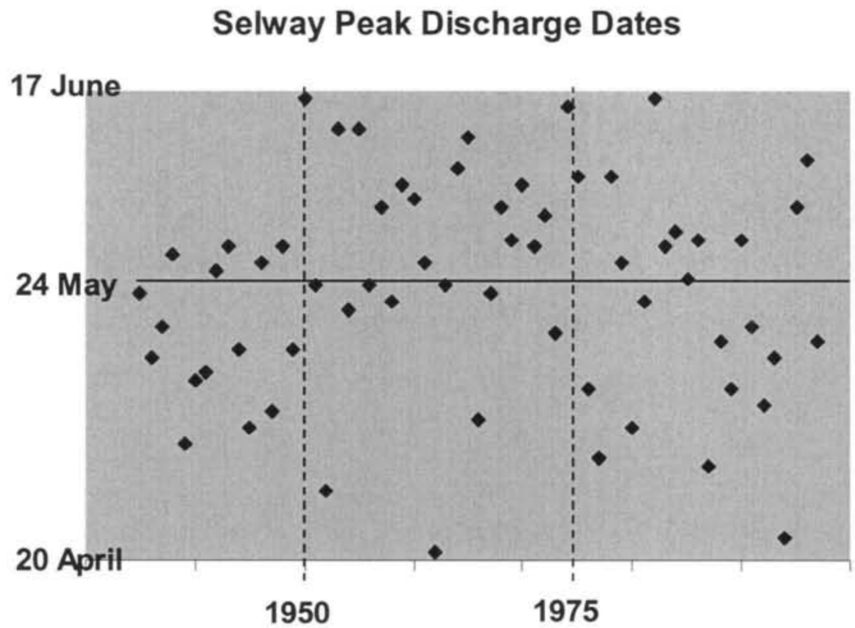


Figure 9. Timing of discharge peaks from 1935 to 1997



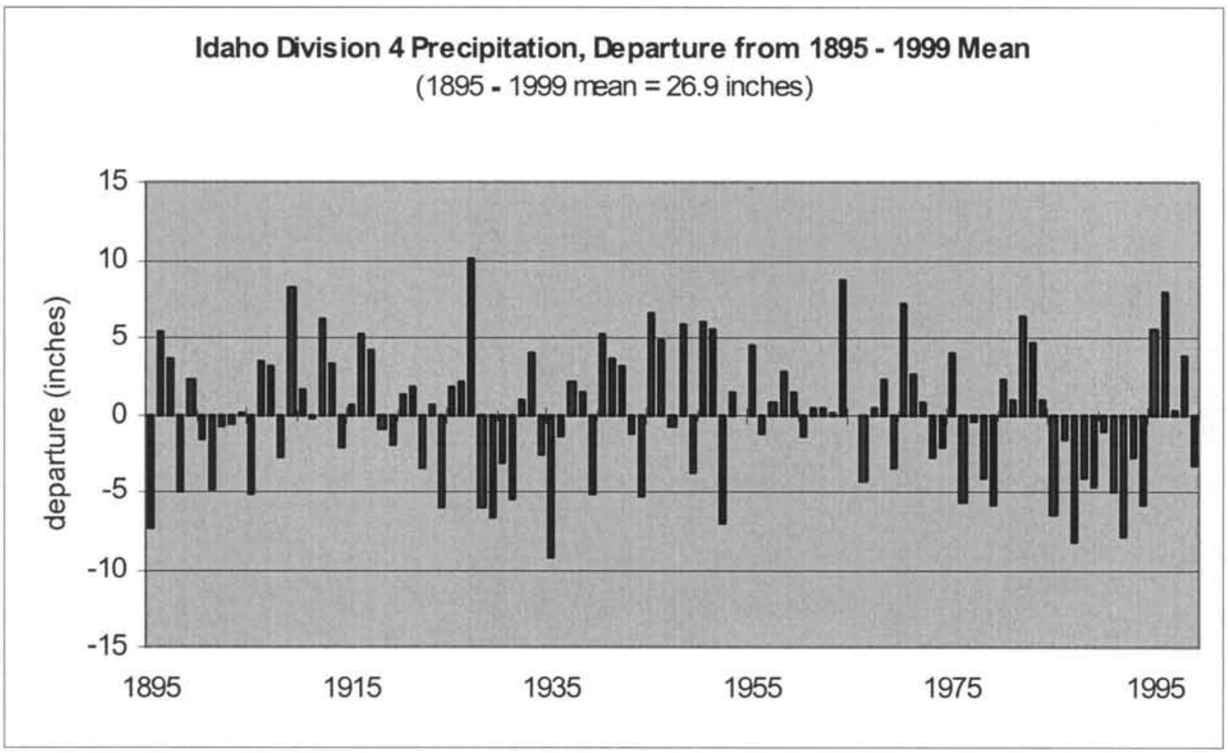
One hypothesis to explain these observations developed in the Lochsa River Subbasin Assessment was that the forest practices used during the 1951 to 1974 period may have caused peaks to occur later than during the previous, unmanaged, period. These data, from the largely unmanaged Selway subbasin, mimic those of the adjacent Lochsa subbasin. The similarity of the Lochsa and Selway data support the alternate hypothesis presented in the Lochsa River Subbasin Assessment to explain the observed changes in peak timing. The alternate hypothesis is that the shift to an earlier peak from 1975 to 1995 is caused by climatic variation, as seen in Division 4 monthly mean temperature for these periods (Bugosh, 1999). Table 2 shows that the Division 4 1951 to 1974 monthly mean spring temperatures are lower than the preceding and following periods. Cooler spring weather may explain the later peaks during 1951 to 1974.

Table 2. Unit 4 monthly mean temperatures in degrees Fahrenheit (^{o}F) and mean discharge (cfs) at peak for period

Period	March	April	May	Mean peak discharge
1935-1950	31.6	41.0	49.8	26,488
1951-1974	30.3	39.3	48.8	29,679
1975-1995	34.8	42.5	50.0	24,038

Analysis of the peak discharges for these periods shows that the average discharge for the 1951 to 1974 period was 12 percent greater than the preceding period and almost 23 percent greater than the following period. These data further support the alternate hypothesis because cooler conditions are generally wetter also. The shifts in temperature and rain and snow precipitation are also recorded in the data presented in Table 1 and Figures 5 and 7 (p. 10, 12, 13). Figure 10 below displays the Idaho climatic division 4 precipitation as departure from the mean for the period of record, which spans the twentieth century. The drier, wetter, and drier shifts during the twentieth century are apparent in Figure 10. The precipitation and temperature shifts that contributed to the change in peak timing for the 1935 to 1995 discharge record can also be seen in Figures 5.a. & b. The climatic division 4 record shows the shift to below-average temperatures and above-average precipitation beginning in the 1940s and running through the mid-1970s. How these climatic shifts affect the subbasin hydrology, sedimentation regime, and natural range of sedimentation is discussed in greater detail in section 3.0. below.

Figure 10. Precipitation displayed as departure from 1895 to 1999 period-of-record mean



Thirteen geothermal springs are known to occur in Idaho County. They range from 41 to 59^0 C, are distributed over a large area, and are not limited to one locality or rock type. Most geothermal springs issue from granitic rocks or a granitic contact, and all are associated with known faults or linear features (Idaho Department of Water Resources, 1980). The igneous and metamorphic rocks that underlie the entire subbasin can be assumed to have secondary permeability, i.e., fracture permeability, for ground water flow. Table 3 lists information about the four recorded geothermal springs in the subbasin.

Table 3. Characteristics of geothermal springs in the Selway River subbasin

Name	Rock Type	Temp. (^{0}C)	Discharge (gpm)	Number of Vents
Running Springs	Quaternary Alluvium near Granitic	41	70	5
Marten	Granitic	no data	no data	no data
Stuart	Granitic	49	no data	no data
Prospector	Granitic	no data	no data	no data

The first three are on a lineament that extends north to Stanley hot springs in the contiguous Lochsa River subbasin. The lineament that joins these four springs has been called the "best defined arcuate trend in the region" (Idaho Department of Water Resources, 1980). Based on: 1) the observed lineation in the subbasin that may be associated with faulting or fracturing, 2) the assumption that ground water must flow via fracture permeability, and 3) the string of geothermal springs along the lineation, assuming that there is a geothermal component to stream baseflow in the subbasin (besides these surface discharges) is reasonable.

The portion of the Selway subbasin for which geologic maps have been produced seems to have a lower fault density than the contiguous Lochsa River subbasin, especially near the subbasin mouth where the lower Selway subbasin assessment streams are. None of the recorded geothermal springs are in the lower Selway River subbasin. Because known geothermal springs are all associated with faults or linear features, there may be a smaller proportion of geothermal baseflow component in the Selway River subbasin as compared to the Lochsa River subbasin.

Additional information about stream characteristics of 303(d) listed streams in the subbasin is in Section 4.0. below.

1.2. Biological Characteristics

This section summarizes the typical terrestrial vegetation and aquatic life in the subbasin.

1.2.1. Terrestrial Vegetation

The subbasin is dominated by coniferous forest vegetation. Western red cedar, Engelmann spruce, and grand fir are common tree species. Ponderosa pine and Douglas fir are found in drier areas. Alder, cottonwoods, birch, mountain maple and mixed forbes and shrubs have reforested some areas subjected to severe forest fires.

Forest fires have affected the distribution and types of vegetation in most of the subbasin during the last 100 years. The Nez Perce forest estimates that about half of the timber stands show evidence of one or two underburns before a stand replacing fire occurred. Stand replacing fires are estimated to occur at 200 year or greater intervals south of the Selway River and more frequently north of the river. Steep south aspect slopes have the most frequent mean fire return interval at 10 to 20 years, but these are typically lower severity fires. Loss of root strength and increased water yield after fires can exacerbate slope instability, particularly where soils are thin, and deliver sediment to streams via debris flows (USDA, 1995).

Man-caused fires were described by early western explorers, for example:

> *"The Columbia Basin landscapes Lewis and Clark saw were richly peopled. They were also managed by indigenous people, who took action to maintain the natural resources they relied on. Some of these actions were symbolic - returning the first salmon caught in the spring to the river so that more would follow - and some were pragmatic - setting fires to create clearings for huckleberries and other important food plants."* (Hollenbach and Ory, 1999)

Forest fire history records show that 93 percent of the lower Selway River subbasin burned from 1884 to 1934. Especially large fires burned in 1910, 1919, and 1934. Because some drainages burned two to three times between 1910 and 1934, forest succession there has been retarded and seral shrub fields still replace trees in 25 percent of the subbasin. The effect of these fires on natural sedimentation in the lower Selway subbasin has been correspondingly large. Fire is now used as a management tool. From 1964 to 1994 fourteen times as many acres were subject to prescribed burns (12,807 acres) as were burned by wildfire (911 acres)(USDA, 1995).

1.2.2. Aquatic Life

The following game fish may be found in the subbasin.

Common Name	Taxonomic Nomenclature
brook trout	*(Salvelinus fontinalis)*
bull trout	*(Salvelinus confluentus)*
chinook salmon	*(Oncorhynchus tshawytscha)*
coho salmon	*(Oncorhynchus kisutch)*
mountain whitefish	*(Prosopium williamsoni)*
rainbow trout	*(Oncorhynchus mykiss)*
steelhead	*(Oncorhynchus mykiss)*
westslope cutthroat	*(Oncorhynchus clarki lewisi)*

Common Name	Taxonomic Nomenclature
mottled sculpin	*(Cottus bairdi)*
Paiute sculpin	*(Cottus beldingi)*
shorthead sculpin	*(Cottus confusus)*
pikeminnow	*(Ptychocheilus oregonensis)*
redside shiner	*(Richardsonius balteatus)*
longnose dace	*(Rhinichthys cataractae)*
speckled dace	*(Rhinichthys osculus)*
sucker	*(Catostomus ?)*
Pacific lamprey	*(Entosphenus tridentatus)*

More detailed summaries of fish species present during in-stream sampling events in the subbasin are presented later in Section 3.3. in Table 6 (p. 36-37), and in Section 4.1.

Several varieties of herptofauna are known or suspected to inhabit the subbasin including, Coeur d'Alene salamander, Pacific giant salamander, garter snake, rattlesnake, western toad, Pacific chorus frog, and tailed frog (DEQ, 1996)(USDA, 1999).

The aquatic macroinvertebrate assemblage includes Ephemeroptera, Plectoptera, Trichoptera, Coleoptera, and Diptera. The 1996 Beneficial Use Reconnaissance Project data suggest that most of the macroinvertebrates sampled basin-wide are Ephemeroptera, Plectoptera and Trichoptera (DEQ, 1996). These genera are generally indicators of good water quality.

1.3. Cultural Characteristics

This section describes present land ownership and principal land uses in the subbasin.

1.3.1. Land Ownership

Total subbasin acreage	106,977
United States lands managed by USFS	105,916
Private lands (all within Wild and Scenic River corridor)	864
State land (all in Swiftwater Creek drainage)	197

Treaties reserved to tribes' access to lands outside reservation boundaries for activities such as hunting, fishing, and gathering in "usual and accustomed" places.

1.3.2. Land Use

Resource commodities that support commercial activities are timber, grazing, firewood, berries, minerals, and wildlife. Five active and one inactive livestock grazing allotments are in the subbasin (USDA, 1999).

As of 1995, timber harvest had occurred on 8,098 acres with an associated 1,070 acres of disturbance for 214 miles of access roads. This represents 8.6 percent of the subbasin. Logging still plays an important role in the economies of the communities surrounding the subbasin (USDA Forest Service, 1999) (Idaho Department of Commerce, 1997). In 1962, U.S. Highway 12 was completed, connecting Lewiston with Missoula and providing all weather access to the subbasin for timber harvesting and recreational activities.

The 1964 Wilderness Act identified the northeastern-most portion of the subbasin as part of the Selway-Bitterroot Wilderness area. These designated wilderness lands constitute about 10 percent of the subbasin. These lands are now used mainly for nonmotorized recreational activities. The area's wilderness and Wild and Scenic River designations may attract recreationists.

Recreational activities include fishing, kayaking, canoeing, rafting, swimming, hunting, camping, mountain biking, wildlife and scenery viewing, winter sports, motorcycling, and hiking. Developed campgrounds at O'Hara, Rackliff, Boyd, and Glover Creeks receive heavy use from Memorial Day through Labor Day. Upstream recreation draws users through the lower Selway River subbasin. Whitewater rafting on the upper Selway River is limited to 1,248 people from 15 May through 31 July. An early elk hunting season in the upper Selway River and Meadow Creek areas attracts big game hunters from mid-September through late November.

The Selway River Road along the right bank receives relatively heavy use for wilderness area access. It is paved for 6.7 miles upstream from the river mouth and dirt surfaced for the remaining 12.8 miles. The USFS reports that average subbasin road density is 1.24 road miles per square mile, about 1.0% of the subbasin area (USDA, 1995).

2.0. WATER QUALITY CONCERNS

This section discusses the reasons that stream segments were placed on the 303(d) list, describes the applicable water quality standard, identifies potential sources of surface water pollutants, and describes past and present pollution control efforts.

2.1. Water Quality Limited Segments

The fifteen lower Selway River subbasin stream segments on the 1996 303 (d) list are:

Boyd Creek	Hamby Fork (upper)	O' Hara Creek (lower)
Elk City Creek	Hamby Fork (lower)	Rackliff Creek
Falls Creek	Island Creek	Slide Creek
Glover Creek	Nineteenmile Creek	Twentythreemile Creek
Goddard Creek	O' Hara Creek (upper)	Wart Creek

Twelve of the segments on the 1996 303 (d) list were not retained on the 1998 303 (d) list that DEQ submitted to EPA in January 1999. The 1998 303 (d) list includes Island Creek, Slide Creek, and O'Hara Creek (lower) in the lower Selway River subbasin (DEQ, 1999).

The fifteen tributary segments on the 1996 303(d) list occur in thirteen tributary watersheds. The tributaries were listed as not meeting the state sediment criterion. In each case, the basis for listing the stream as not meeting the Idaho sediment criterion was because USFS modeling had estimated that the basin's sediment production exceeded forest standards or that another USFS sedimentation indicator, like cobble embeddedness, exceeded a USFS "Desired Future Condition." The Idaho sediment criterion requires that sediment quantities not impair designated beneficial uses, which for cold water biota is *protection and maintenance of viable communities of aquatic organisms and populations of significant aquatic species which have optimal growing temperatures below eighteen (18) degrees C* and for salmonid spawning is providing *a habitat for active self-propagating populations of salmonid fishes.*

2.2. Applicable Water Quality Standards

The Idaho general surface water quality criterion for sediment (IDAPA 16.01.02.200.08) relevant to the 303(d) listings in the subbasin is

> *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.* [Subsection 350.02.b. describes nonpoint source restrictions when water quality criteria are not being met, but does not add any specific sediment criteria.]

2.3. Pollutant Source Inventory

This section lists potential sources of surface water pollutants in the subbasin. The pollutants cited as causing exceedance of water quality standards in the 303(d) listing of subbasin streams are discussed in detail. The section also discusses where additional data can help clarify questions about pollution and maintenance of state water quality standards in the subbasin.

2.3.1. Lower Selway Subbasin Pollutant Source Inventory

Pollutant sources may occur as point sources, those for which effluent limitations (i.e., discharge permits) may be required under sections 301(b)(1)(A) and 301(b)(1)(B) or nonpoint sources of pollutants that are not subject to effluent limitations.

The Fenn Ranger Station administration area generates a point source pollutant discharge from its sewage treatment plant. The discharge is regulated by the U.S. Environmental Protection Agency that sets effluent limits for biochemical oxygen demand, coliform bacteria, pH, residual chlorine, and suspended solids and requires monitoring to verify compliance with the limits (USDA, 1999).

Nonpoint pollution sources that can affect sediment discharges in the lower Selway subbasin include forest management and forest road activities, the Fenn Ranger Station administration area, recreational activities, livestock grazing. Mining activities are not presently conducted in the subbasin. The precise pollutant contributions from each of these nonpoint sources to the subbasin are unknown. These sources create a portion of the total subbasin sediment load described in sections 3.0., 3.1., and 3.2. below.

The Nez Perce National Forest and timber companies conduct forest management activities including road building, timber thinning and harvesting, fertilizing, and fire suppression that may result in increased erosion and sedimentation. Ongoing timber harvest in the subbasin is occurring in the Swiftwater, Goddard, and O'Hara Creek watersheds (USDA, 1999).

The Fenn Ranger Station would be expected to produce a small, localized increase in storm water discharge because of the increased low permeability surface areas of pavement, hard-packed dirt surfaces, and building roofs.

Recreational activities in the subbasin may contribute to erosion and sedimentation. They include picnicking, hiking, camping, hunting, horseback riding, bicycling, off-road vehicle use, fishing, kayaking, canoeing, rafting, swimming, cross country skiing, snowmobiling, and scenery and wildlife viewing. These activities may be carried on by occasional users or professional outfitters.

Grazing activities that may contribute to riparian area denudation and the sediment load within the subbasin are relatively few and small. They include short-term, site-specific grazing of pack and saddle stock, minor domestic livestock grazing mostly on private lands, and five active grazing allotments. Four active allotments with approximately 55 to165 cow/calf pairs are in the uppermost areas near the southern watershed divide. The Fenn Ranger Station corral and pastures hold 35 to 40 horses and mules near the Selway River. Recently, the Elk Creek and Lick Creek allotments were grazed by about 33 cow/calf pairs and the Hamby Creek allotment had 25 cow/calf pairs. The Clear Creek/Tahoe allotment is authorized for up to 110 cow/calf pairs, but actual use has not been monitored The Glover Ridge allotment in the Glover Creek watershed is inactive (USDA, 1999).

Landslides are important sedimentary processes in the subbasin. The combination of readily weathering crystalline rocks that yield non-cohesive soils on steep slopes, fire-damaged soils that have not been able to reforest, and warm Pacific air masses flowing up the valley that can cause rain on snow events, can result in significant landslides. These rain-on-snow events were first recorded in 1919 and have recurred in 1933, 1948, 1964, 1974, and 1995/1996. Aerial photos document that most of these events affected both the Lochsa and Selway River basins similarly (USDA, 1999). Forest management activities have been shown to increase the numbers of landslides.

For example, 907 landslides were documented in the winter of 1995 and 1996 in the contiguous Clearwater National Forest. The USFS determined that about two-thirds of these were related to management activities and about one-third were natural: 58 percent were road-related, 12 percent were associated with timber harvest, and 29 percent were natural. These findings are similar to those for the major landslide event in 1974, which was also triggered by rain on snow, but the more recent event is estimated to have produced twice the sediment volume. Total sediment volume, rather than number of slides, may be more relevant to water quality. The best available data estimate that the sediment volume delivered to streams was apportioned as follows: 25% from roads, 4% from timber harvest areas, and 71% from natural landslides. For example, two of the 907 landslides resulting from the 1995-1996 rain-on-snow events produced 38 percent of the sediment volume delivered to streams. One of these two landslides, the No-see-um Creek debris flow, occurred in the Lochsa subbasin. The No-see-um Creek watershed is unroaded and unmanaged. This natural landslide transported approximately 100,000 cubic yards of sediment into the Lochsa River. That volume is 25 percent of the estimated volume delivered to streams from all 907 landslides in the Clearwater National Forest in 1995-1996 (McClelland, et al., 1997).

2.3.2. Lower Selway River Subbasin Pollutant Source Data Gaps

Invasive, non-native plant species, such as spotted knapweed, may affect soil and water conservation. The effect on water quality of non-native plants is unknown.

2.4. Summary of Pollution Control Efforts

This section describes some past and present pollution control efforts in subbasin watersheds. Its scope is limited to those efforts that could control sediment, the parameter of concern identified in the 1996 303(d) list.

2.4.1. Past Pollution Control Efforts

The Idaho Forest Practices Act was codified during the mid-1970s to comply with Section 208 of the federal Clean Water Act. The Forest Practices Water Quality Management Plan identifies the Rules and Regulations Pertaining to the Idaho Forest Practices Act as best management practices (BMPs) to be used during forest practices, e.g., logging, to protect surface water quality. Espinosa *et al.*(1997) describe estimated sediment delivery in the Clearwater National Forest above USFS management plan goals from the 1950s through the 1970s, but noted, *"The awareness of watershed and habitat degradation problems helped to initiate a moderation of timber and road construction impacts in the early 1980s."* On-site audits of project compliance with the Forest Practices Act are conducted. Because of these audits, BMPs have been revised to promote better water quality protection (Idaho Department of Health and Welfare, 1993) (USFS, 1998).

2.4.2. Present Pollution Control Efforts

Erosion and sedimentation control has been the subject of many recent efforts in the subbasin. A fishery's improvement project, to rectify problems created by a 1980's project, for the lower five miles of O'Hara Creek started in the summer of 1999. The USFS has an ongoing program to control pollution associated with forest practices. Fire prevention, suppression, and management activities are conducted by the Forest Service in ways developed to minimize water pollution. Prescribed burns proposed for area between Twentythreemile and Gedney Creeks will be away from riparian and landslide-prone areas.

In 1997 the USFS completed a study of the 1995-1996 subbasin landslides and made recommendations to reduce slides associated with forest management. One management directive that resulted from these recommendations was a project to identify, and either abandon or obliterate, roads with high failure risk. A contract was awarded in 1998 to obliterate and recontour two roads in the head of the Goddard Creek watershed during 1999. The Forest Service plans to continue obliteration of roads with a high potential to fail and deliver sediment to streams. Work is planned for the Hamby Creek watershed in 2000 (Gerhardt, 2000).

An interagency agreement has created minimum stream buffer zones for protection of anadromous (PACFISH) and inland (INFISH) fish species. These measures that are more restrictive than those in the Idaho Forest Practices Act, are being used by the Forest Service in the subbasin. The USFS audits implementation of the Forest Practices Act using an interagency team. Sections 3.1. and 4.0. document how these efforts have kept sediment loads to subbasin streams in compliance with the Idaho water quality standards.

Recreational sites are maintained to minimize erosion and sedimentation. Besides regular maintenance, the Selway corridor recreational site rehabilitation and Rackliff trail reconstructions were scheduled for 1999. The Forest Service issues special use permits to outfitters and guides operating on Nez Perce National Forest lands. The permits address camp locations, camp operations, maximum number of stock and areas grazed, and number of clients present during the designated period. The Forest Service conducts camp inspections to verify permit compliance (USDA, 1999).

The Forest Service operates the Fenn Ranger Station administrative area in the lower Selway subbasin. As described in section 2.3.1. above, the facility is regulated by an NPDES wastewater discharge permit. A silt fence was installed downslope of the facility's pasture in early 1999 and the Forest Service is evaluating alternate pasture sites that are not in the riparian area (USDA, 1999).

Grazing allotments are monitored by the Forest Service, compliance with restrictions on stream bank disturbance and riparian shrub use is verified, and PACFISH grazing standards are used (USDA, 1999).

3.0. WATER QUALITY STATUS

This section presents and discusses various data used to evaluate water quality status compared with the state sediment criterion. Sediment transport, biologic assessment, fish data, and data gaps are discussed. A brief discussion here about how these streams were listed as water quality limited because of sediment will help the reader understand the conclusions and recommendations presented later.

The fifteen stream segments in the subbasin were added to the 303(d) list because they did not meet a Forest Service management goal called a "Desired Future Condition," not because they had been shown to fail to support their designated beneficial uses and exceed the state water quality criterion. Idaho's water quality standards do not incorporate or reference these "Desired

Future Conditions" or the models the Forest Service uses to measure progress toward these management goals. Forest Service model results or evaluations of progress toward a "Desired Future Condition" should not be used to establish compliance with state water quality standards.

The Nez Perce National Forest states that, *"The fish/water quality objectives are based on the concept of potential . . . It is recognized that fish habitat quality changes over time under natural conditions. Thus a stream unaltered by human activities may or may not be at its natural potential at any point in time. The natural potential for any given habitat variable is a theoretical or measurable optimum condition for that variable considering natural cycles of disturbance and recovery. The Forest Plan fish/water quality objectives are not really objectives in the sense that they are targets to be attained* (USDA, 1995)."

These "Desired Future Conditions" do not correspond to the state water quality sediment criterion that is based on support of beneficial uses. "Desired Future Conditions" are a Forest Service management tool that may set internal goals, objectives, and standards different from state and federal water quality standards, but they are not the state water quality standards approved under the Clean Water Act.

Background Stream Sedimentation

The Protocol for Developing Sediment TMDLs (US EPA, 1999) notes that *"it is important to have a basic understanding of sediment processes in a watershed and how excessive or insufficient sediment can affect water quality and designated uses of water."* Two important ideas emerge in this quotation; 1) watershed specific sedimentation varies within a range and 2) the concern is for sedimentation outside this range that makes water quality unable to fully support designated uses of the water.

According to the EPA (1999) protocol, *"Because erosion is a natural process and some sedimentation is needed to maintain healthy stream systems, it is often necessary to evaluate the degree to which sediment discharge in a particular watershed exceeds natural rates or patterns."* The rock, soil, and natural processes that define the natural erosion and sedimentation processes in the subbasin have been discussed in sections 1.1. and 1.2.1. Those discussions address a point that the EPA (1999) protocol emphasizes: *"This type of analysis is particularly important in settings that are vulnerable to high natural sediment production rates and are particularly sensitive to land disturbance (e.g., the Pacific Northwest . . .)."*

The physical characteristics described in section 1.1., rocks, mineralogy, geologic structure, topography, soils, temperature patterns, and precipitation combine to create conditions favorable for mass wasting processes. The fire history has affected the amount of root binding of soil and the runoff and infiltration characteristics in the subbasin. The rain-on-snow events that trigger mass wasting, usually as debris flows, have recurred at about a 15-year interval since first recorded in 1919. Other controls on subbasin sedimentation have not occurred as regularly during the period of record. Notably the fire history has varied widely and the temperature and precipitation regime was cooler and wetter for approximately 23 years. These variations led to larger scale changes in sedimentation rates onto which the 15-year mass wasting events have been superimposed.

Those larger scale changes in twentieth century sedimentation rates were not confined to the lower Selway subbasin, but were the norm across the western United States. An excellent review of recent (Holocene) alluvial valley development is provided by Dunne and Leopold (1978). Geomorphic study of stream valleys in the western United States, augmented by radiocarbon dating and pollen profiles, has confirmed that climate has been the driving force in alternate cycles of aggradation (deposition) and degradation (erosion) in the recent geologic past. Those studies have shown that modern gully downcutting in the western United States began about 1880 to 1900 because of an increase in the intensity of summer storms and stock grazing (Leopold, 1951). At about the turn of the century, a warming trend began and persisted until about the 1940s. *"The warmest years in the United States occurred during the dust bowl era, with 1934 being the warmest year* (NASA, 2000)." Recent analyses of tree-ring data for North America show that, although the most severe prolonged drought in the last 500 years occurred in the 16th century, *"tree ring reconstructed drought during the 1930s exceeded the 16th century droughts only in the Pacific Northwest and western Canada* (Stahle, et al., 2000)." Consequently, an extremely large and hot fire burned in the lower Selway River subbasin in 1934, exposing slopes to erosion and mass wasting processes. A climatic shift toward cooler and wetter conditions began in about 1945 in most of the United States (Broecker, 1975). These interpretations are further supported by ice-core data using O^{18} ratios (Johnsen et al.,1970). The data showing that these changes occurred in the lower Selway River subbasin have been presented in sections 1.1.4. and 1.1.5 above.

The change from erosional to aggradational conditions then was observed in channel cross sections before it was evident in the climatic record (Leopold, Emmett and Myrick, 1966; Leopold and Emmett, 1972).

> *"There is also visual evidence in many places in Wyoming, Colorado, and New Mexico that gully floors that were bare of vegetation in the 1940's were green and often moist in the 1970's . . . Gullies eroding during the first half of the century have begun to aggrade or fill . . . The totality of these observations shows clearly that the relations among rainfall, runoff, vegetation, and sediment altered, creating at times a condition in which more sediment was eroded from the landscape than could be carried through the valley by the available water* (Dunne and Leopold, 1978)."

Those changing conditions are documented in the lower Selway River subbasin in the most extensive survey of anadromous fish habitat Idaho Fish and Game has ever conducted in the subbasin. In 1962,

> *Except for a few miles, the Selway River drainage is a wilderness area of 1,910 square miles . . . Extensive forest fires that occurred between 1889 and 1945 ranged over 826 square miles or about 38 percent of the Selway drainage . . . The fires have had a detrimental effect on the potential of spawning streams. Rapid snowwater run-off,*

*resulting from the lack of moisture retaining vegetation, has resulted in **erosion deposits of decomposed granite and silt in many of the stream bottoms within the basin area. Sediment and stream gravel have built up behind lodged debris*** (Emphasis added.) (Murphy and Metsker, 1962).

Those conditions began to change again around 1975 and, except for a few interruptions, the climate for the remainder of the twentieth century returned to the warmer and drier conditions characteristic of the early part. The available information shows that for more than the last 100 years, the subbasin sedimentation conditions were similar to those existing presently and that a period of aggradation (sediment deposition) occurred from about 1950 to 1975. Understanding these natural background sediment processes in the watershed is necessary to *"evaluate the degree to which sediment discharge in a particular watershed exceeds natural rates or patterns* (US EPA, 1999)."

3.1. Water Column Data

The Nez Perce National Forest collects minimal sediment data in the lower Selway River subbasin. It operates sediment traps in Horse Creek and East Fork Horse Creek in the Meadow Creek drainage. The traps are in the stream channels downstream of flumes.

The Nez Perce National Forest's 1995 Biological Assessment compared USGS data about suspended sediment samples collected from the Selway River near the mouth of O'Hara Creek with suspended sediment concentrations modeled using NEZSED. The USGS analysis is based on 52 samples collected during the 1988 through 1992 spring runoffs. Suspended sediment statistics for those samples include:

Mean concentration	8.6 mg/L
Median concentration	4.7 mg/L
Range	0.8 - 51.0 mg/L
Standard Deviation	10.16

These values are very low, and similar to the adjacent Lochsa River that was sampled at the same times. The Lochsa River's mean concentration was 7.3 mg/L and its range was 1.1 to 36.0 mg/L.

The Nez Perce National Forest compared Selway River sediment yield values calculated from the USGS data (53,900 tons per year) with values estimated by its (USDA, 1981) R1/R4 sediment yield guide (56,800 tons per year). The modeled values were within about 5 percent of the values calculated from the suspended solids sample data and streamflow rating curves. The total values from either calculation are very low.

The USGS sediment versus discharge rating curve method does not provide for separation of natural and management-induced sediment. The Nez Perce National Forest uses its version of the R1/R4 sediment model, NEZSED, to evaluate surface erosion risk from road construction and timber harvest. The NEZSED model predicts sediment yields from roads, logging, and man-caused fire, but does not model mass wasting greater than 10 cubic yards. Using the NEZSED model, the Forest Service estimates that management activities increase sediment yields by about 632 tons per year over natural, or about 1 percent over natural background.

The contiguous parts of the Lochsa River subbasin share rock, soil, and natural process types with the Selway River subbasin. The discussion that follows will focus on how sedimentation has been documented to vary in different stream reaches in the Lochsa River subbasin. In 1997, the Clearwater National Forest analyzed 2,700 suspended sediment and 20 bedload samples. The USFS presently monitors only suspended sediment in the Lochsa River subbasin. Table 4 summarizes these data for the subbasin streams close to the lower Selway River subbasin, which are for suspended sediment only. The sediment monitoring data in Table 4 show that the average suspended sediment concentrations in all streams for the period of record are low.

Table 4. Summary of USFS discharge and suspended sediment data for Lochsa River subbasin streams similar to lower Selway River subbasin streams

Creek	Period of Record	Average Discharge & Suspended Sediment through 1996		1997 Discharge & Suspended Sediment	
		(cfs)	(mg/L)	(cfs)	(mg/L)
Canyon	92-97	36.8	11.0	92.5	34.1
Deadman	80-97	44.0	7.6	62.1	23.1
Pete King	76-97	45.5	32.7	58.5	52.1

Additionally, the landslides discussed in Section 2.3.1. occurred throughout the subbasin during the 1995-1996 winter and provided fresh sediment to the streams. The 1996 and 1997 record setting precipitations combined with the sediment from the 1995-1996 landslide activity explain the rise in suspended sediment concentrations in the subbasin in 1997. This sediment pulse is expected to subside, as happened following the 1974, 1975, and 1976 period, and sediment concentrations will approach the average concentrations with the return of more normal climatic conditions.

Direct acute effects of suspended sediment on adult fish may not be seen until concentrations are in the 1,000 to more than 10,000 mg/L range (Waters, 1995; Everest, et al., 1987; Newport and Moyer, 1974; Wallen, 1951). Chronic exposure to suspended sediment has been shown to significantly affect the percent of egg-to-fry survival of rainbow trout; survival dropped below 30 percent at about 1,000 mg/L-day (Slaney, et al., 1977). The US Environmental Protection Agency considers impairment of an aquatic habitat or organisms by total suspended solids probable when concentrations are greater than 100 mg/L, possible when concentrations range from 10 to 100 mg/L, and improbable when concentrations are less than 10 mg/L (Mills, et al., 1985). Some macroinvertebrate taxa, including species of Plecoptera and Ephemeroptera, have been shown to be very sensitive to chronic exposure to suspended sediment, leaving soon after unacceptable sediment levels are reached. For example, populations of Ephemeroptera unacceptable sediment levels are reached. For example, populations of Ephemeroptera disappeared when exposed to greater than 29 mg/L suspended sediment for 30 days (M.P. Vivier, personal communication in Alabaster and Lloyd [1982]). This is one reason Idaho's DEQ studies these macroinvertebrate taxa, as mentioned above in section1.2.2.

These sediment monitoring data are consistent with the findings of Idaho's Beneficial Use Reconnaissance Project, further described in Sections 3.2. and 4.0., that confirmed that the stream's beneficial uses are being met and, consequently, that Idaho's narrative sediment criterion is not being exceeded.

3.2. Other Water Quality Data

Cobble embeddedness, though not a water quality parameter, is discussed here because the USFS uses cobble embeddedness to gauge the effect of bedload (Jones and Murphy, 1999). The Forest Service sets levels of cobble embeddedness to correspond to a "Desired Future Condition" for streams. Cobble embeddedness refers to the percentage of a larger stream bed particle's horizontal axis as it lies in the streambed surrounded by less than 6.4 millimeter particles. The Nez Perce and Clearwater National Forests use a set of desired future condition tables to list for fish habitat potential. Some USFS surveys identify high levels of cobble embeddedness as a factor limiting fish habitat potential on some streams in the subbasin.

Many of those using cobble embeddedness to evaluate stream bed sedimentation have reported results that confounded conclusions. The Clearwater National Forest evaluated cobble embeddedness in the contiguous Lochsa subbasin and compared those levels to fish populations with important results. They found that *"The highest sediment levels documented were in Post Office Creek, an unmanaged drainage.* (Emphasis added.)*"* And that *"Managed streams were not more heavily embedded than unmanaged streams . . . One of the more noteworthy findings was the stream with the highest levels of sediment (Post Office Creek) had some of the highest fish densities."* The study in the subbasin compared cobble embeddedness and fish populations and found, *"Relationships between fish populations and sediment levels were evaluated and were not interrelated* (Parker, Lee, and Espinosa, 1989).*"* DEQ made an observation in the lower Selway River subbasin similar to that made by the Clearwater National Forest on Post Office Creek; during its October 1999 fish sampling of Island, Slide and O'Hara Creek, DEQ observed the highest sediment levels in the stream reach (Slide Creek) with the highest catch per unit effort. When reviewing cobble embeddedness sampling methods Burton and Harvey (1990) noted that, *"Percent embeddedness is highly variable in space and time and its measure can be influenced by the location of sediment within the substrate matrix."* Huntington (1995) compared cobble embeddedness within managed and unroaded landscapes in the Clearwater National Forest and reported that, *"For all channel types and treatments, at least a small number of reaches on the CNF exhibit either extremely high or relatively low cobble embeddedness."* Analysis of recent embeddedness measurements by the Bureau of Land Management on the South Fork Clearwater River *". . . ranged from 23% to 40% in four years sampled between 1993 and 1998, with a high degree of variability among samples within years* (Huntington, 1999)."

The Nez Perce National Forest cautions that, *"Although there is no assurance that any specific Nez Perce stream ever reached or could reach all of the numeric values specified in the DFC tables, or that some of the values may have been exceeded in some streams at some time in the past, the existing DFC tables will continue to be used until numeric values more reflective of local topography, geology, precipitation, and riparian vegetation are developed* (USDA, 1999). *"* Similarly, the Clearwater National Forest found that only one of nine streams the Forest Service surveyed in 1997 had cobble embeddedness levels that met its "Desired Future Conditions" and concluded that *"although these levels are higher than the desired conditions, the extent the levels are within or outside natural conditions have not been finalized* (USFS, 1998)."

Consideration of characteristics of the cobble embeddedness measurements and stream characteristics may help to improve interpretation of these data. Cobble embeddedness is neither suspended sediment nor bedload, which are, by definition, particles in transport by the stream. Cobble embeddedness is a field expedient estimate of stream bed particle sorting. Burns' (1984) proposed protocol measured the amount of fine sediment deposited around larger stream particles in a specific fish habitat. Other protocols measure cobble embeddedness in all parts of the stream bed (Burton and Harvey, 1990). Cobble embeddedness may result wherever, and whenever, a stream loses competence (the ability to carry its sediment load). For example, a stream may be expected to have lower competence in eddies, such as those formed by large woody debris and rocks, or where channel gradient abruptly decreases. A stream's competence may also vary with diurnal hydrograph fluctuations, in the waning flows after peak discharge, and because of other factors. The often confusing findings reported by workers trying to compare cobble embeddedness values among drainages, or at different times or places in a single stream, may be because the many factors that can affect stream competence (e.g., stream hydrograph, stream type, sediment particle size, sediment mineralogy, channel sediment storage, etc.) are not considered. Some studies have compared "unmanaged" with "managed" drainages with little consideration of these many variables that affect stream competence.

Considerations when interpreting cobble embeddedness data

Recent work by the Clearwater National Forest considers two of those variables, Rosgen channel type and discharge, as well as cobble embeddedness and may explain some of those confusing findings (Jones, 1999). The forest hydrologist has analyzed cobble embeddedness values from 1,152 unroaded reaches and 610 roaded reaches considering two of these variables: stream channel type and bankfull discharge. This work, summarized below in Tables 5.a. and 5.b., sheds some light on the cobble embeddedness values in the subbasin.

Channel Type

Table 5.a. Cobble embeddedness versus channel type in roaded and unroaded streams (*after* Jones, 1999)

Channel Type	Unroaded Cobble Embeddedness (%)	Roaded Cobble Embeddedness (%)	Percent Difference
A	28.7	36.1	+7.4
B	33.2	33.0	-0.2
C	54.7	46.0	-8.7
E	73.3	70.3	-3.0

The cobble embeddedness measurements were determined for streams in the Lochsa subbasin between 1989 and 1998. Table 5.a. shows that, when segregated by roaded versus unroaded and Rosgen stream channel type, cobble embeddedness values in roaded reaches were 7.4% higher in the A channel-type streams and lower in the B,C, and E channel type streams.

Huntington (1995) ". . . grouped E and G-type channels surveyed in 1993 with C and B-type reaches, respectively, because that is how those two types of channels were classified prior to 1993." While that approach is valid for the purpose of comparing the 1993 data to earlier data sets, its utility is limited for understanding and explaining variations in cobble embeddedness because such grouping will clearly skew the data. Cobble and pebble dominated G-type streams tend to be very unstable, while the same particle-sized B-type streams can be very stable (Rosgen, 1996). Similarly, the data displayed in Table 5.a. above (Jones, 1999) show that in the Lochsa subbasin E-type channels average greater than 70% embeddedness (whether roaded or unroaded), whereas C-type channels average about 20% lower embeddedness. These are reasons why groupings such as those Huntington duplicated would be expected to confound interpretation of the results. One could compare extremes of the range in Table 5.a. (e.g., 70.3 percent for roaded E-type channels versus 28.7 percent for unroaded A-type channels) and conclude that the difference was attributable to the roaded versus unroaded condition, when the difference in channel type explains more of the variation.

Discharge

Table 5.b. Cobble embeddedness versus bankfull discharge class in roaded and unroaded Streams (*after* Jones, 1999)

Bankfull Discharge Class (cfs)	Unroaded Cobble Embeddedness (%)	Roaded Cobble Embeddedness (%)	Percent Difference
0-20	40.9	46.2	+5.3
20-50	31.7	35.7	+4.0
50-150	26.2	28.6	+2.4
150+	19.2	19.6	+0.4

Table 5.b. shows that, when segregated by roaded versus unroaded and bankfull discharge class, cobble embeddedness values in roaded reaches were 5.3% higher in the smallest (0-20 cfs class) streams and had progressively smaller differences as discharge class increased. The greatest discharge class, greater than 150 cfs, showed only a 0.4% difference between roaded and unroaded streams. These data show that the difference in cobble embeddedness values between unroaded and roaded stream segments is slightly (5.3 versus 0.4 percent) higher in the smaller streams than in the larger streams. These data also show a far greater difference in cobble embeddedness values among all small streams and all large streams. For example, the zero to 20 cfs class' 46.2 percent cobble embeddedness value in roaded segments was only 5.3 percent greater than unroaded segments in that class, but was more that twice (236 percent greater) the 19.6 percent cobble embeddedness value of the greater than 150 cfs class.

These analyses of 1,762 stream reaches show that cobble embeddedness is elevated only in A-type roaded drainages when embeddedness values are segregated by stream type. Embeddedness is elevated in roaded drainages by 0.4 to 5.3 percent when embeddedness values are segregated by bankfull discharge class. One could compare the extremes of the range in Table 5.b. (e.g., 46.2 percent versus 19.2 percent by bankfull discharge class) and conclude that the difference was attributable to the roaded versus unroaded condition, when the more plausible explanation would be that this difference is largely attributable to the discharge class.

These results are consistent with those reported by Megahan (1982) who studied the effect of obstructions (rocks, logs, debris) on channel sediment storage. He reported that the numbers of obstructions and the volume of sediment stored in stream channels varied between basins and by years. Some of the difference between drainage basins was explained by a direct relationship to bankfull channel width. Bankfull channel width is a function of drainage basin area and is closely correlated with many stream size and discharge characteristics (Dunne and Leopold, 1978). The differences among years were inversely proportional to annual instantaneous peak discharge, i.e., higher discharge resulted in less channel sediment storage.

Consideration of how these factors affect embeddedness analysis is important. For example, because there are so many more 0-20 cfs class drainages (956) than 150+ cfs class drainages (184), averaging embeddedness values of these two classes would skew the results toward the higher values of the smaller class. As shown above, comparing cobble embeddedness values among roaded and unroaded reaches without considering discharge class can distort interpretations. Additionally, because cobble embeddedness is expressed as a percentage, the amount of sediment a given embeddedness value represents varies with the substrate particle size (i.e., 7.4 percent of 20mm = 1.5mm, 7.4 percent of 128mm = 9.5mm). In other words, the same percentage of embeddedness can refer to very different fine sediment thicknesses. One can see how analysis of cobble embeddedness that does not carefully consider relevant stream variables can lead to confusing conclusions.

Idaho determines if its narrative sediment criteria are met by surveying streams to verify if viable communities of aquatic organisms are present and if evidence of salmonid spawning exists in the stream. The Beneficial Use Reconnaissance Project (BURP) is a consistent scientific process used statewide for this purpose. BURP evaluations result in indices used to compare water quality with the standards to determine beneficial use support status. The Macrobiotic Index (MBI) is the first of the indices DEQ uses; supplemental information is used when needed to confirm beneficial use support status. A MBI of 2.5 or less indicates impairment, between 2.5 and 3.5 indicates that more information is needed to make a determination, and 3.5 or greater indicates that the use is not impaired. The state's procedure also specifies when to supplement the MBI with fish data, algal data, and habitat data in making these determinations. DEQ does not base its water quality status evaluations on BURP data alone, but uses all available and relevant data.

3.3. Fish Data

This section summarizes available salmonid fish data for streams in the lower Selway River subbasin. These data were compiled from Welsh(1964), Lindland (1975, 1976, 1977, 1978), Brostrom (1993, 1994, 1995), Idaho Department of Fish and Game (1997, 1998, 1999), and Stewart (1999a, 1999b, 1999c). Data are presented for chinook salmon (*Oncorhynchus tshawytscha*), steelhead (*O. mykiss*), mountain whitefish (*Prosopium williamsoni*), and westslope cutthroat trout (*O. clarki*). Available data for the streams on the 1998 303 (d) list, Island Creek, O'Hara Creek, and Slide Creek, are included, as well as those for the Selway River to which they discharge. No fish data were available for Boyd Creek, Elk City Creek, Falls Creek, Glover Creek, Goddard Creek, Hamby Fork, Nineteenmile Creek, Rackliff Creek, Twentythreemile Creek, or Wart Creek.

Table 6 (p. 36-37) presents several monitored species and the numbers of age classes of each that were found in the streams during field surveys. Juvenile fish and juveniles present with other age classes are indicators that successful spawning and rearing occur in the stream. These data further demonstrate that the subbasin water quality provides for protection, maintenance, and propagation of an indigenous fish population. In its most recent biological assessment, the Forest Service stated that,

> "*In the Selway subbasin, all streams with sufficient size and gradient which are accessible to fish in the mainstem river support steelhead juvenile rearing or spawning or both. Deposited sediment may have lowered the carrying capacity for juvenile rearing and the quantity and quality of spawning habitat in streams with high road densities* (USDA, 1999)."

When reading the Forest Service's tentative inference that streams with high road densities may have lowered carrying capacity, consider that the Forest Service stated, and the data in Table 6 and section 4.1. below show, that O'Hara Creek, which has some of the highest road densities in the subbasin, has water quality that is providing full support of salmonid spawning and cold water biota. Consider also that in 1958 Slide Creek was not considered to be of value to anadromous fish and Island Creek was *". . . considered to be of little value to anadromous fish."* (Murphy and Metsker, 1962), but today both streams have juvenile steelhead. These data support that water quality not only supports these uses, but has improved since 1958 in these subbasin streams.

Table 6.a. Summary of lower Selway River subbasin chinook salmon data
The chinook salmon data summarized in the table indicate that natural spawning and rearing occurs from the wild population. The natural spawning and rearing are supplemented by Nez Perce Tribe stocking (Cochnauer, 2000).

STREAM	HUC4	WBID	REFERENCE	YEAR	FISH	COUNT	AGE CLASSES
O'Hara Creek	17060302		Brostrom 1993	1993	juvenile chinook	6	
O'Hara Creek	17060302	3	Brostrom 1994	1994	juvenile chinook	3	
O'Hara Creek	17060302		IDFG 1997	1997	juvenile chinook	11	2
O'Hara Creek	17060302		IDFG 1998	1998	juvenile chinook	204	1
O'Hara Creek	17060302		IDFG 1999	1999	juvenile chinook	47	2
O'Hara Creek	17060302		Stewart 1999a	1999	chinook	2	1
Selway River	17060302		Welsh 1964	1964	juvenile chinook	17	1
Selway River	17060302		Lindland 1977	1973	juvenile chinook	209	
Selway River	17060302		Lindland 1977	1974	juvenile chinook	57	
Selway River	17060302		Lindland 1977	1975	juvenile chinook	49	
Selway River	17060302		Lindland 1978	1976	juvenile chinook	10	
Selway River	17060302		Lindland 1978	1977	juvenile chinook	5	

Table 6.b. Summary of lower Selway River subbasin steelhead data
The steelhead data summarized in the table indicate that natural spawning and rearing is occurring.

STREAM	HUC4	WBID	REFERENCE	YEAR	FISH	COUNT	AGE CLASSES
Island Creek	17060302	6	Stewart 1999c	1999	steelhead	15	3
O'Hara Creek	17060302		Brostrom 1993	1993	steelhead	145	>3
O'Hara Creek	17060302	3	Brostrom 1994	1994	steelhead	109	>3
O'Hara Creek	17060302		Brostrom 1995	1995	steelhead	198	>3
O'Hara Creek	17060302		IDFG 1997	1997	steelhead	204	>3
O'Hara Creek	17060302		IDFG 1999	1999	steelhead	43	>3
O'Hara Creek	17060302		Stewart 1999a	1999	steelhead	6	2
Selway River	17060302	1	Welsh 1964	1964	juvenile steelhead	250	>2
Selway River	17060302		Lindland 1978	1973	juvenile steelhead	331	2
Selway River	17060302		Lindland 1978	1974	juvenile steelhead	210	2
Selway River	17060302		Lindland 1978	1975	juvenile steelhead	270	2
Selway River	17060302		Lindland 1978	1976	juvenile steelhead	165	2
Selway River	17060302		Lindland 1978	1977	juvenile steelhead	156	2
Slide Creek	17060302	6	Stewart 1999b	1999	steelhead	17	3
Slide Creek	17060302	6	Stewart 1999b	1999	steelhead	17	3

Table 6.c. Summary of lower Selway River subbasin mountain whitefish data
Mountain whitefish data presented in the table confirm that this species occurs in the subbasin.

STREAM	HUC4	WBID	REFERENCE	YEAR	FISH	COUNT	AGE CLASSES
O'Hara Creek	17060302		IDFG 1999	1999	mountain whitefish	2	2
Selway River	17060302		Lindland 1977	1973	mountain whitefish	598	
Selway River	17060302		Lindland 1977	1974	mountain whitefish	512	
Selway River	17060302		Lindland 1977	1975	mountain whitefish	511	
Selway River	17060302		Lindland 1977	1976	mountain whitefish	251	
Selway River	17060302		Lindland 1978	1977	mountain whitefish	756	

Table 6.d. Summary of lower Selway River subbasin cutthroat trout data
Cutthroat trout data presented in the table indicate cutthroat trout spawn and rear in the Selway River subbasin.

STREAM	HUC4	WBID	REFERENCE	YEAR	FISH	COUNT	AGE CLASSES
O'Hara Creek	17060302		IDFG 1997	1997	cutthroat	3	
O'Hara Creek	17060302		IDFG 1998	1998	cutthroat	12	2
O'Hara Creek	17060302		IDFG 1999	1999	cutthroat	21	>3
Selway River	17060302		Lindland 1975	1973	cutthroat	76	>2
Selway River	17060302		Lindland 1975	1974	cutthroat	108	>2
Selway River	17060302		Lindland 1976	1975	cutthroat	72	>2
Selway River	17060302		Lindland 1977	1976	cutthroat	89	>2
Selway River	17060302		Lindland 1978	1977	cutthroat	201	>2
Slide Creek	17060302	6	Stewart 1999b	1999	cutthroat	1	1

3.4. Data Gaps in Assessing Water Quality

Bedload data are known for only the Horse Creek sediment trap in the adjacent Meadow Creek drainage and for 16 Lochsa River tributary streams. Particle size distribution of stream bed material and USFS cobble embeddedness estimates generally describe the stream bed. There is a lack of documentation about stream bed sediment quantity and size distribution that is suitable for salmonid spawning and propagation, and cold water biota.

4.0. WATER QUALITY DATA SUMMARIES AND STATUS CONCLUSIONS

This section summarizes the known background conditions and present characteristics of each subbasin stream included on the 1996 303(d) list, the results of the state's investigation of the stream's water quality, and the assessment conclusions. DEQ is addressing here stream segments identified on the 1996 303(d) list created by EPA to comply with a federal court order. The Idaho 1998 303 (d) list submitted to EPA in January 1999 retained three of the segments from the previous list: Island Creek, Slide Creek, and lower O'Hara Creek (DEQ, 1999).

The stream segments were included on the lists as exceeding the Idaho sediment criterion, as discussed in section 2.1. The sediment criterion is based on water quality that fully supports the designated beneficial uses. Idaho verified full support of the beneficial uses through 1996 macroinvertebrate sampling data, fish sample data, and fish habitat data. DEQ evaluated geologic, soil, topography and landform, climatic, and hydrologic data to understand the subbasin's sedimentation regime. The sedimentation regime was considered both in its present state and in light of known change in important variables (e.g., temperature, precipitation, fire) over the last 100 years. Idaho Fish and Game survey data from 1958 that describes and evaluates stream conditions in the subbasin when disturbances by man were minimal are included.

This subbasin assessment identified various nonpoint sources of pollution in section 2.3. These activities have, at times, affected subbasin water quality, but past and present pollution control efforts discussed in section 2.4. have been used to minimize those effects. Not all subbasin streams flow in pristine drainages, but the water quality in these streams provides full support for their designated beneficial uses. Full support of designated beneficial uses establishes compliance with the Idaho sediment criterion.

4.1. Lower Selway River Tributary Stream Segments

1) Boyd Creek was listed for sediment.

The watershed is 3,665 acres, dropping from more than 6,200 feet to about 1,580 feet. The Coolwater Ridge Road and a National Recreation Trail run along the drainage divide and a small developed campground is near the mouth. The road 223 culvert is a partial or complete barrier to fish passage.

Background conditions of Boyd Creek in 1958 are documented in an Idaho Fish and Game Department survey funded by the U.S. Fish and Wildlife Service as part of the Columbia River Fishery Development Program (Murphy and Metsker, 1962). The creek flows into the Selway River at river mile 10.5 and is about 5 miles long. The survey was stopped 1.2 miles above the mouth because the channel became *"very steep"* further upstream. It is one of the parallel tributaries that flow down the Coolwater Ridge tonalite of the north valley wall. *"Heavy stream silting"* was noted and attributed to loss of vegetation in the watershed from the 1910, 1917 and 1934 forest fires. The survey identified 144 square yards of suitable steelhead spawning gravel.

DEQ evaluated a reach at 1,950 feet elevation. The 11 percent reach slope is typical of a Rosgen type Aa channel, its 16:1width to depth ratio is more typical of a type B channel, and the measured discharge on 3 July 1996 was 8.6 cubic feet per second. Human activities affecting the reach include forestry and recreation.

In 1988, a stream surveyor noted a good pool to riffle ratio, questionable fish passage through the culvert, habitat provided by large woody debris, several small debris dams, some spawning habitat for both anadromous and resident fish, and steelhead/rainbow and cutthroat trout juveniles.

DEQ calculated a macroinvertebrate biotic index (MBI) of 4.17. Two age classes of rainbow trout were present in the fish sample. DEQ calculated a habitat index (HI) of 96.

DEQ determined that Boyd Creek's water quality provided full support of its beneficial uses because its MBI was greater than 3.5, its HI was greater than or equal to 73 and not in the impaired range, and it had two age classes of trout.

2) Elk City Creek was listed for sediment.

The watershed is 1,800 acres, dropping from more than 5,000 feet to about 1,490 feet. Timber harvest activity has cut 200 acres and built 20 acres (4.1 miles) of roads.

Background conditions of Elk City Creek in 1958 are documented in an Idaho Fish and Game Department survey funded by the U.S. Fish and Wildlife Service as part of the Columbia River Fishery Development Program (Murphy and Metsker, 1962). For that project, *"Each stream large enough to support anadromous fish runs was investigated in the main Clearwater, Middle Fork, South Fork, Selway and Lochsa River drainages."* The streams on either side of Elk City Creek were surveyed, but Elk City Creek was not. This shows that the stream in 1962 was not considered to have the potential to support anadromous fish runs.

A 1988 survey noted a *"high amount of sediment deposition,"* major fish passage barriers about half way up the stream, and cutthroat trout and juvenile steelhead/rainbow trout (USDA, 1999).

DEQ evaluated a reach at 1,800 feet elevation. The 8 percent reach slope is typical of a Rosgen type A channel, its 20:1width to depth ratio is more typical of a type B channel, and the measured discharge on 22 July 1996 was 1.5 cubic feet per second. Human activities affecting the reach include forestry, roads, and grazing.

DEQ calculated a MBI of 4.35. Three age classes of cutthroat trout and one age class of rainbow trout, including juvenile salmonids, were present in the fish sample. DEQ calculated a HI of 93.

DEQ determined that Elk City Creek's water quality provided full support of its beneficial uses because its MBI was greater than 3.5, it was supporting salmonid spawning, and its HI was greater than or equal to 73 and not in the impaired range.

3) Falls Creek was listed for sediment.

The watershed is 7,570 acres, dropping from 5,910 feet to about 1,660 feet. Timber harvest activity has cut 759 acres and built about 141 acres (26.6 miles) of roads in the upper third of the watershed (USDA, 1999).

Background conditions of Falls Creek in 1958 are documented in an Idaho Fish and Game Department survey funded by the U.S. Fish and Wildlife Service as part of the Columbia River Fishery Development Program (Murphy and Metsker, 1962). The creek flows into the Selway

River at river mile 16 and is about 7 miles long. A *"log barrier four feet high"* 0.7 miles upstream prevented fish passage. The survey was stopped 0.9 miles above the mouth because of the *"steep channel gradient"* further upstream. The survey identified *"407 square yards of suitable steelhead spawning area."* It concluded that, *"This stream is considered to be of little value to anadromous fish. Passing fish over the falls* [i.e., a log barrier] *is not recommended."*

A June 1980 survey noted a steep channel slope, *"moderate to low levels of deposited sediment, and small boulders as the dominant substrate,"* and juvenile rainbow/steelhead trout (USDA, 1999).

DEQ evaluated a reach at 2, 020 feet elevation about 0.5 miles upstream. The 7 percent reach slope is typical of a Rosgen type A channel, its 17:1width to depth ratio is more typical of a type B channel, and the measured discharge on 12 August 1996 was 5.9 cubic feet per second. Human activities affecting the reach include forestry and recreation.

DEQ calculated a MBI of 4.57. One age class of cutthroat trout, three age classes of rainbow trout, and one age class of rainbow/cutthroat hybrid, including juvenile salmonids, were present in the fish sample. DEQ calculated a HI of 100.

DEQ determined that Falls Creek's water quality provided full support of its beneficial uses because its MBI was greater than 3.5, it was supporting salmonid spawning, and its HI was greater than or equal to 73 and not in the impaired range.

4) Glover Creek was listed for sediment.

The watershed is 5,720 acres, dropping from more than 6,000 feet to 1,750 feet. In the 1940's, logs from a stream side logging operation were skidded down the channel. The watershed is roadless, except for the Coolwater Ridge Road at the head of the drainage. A National Recreation Trail follows the drainage divides. A campground has been developed near the creek's mouth.

Background conditions of Glover Creek in 1958 are documented in an Idaho Fish and Game Department survey funded by the U.S. Fish and Wildlife Service as part of the Columbia River Fishery Development Program (Murphy and Metsker, 1962). The creek flows into the Selway River at river mile 15 and is about 5 miles long. It is one of the parallel tributaries that flow down the Coolwater Ridge tonalite of the north valley wall. A *"log barrier four feet high"* 0.7 miles upstream prevented fish passage. The survey was stopped 1.1 miles above the mouth at a ten-foot high log jam because *"of the completeness of the barrier and the steep channel gradient above it."* The survey identified *"565 square yards of suitable steelhead spawning area."* It concluded that, *"Because of the steep channel gradient and excessive amounts of large and medium rubble above the barrier, removal of the barrier is not recommended."*

In 1984, a stream surveyor noted a steep channel slope, high levels of deposited sediment, and steelhead and cutthroat trout, including juveniles and young of the year. A 1989 survey noted a steep channel slope, low pool to riffle ratio, high sediment deposition, and steelhead trout.

DEQ evaluated a reach at 2,150 feet elevation 1.0 miles above the mouth. The 9 percent reach slope is typical of a Rosgen type A channel, its 15:1width to depth ratio is more typical of a type B channel, and the measured discharge on 10 July 1996 was 13.8 cubic feet per second. Human activities affecting the reach include forestry, roads, and recreation.

DEQ calculated a MBI of 4.42. Three age classes of rainbow trout, including juvenile salmonids, were present in the fish sample. DEQ calculated a HI of 113.

DEQ determined that Glover Creek's water quality provided full support of its beneficial uses because its MBI was greater than 3.5, it was supporting salmonid spawning, and its HI was greater than or equal to 73 and not in the impaired range.

5) Goddard Creek was listed for sediment.

The watershed is 9,275 acres, dropping from 5,869 feet to about 1,495 feet. Timber harvest activity has cut 1,056 acres and built 114 acres (22.6 miles) of roads (USDA, 1999).

Background conditions of Goddard Creek in 1958 are documented in an Idaho Fish and Game Department survey funded by the U.S. Fish and Wildlife Service as part of the Columbia River Fishery Development Program (Murphy and Metsker, 1962). The creek flows into the Selway River at river mile four and is about 8 miles long. *"A series of partial and complete log barriers 2.3 miles upstream"* prevented further fish passage. The survey identified *"1,707 square yards of suitable steelhead spawning area* [12 percent of the stream bed]. " It concluded that the barriers should be left in place *"to prevent further scouring of the stream bed downstream."*

The Forest Service has an active timber salvage operation in the drainage. Salvage operations are directed toward about 15 acres of timber blown down in a 1998 windstorm. The salvage areas are outside proposed PACFISH buffers and the access roads are closed to public traffic all year. Timber removal is restricted to the 31 July through 15 September period to avoid traffic on wet roads. In 1997, 1.5 miles of road 9701D was obliterated (Gerhardt, 1999). The Forest Service awarded a contract in 1998 to obliterate about 2.5 miles of two roads, 1119F and 77791, in the upper drainage (USDA, 1999).

A 1996 survey documented steelhead and cutthroat trout and spawning habitats for both species. Stream size, channel slope, and fine sediment were identified as *"most limiting to steelhead production in this stream."* The survey concluded the stream *"does not have an inherent high capability to support either species"* (USDA, 1999).

DEQ evaluated a reach at 2,240 feet elevation about 2.2 miles upstream. The 6 percent reach slope is typical of a Rosgen type A channel, its 13:1width to depth ratio is more typical of a type B channel, and the measured discharge on 11 July 1996 was 9.2 cubic feet per second. Human activities affecting the reach include forestry and roads.

DEQ calculated a MBI of 4.52. One age class of cutthroat trout and three age classes of rainbow trout, including juvenile salmonids, and three age classes of Piute sculpin were present in the fish sample. DEQ calculated a HI of 114.

DEQ determined that Goddard Creek's water quality provided full support of its beneficial uses because its MBI was greater than 3.5, it was supporting salmonid spawning, and its HI was greater than or equal to 73 and not in the impaired range.

6) Hamby Fork (upper) was listed for sediment.

Background conditions of Hamby Fork in 1958 are documented in an Idaho Fish and Game Department survey funded by the U.S. Fish and Wildlife Service as part of the Columbia River Fishery Development Program (Murphy and Metsker, 1962). The creek flows into the O'Hara Creek at about stream mile five and is about 7 miles long. The survey stopped at a barrier 0.7 miles upstream from the confluence with O'Hara Creek. Providing fish passage past the barrier was not recommended because of *"excessive amounts of large rubble and the steep gradient upstream from the obstruction."* The report stated, *"Most of the stream bottom is considered poor for anadromous fish spawning purposes"* and identified 140 square yards of suitable steelhead spawning area [2.5 percent of the stream bed].

The Forest Service has planned culvert removal, road obliteration, channel reconstruction, and slope recontouring on roads 651C and 1123. This area experienced landslides related to these roads during the 1995/1996 rain-on-snow events. Work will affect about two miles of road 651C and about six miles of road 1123.

DEQ evaluated a reach at 4,270 feet elevation about 4.8 miles upstream from the confluence with O'Hara Creek. The 1 percent reach slope and its15:1width to depth ratio are typical of a Rosgen type C channel, and the measured discharge on 27 June 1996 was 12.6 cubic feet per second. Human activities affecting the reach include forestry and roads.

DEQ calculated a MBI of 5.36. Three age classes of brook trout, including juvenile salmonids, were present in the fish sample. DEQ calculated a HI of 101.

DEQ determined that Hamby Fork's (upper) water quality provided full support of its beneficial uses because its MBI was greater than 3.5, it was supporting salmonid spawning, and its HI was greater than or equal to 73 and not in the impaired range.

7) Hamby Fork (lower) was listed for sediment.

Background conditions of Hamby Fork are described above.

DEQ evaluated a reach at 3,540 feet elevation about 2.8 miles upstream of the confluence with O'Hara Creek. The 5 percent reach slope is typical of a Rosgen type A channel, its 17:1width to depth ratio is more typical of a type B channel, and the measured discharge on 25 June 1996 was 17.7 cubic feet per second. Human activities affecting the reach include forestry and roads.

DEQ calculated a MBI of 4.37. Two age classes of rainbow trout and two age classes of sculpin were present in the fish sample. DEQ calculated a HI of 84.

DEQ determined that Hamby Fork's (lower) water quality provided full support of its beneficial uses because its MBI was greater than 3.5, it had two age classes of trout, and its HI was greater than or equal to 73 and not in the impaired range.

8) Island Creek was listed for sediment.

The watershed is 3,866 acres, dropping from 5,807 feet to about 1,595 feet. Timber harvest activity has cut 282 acres and built 91 acres (8.7 miles) of roads (USDA, 1999).

Background conditions of Island Creek in 1958 are documented in an Idaho Fish and Game Department survey funded by the U.S. Fish and Wildlife Service as part of the Columbia River Fishery Development Program (Murphy and Metsker, 1962). The creek flows into the Selway River at about stream mile 11.5 and is about 7 miles long. Fish passage into the stream can only occur during extremely high river flows because of a natural five-foot high falls at the stream's mouth. The report concluded that, "*Correction of the falls*" to allow fish passage was not appropriate because of "*the small amount of spawning area present*" and that, "*This stream is considered to be of little value to anadromous fish.*" The survey identified 67 square yards of suitable steelhead spawning area.

A 1983 survey noted "*high levels of deposited sediment, a lack of spawning habitat, steep channel gradient, numerous small waterfalls, and few deep pools. No fish were sighted.*" A 1989 survey noted "*low densities of juvenile rainbow/steelhead trout, high channel gradient, high numbers of large woody debris, and small substrate, including fines.*" A 1995 survey "*documented the presence of both juvenile steelhead* [/rainbow] *trout and cutthroat trout, as well as spawning habitat for small resident fish and large woody debris.*" That survey also snorkeled the Selway River at the mouth of Island Creek and found "*a high number of juvenile steelhead, chinook salmon, dace, northern pikeminnow, and several large fluvial cutthroat trout.*" The surveyors concluded that the fish were seeking thermal refuge in these waters that were five degrees cooler than the ambient river temperature (USDA, 1999).

DEQ calculated a MBI of 3.73. One age class of rainbow trout were present in the 1996 fish sample. DEQ calculated a HI of 100. DEQ returned to the evaluated reach on 5 October 1999 and found three age classes of rainbow trout present in the fish sample, and juvenile salmonids. DEQ also conducted a Pfankuch channel stability evaluation then on this reach that placed the stream in the lower end of the "good" range (rating = 90).

DEQ evaluated a reach at 1,690 feet elevation about 300 feet above the mouth. The 11 percent reach slope is typical of a Rosgen type Aa channel, its 37:1width to depth ratio is more typical of a type B channel, and the measured discharge on 12 August 1996 was 4.1 cubic feet per second. Human activities affecting the reach include forestry and mining.

DEQ determined that Island Creek's water quality provides full support of its beneficial uses because its MBI was greater than 3.5, it had three age classes of trout, as well as juveniles and its HI was greater than or equal to 73 and not in the impaired range.

9) Nineteenmile Creek was listed for sediment.

The watershed is 1,989 acres, dropping from more than 6,900 feet to about 1,565 feet. A campsite is at the stream mouth and trail access to the watershed ends about one-quarter mile upstream.

Background conditions of Nineteenmile Creek in 1958 are documented in an Idaho Fish and Game Department survey funded by the U.S. Fish and Wildlife Service as part of the Columbia River Fishery Development Program (Murphy and Metsker, 1962). The creek flows into the Selway River at river mile 9.5 and is about 5 miles long. The survey was stopped 0.4 miles above the mouth *"because of steep channel gradient and extensive silting of the stream bottom."* It is one of the parallel tributaries that flow down the Coolwater Ridge tonalite of the north valley wall. The survey noted that *"excessive amounts of large rubble, logs and debris were present"* and *"The pool structure is poor and spawning riffles rare."* The survey identified 46 square yards of suitable steelhead spawning gravel [3.2% of the stream bottom].

A June 1964 debris flow scoured the channel and dammed the Selway River with debris for several hours. After this event, YCC workers placed gabion walls along the lower reaches trying to reconstruct and stabilize the channel. A 1990 survey noted that the channel still lacked woody debris scoured in the 1964 event and the lowest one-quarter mile reach of the channel was a continuous, straight, series of riffles. In 1993, a snorkeling survey was done in the Selway River immediately below the mouth of Nineteenmile Creek; chinook salmon, westslope cutthroat trout, whitefish, suckers, and juvenile steelhead/rainbow trout were present in higher densities than surrounding areas. Based on those observations, the survey concluded that fish used Nineteenmile Creek because it provided a cool water refuge. The Forest Service lost control of a prescribed burn in the watershed in 1993 and burned many more acres in the Nineteenmile and Rackliff Creek watersheds. Burned timber from this fire was salvaged by helicopter logging in 1994. As part of this project, the helicopter placed logs and rootwads in the stream channel from

Rackliff Creek watersheds. Burned timber from this fire was salvaged by helicopter logging in 1994. As part of this project, the helicopter placed logs and rootwads in the stream channel from the headwaters to about one-quarter mile upstream of the mouth. The gabions were removed from there to the mouth and rock structures were placed in the channel. This reconstruction effort ended in 1996 (USDA, 1999).

DEQ evaluated a reach at 1,968 feet elevation about 0.25 miles above the mouth. The 12 percent reach slope is typical of a Rosgen type Aa channel, its 20:1width to depth ratio is more typical of a type B channel, and the measured discharge on 25 July 1996 was 3.4 cubic feet per second. Human activities affecting the reach include forestry and channelization.

DEQ calculated a MBI of 3.93. Two age classes of rainbow trout were present in the fish sample. DEQ calculated a HI of 92.

DEQ determined that Nineteenmile Creek's water quality provided full support of its beneficial uses because its MBI was greater than 3.5, it had two age classes of trout, and its HI was greater than or equal to 73 and not in the impaired range.

10) O' Hara Creek (upper) was listed for sediment.

The watershed is 37,970 acres, dropping from 6,815 feet to about 1,535 feet. There is a campsite at the stream mouth and road access through the watershed. Tributary streams to this relatively large watershed include Hamby Creek and Wart Creek, which were also placed on the 1996 303 (d) list.

Background conditions of O'Hara Creek in 1958 are documented in an Idaho Fish and Game Department survey funded by the U.S. Fish and Wildlife Service as part of the Columbia River Fishery Development Program (Murphy and Metsker, 1962). The creek flows into the Selway River at river mile 6.5 and is about 9 miles long. The survey was stopped about eight miles above the mouth *"at a series of falls ranging in height to ten feet."* Completion of removal of a log jam about one mile upstream of the mouth was recommended; Forest Service and Idaho Fish and Game personnel began removal in 1960. Portions of the drainage were burned in the 1910 forest fire, but a forest canopy had reestablished by 1962. Timber sales in the drainage began in 1960 and three miles of timber access road were under construction in 1962. The survey noted that adult and juvenile steelhead used the stream for *"transportation and spawning"* and that fishermen sought both rainbow and cutthroat trout in the stream. The survey identified 10,609 square yards of suitable steelhead spawning gravel [8 percent of the streambed] and 1,338 square yards *"suitable for salmon spawning"* [1 percent of the streambed].

DEQ evaluated an upper reach at 2,150 feet elevation, about 4.4 miles above the mouth, upstream of the mouth of Hamby Fork. The 3 percent reach slope and its 35:1width to depth ratio are typical of a Rosgen type B channel, and the measured discharge on 11 July 1996 was 50.3 cubic feet per second. Human recreational activities affect the reach.

DEQ calculated a MBI of 4.59. Three age classes of rainbow trout, including juvenile salmonids, and three age classes of Piute sculpin were present in the fish sample. DEQ calculated a HI of 92.

DEQ determined that O'Hara Creek's (upper) water quality provided full support of its beneficial uses because its MBI was greater than 3.5, it was supporting salmonid spawning, and its HI was greater than or equal to 73 and not in the impaired range.

11) O'Hara Creek (lower) was listed for sediment.

The background conditions of the stream are described above.

An instream habitat improvement project completed In the early 1990s in the lower five to six miles resulted in both increased number of pools and increased channel sediment storage. The 1995/1996 landslide events deposited sediment directly into the stream channel. Some of the sediment came from road fill and culvert failures and from a 1991 clearcut. The 100.2 miles of road in the watershed are subject to a project that will identify and obliterate 15 miles of problem road segments by 2000 (USFS, 1999).

DEQ evaluated a lower reach at 1,640 feet elevation about two miles above the mouth. The 1 percent reach slope and its 30:1width to depth ratio are typical of a Rosgen type C channel, and the measured discharge on 15 July 1996 was 50.4 cubic feet per second. Human activities affecting the reach include roads and recreation.

DEQ calculated an MBI of 4.65. Three age classes of rainbow trout, including juvenile salmonids, three age classes of Piute sculpin, and one age class of longnose dace were present in the 1996 fish sample. DEQ calculated a HI of 89. Because the 1996 analysis used "young of the year" rather than "juveniles" to confirm successful spawning and rearing, DEQ sampled the lower reach again to supplement the fish data used for beneficial use support status assessment. The lower reach was sampled again on 5 October 1999 and two age classes of rainbow trout and one age class of chinook salmon, including juvenile salmonids, and sculpins were present. DEQ also conducted a Pfankuch channel stability evaluation then on this reach that placed the stream in the middle to upper end of the "good" range (rating = 75).

DEQ determined that O'Hara Creek's (lower) water quality provided full support of its beneficial uses because its MBI was greater than 3.5, it had three age classes of salmonids present, including juvenile salmonids, and its HI was greater than or equal to 73 and not in the impaired range.

12) Rackliff Creek was listed for sediment.

The watershed is 5,426 acres, dropping from more than 6,900 feet to about 1,550 feet. There is a campsite at the stream mouth and road access through the watershed. The Coolwater Ridge

Road runs along the head of the drainage and trail 302 runs along the drainage divide between Rackliff and Nineteenmile Creeks.

Background conditions of Rackliff Creek in 1958 are documented in an Idaho Fish and Game Department survey funded by the U.S. Fish and Wildlife Service as part of the Columbia River Fishery Development Program (Murphy and Metsker, 1962). The creek flows into the Selway River at river mile 8.5 and is about 6.5 miles long. The survey was stopped 2.6 miles above the mouth because the channel became *"of steep channel gradient"* further upstream. It is one of the parallel tributaries that flow down the Coolwater Ridge tonalite of the north valley wall. The stream passed under the road through a culvert with a five-foot drop that was believed to prohibit fish passage when river discharge was less than 10,000 cubic feet per second, a value close to the 10 percent probability of exceedance discharge for the water years 1911 through 1998. Four log barriers four to six feet high were in the channel at 0.6, 0.9, 1.0, and 2.6 miles upstream; the survey recommended that these barriers should be removed. The survey identified 1,566 square yards of suitable steelhead spawning gravel.

A 1989 survey noted a steep channel gradient (6 to 12 percent), low amounts of woody debris, *"Deposited sediment was moderate to high, with cobble embeddedness up to 36 percent"*, and steelhead and cutthroat trout (USDA, 1999). A 1993 prescribed fire burned out of control over many acres of the Rackliff Creek and Nineteenmile Creek watersheds. In 1994, over 1,000 acres of the burned timber were salvaged by helicopter logging.

DEQ evaluated a reach at 3,018 feet elevation, about 0.5 miles above the mouth. The 9 percent reach slope is typical of a Rosgen type A channel, its 20:1width to depth ratio is more typical of a type B channel, and the measured discharge on 27 June 1996 was 19.1 cubic feet per second. Human activities affecting the reach include forestry and recreation.

DEQ calculated a MBI of 4.12. Three age classes of rainbow trout, including juvenile salmonids, and two age classes of Piute sculpin were present in the fish sample. DEQ calculated a HI of 103.

DEQ determined that Rackliff Creek's water quality provided full support of its beneficial uses because its MBI was greater than 3.5, it was supporting salmonid spawning, and its HI was greater than or equal to 73 and not in the impaired range.

13) Slide Creek was listed for sediment.

The watershed drops from 6,788 feet to about 1,580 feet. The Forest Service describes this as one of nine named "face drainages" that are very steep and mostly do not support fish.

Background conditions of Slide Creek in 1958 are documented in an Idaho Fish and Game Department survey funded by the U.S. Fish and Wildlife Service as part of the Columbia River Fishery Development Program (Murphy and Metsker, 1962). It is one of the parallel tributaries that flow down the Coolwater Ridge tonalite of the north valley wall. For that project, *"Each stream large enough to support anadromous fish runs was investigated in the main Clearwater, Middle Fork, South Fork, Selway and Lochsa River drainages."* The streams on either side of Slide Creek were surveyed, but Slide Creek was not. This indicates that the stream in 1962 was not considered to have the potential to support anadromous fish runs.

DEQ evaluated a reach at 1,880 feet elevation, about 0.6 miles above the mouth. The 13 percent reach slope is typical of a Rosgen type A channel, its11:1width to depth ratio is more typical of a type A channel, and the measured discharge on 26 June 1996 was 8.8 cubic feet per second. The human activity affecting the reach was mining.

DEQ calculated an MBI of 3.51. One age class of rainbow trout was present in the 1996 fish sample. DEQ calculated a HI of 105. The lower reach was sampled again on 5 October 1999 and three age classes of rainbow trout and one age class of cutthroat trout were present, including juvenile salmonids. DEQ also conducted a Pfankuch channel stability evaluation then on this reach that placed the stream in the lower end of the "good" range (rating = 91).

DEQ determined that Slide Creek's water quality provided full support of its beneficial uses because its MBI was greater than 3.5, it was supporting salmonid spawning, and its HI was greater than or equal to 73 and not in the impaired range.

14) Twentythreemile Creek was listed for sediment.

The watershed drops from 6,807 feet to about 1,605 feet. The Forest Service describes this as one of nine named "face drainages" that are very steep and mostly do not support fish.

Background conditions of Twentythreemile Creek in 1958 are documented in an Idaho Fish and Game Department survey funded by the U.S. Fish and Wildlife Service as part of the Columbia River Fishery Development Program (Murphy and Metsker, 1962). It is one of the parallel tributaries that flow down the Coolwater Ridge tonalite of the north valley wall. For that project, *"Each stream large enough to support anadromous fish runs was investigated in the main Clearwater, Middle Fork, South Fork, Selway and Lochsa River drainages."* The streams on either side of Twentythreemile Creek were surveyed, but Twentythreemile Creek was not. This indicates that the stream in 1962 was not considered to have the potential to support anadromous fish runs.

DEQ evaluated a reach at 2,040 feet elevation, about 0.5 miles above the mouth. The 12 percent reach slope is typical of a Rosgen type Aa channel, its 20:1width to depth ratio is more typical of a type B channel, and the measured discharge on 17 July 1996 was 1.1 cubic feet per second. Human activities affecting the reach include forestry, roads, and recreation.

DEQ calculated a MBI of 3.46. Three age classes of cutthroat trout, including juveniles, were present in the fish sample. DEQ calculated a HI of 91.

DEQ determined that Twentythreemile Creek's water quality provided full support of its beneficial uses because its MBI was 3.46, it was supporting salmonid spawning, and its HI was greater than or equal to 73 and not in the impaired range.

15) Wart Creek was listed for sediment.

Background conditions of Wart Creek in 1958 are documented in an Idaho Fish and Game Department survey funded by the U.S. Fish and Wildlife Service as part of the Columbia River Fishery Development Program (Murphy and Metsker, 1962). Wart Creek is about 3.4 miles long and tributary to O'Hara Creek, the confluence being about 2.7 miles upstream of Hamby Fork. The creek channel appears subject to geologic control because it follows the contact of schist and gneiss rocks with quartzite and calc-silicate rocks. For the survey project, *"Each stream large enough to support anadromous fish runs was investigated in the main Clearwater, Middle Fork, South Fork, Selway and Lochsa River drainages."* While O'Hara Creek and Hamby Fork were, Wart Creek was not. This indicates that the stream in 1962 was not considered to have the potential to support anadromous fish runs.

DEQ evaluated a reach at 3,240 feet elevation about 330 feet above the mouth. The 21 percent reach slope is typical of a Rosgen type Aa channel, its 15:1width to depth ratio is more typical of a type B channel, and the measured discharge on 16 August 1996 was 1.7 cubic feet per second. The human activity affecting the reach was forestry.

DEQ calculated a MBI of 4.97. Three age classes of cutthroat trout, including juvenile salmonids, were present in the fish sample. DEQ calculated a HI of 106.

DEQ determined that Wart Creek's water quality provided full support of its beneficial uses because its MBI was greater than 3.5, it was supporting salmonid spawning, and its HI was greater than or equal to 73 and not in the impaired range.

4.2 Conclusions

This subbasin assessment addressed 15 stream segments placed on the 1996 303(d) list as not meeting the state sediment criterion. The 15 stream segments studied are on 13 streams. DEQ's review of the available information about the background condition of those streams shows that in 1958 four of the streams were not considered *"large enough to support anadromous fish populations"* and two more were determined *"to be of little value to anadromous fish."* Two of the other streams' beds were noted to have *"heavy stream silting"* and *"extensive silting"* that was attributed to the wildfires of 1934 and earlier. Another two streams' beds were *"considered poor for anadromous fish spawning purposes"* because of *"excessive amounts of large [and medium] rubble and steep gradient.* (Murphy and Metsker, 1962)." That report noted 10 of the 13 streams as having no or very limited use to fish because of channel size or slope or the natural stream bed (substrate) particle size. Three of the listed streams were considered in 1958 as suitable for anadromous fish production and without excessive fine sediment: a large part of O'Hara Creek and relatively small portions of Rackliff and Goddard Creeks. A 1996 Forest Service survey of Goddard Creek for steelhead and cutthroat trout spawning habitat concluded that, based on stream size, slope, and fine sediment, the stream *"does not have an* <u>*inherent*</u> (emphasis added) *high capability to support either species* (USDA, 1999).

Those observations of background conditions are consistent with the aggradational (sediment deposition) period characteristic of the climatic conditions that existed in the third quarter of the twentieth century in the subbasin. The available information about the background conditions of the 13 listed streams indicate that lower reaches of Rackliff Creek and much of O'Hara Creek had water quality conditions related to sediment that were good; the other eleven streams had natural channel conditions, including sedimentation, that may have restricted aquatic life.

As quoted in section 3.3, the Forest Service reported that,

> *"In the Selway subbasin, all streams with sufficient size and gradient which are accessible to fish in the mainstem river support steelhead juvenile rearing or spawning or both. Deposited sediment may have lowered the carrying capacity for juvenile rearing and the quantity and quality of spawning habitat in streams with high road densities* (USDA, 1999)."

Based on the available information on sedimentation in the lower Selway River subbasin, and analysis of data from similar streams on the Clearwater National Forest, streams of the type and discharge that were studied may have stream bed sedimentation in roaded stream reaches increased by about 1percent to 7.5 percent over unroaded stream reaches. Despite these changes, the data analyzed for this subbasin assessment show that presently the water quality in all 15 of the listed reaches on the 13 streams is providing full support for the designated beneficial uses and do not exceed the sediment criterion.

In their 17 April 2000 petition to designate the Selway River and five tributaries as Outstanding Resource Waters, the Idaho Conservation League and Idaho Rivers United identified the entire Selway River from its headwaters to its confluence with the Lochsa River. They stated that,

> *"Water quality in the Selway River system is pristine and qualifies for ORW designation."* And they added that, *". . . the State of Idaho can implement its antidegradation policy in an ideal place: a basin that produces water of the highest quality . . . "* (Gudgell and Bridges, 2000).

Their statements about the water quality of the Selway River through the lower Selway River subbasin is consistent with DEQ's findings in this assessment. The water quality of these tributary streams has not lowered the water quality of the Selway River to which they discharge.

Section 303 (d) of the Clean Water Act directs the states to prioritize the waters for total maximum daily load calculation based on *"the severity of the pollution and the uses to be made of such waters."* The DEQ recommends that, for the present, work under Section 303 (d) stop on the lower Selway River subbasin streams with this assessment. The DEQ can then act to work on high priority water quality limited stream segments. When that work is done, DEQ can revisit all the other streams that are not water quality limited and estimate TMDLs for them for informational purposes in accordance with Section 303 (d)(3).

In summary, the DEQ's review of available data show that the water quality of the subbasin stream segments listed in the 1996 303 (d) list supports designated and existing beneficial uses, in accordance with IDAPA 16.01.02.053, and the stream segments are not water quality limited waters.

The recommendations of this subbasin assessment are:

- That the fifteen stream segments listed for sediment on the 1996 303(d) list can be removed from the list because water quality information continues to show that state sediment standards are met.

- That, for the present, work under Section 303 (d) stop on the lower Selway River subbasin streams with this assessment.

- That management agency and landowner resources in the subbasin continue to be applied to projects to reduce legacy impacts. These activities can continue to enhance water quality in the subbasin.

5.0. PUBLIC PARTICIPATION

IDAPA 16.01.02.052 provides requirements for public participation in water quality decisions. Basin Advisory Groups (BAGS) and Watershed Advisory Groups (WAGS) advise Idaho State DEQ on priority impaired water bodies, management of impaired watersheds, and recommend pollution control activities in impaired watersheds.

The Clearwater Basin Advisory Group (BAG) was appointed by the Administrator of the Idaho Division of Environmental Quality in 1995 to fulfill the public participation requirements of Idaho Code 39-3601 *et seq.* Because the subbasin is managed almost entirely by a single agency, the Nez Perce National Forest, an ad hoc Watershed Advisory Group consisting of the Nez Perce National Forest and Nez Perce tribe was created. The ad hoc WAG provided data and comment useful to DEQ for making the subbasin assessment.

On 25 February 2000, DEQ sent photocopies of an 18 FEB 2000 working draft to:

- All members of the Clearwater Basin Advisory Group
- Nick Gerhardt, hydrologist, Nez Perce National Forest, Grangeville
- Marci Gerhardt, hydrologist, Nez Perce National Forest, Fenn Ranger Station

- Greg Haller, water resource planner, Nez Perce Tribe, Lapwai
- Don Essig, TMDL Coordinator, DEQ State Office, Boise

The 1 MAR 2000 *Idaho County Free Press* notified area residents that DEQ would provide an update on the subbasin assessment at its regular meeting. The DEQ presented its subbasin assessment findings and recommendations to the Clearwater BAG and attending publics at the 2 March 2000 BAG meeting in Grangeville, Idaho. The DEQ presented its recommendations: 1) that water quality information continues to show that state sediment standards are met and the fifteen stream segments listed for sediment on the 1996 303 (d) list can be removed from the list, 2) that for the present, work under Section 303 (d) stop on the lower Selway River subbasin streams with this assessment, and 3) that management agency and landowner resources in the subbasin continue to be applied to projects to reduce legacy impacts. The DEQ asked the BAG for concurrence with these recommendations. The BAG unanimously voted to concur with the recommendations as presented. The DEQ agreed to prepare and distribute a draft for public comment.

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Appendix

Selway River Subbasin Assessment Public Involvement

The Selway River Subbasin Assessment was presented to an ad hoc watershed advisory group on 25 February 2000. A formal watershed advisory group was not formed because a single entity, the Nez Perce National Forest, manages nearly the entire subbasin. The ad hoc watershed advisory group consisted of the Nez Perce National Forest, Idaho Department of Lands and the Nez Perce Tribe. A copy of this working draft was also sent to EPA.

The DEQ presented the subbasin assessment to the Clearwater Basin Advisory Group (BAG) on 2 March 2000. The BAG agreed with the conclusions of the subbasin assessment. DEQ asked the BAG for its guidance about whether, based on the results of the subbasin assessment, DEQ should proceed to calculate and estimate total maximum daily loads or if it should recommend removing all the subbasin segments placed on the 1996 303(d) list by EPA. The BAG said that DEQ's work on the subbasin should stop with the subbasin assessment, that DEQ should remove the stream segments from the state's current list, and that DEQ should open the subbasin assessment to public comment.

DEQ accepted the BAG's guidance, revised the subbasin assessment based on comments from the BAG and responses received from the ad hoc watershed advisory group, and opened a thirty day public comment period on 22 May 2000. Public notices of the comment period were placed in five Idaho newspapers. DEQ sent the Public Comment Draft to eight locations for public review, to the Clearwater BAG, and to seventeen individuals and organizations, including EPA, on DEQ's Clearwater Subbasin mailing list.

Response to Public Comments

The DEQ received two comment letters from two organizations during the thirty day public comment period. One was very positive and the other was neutral. Comments were also received on the working draft provided to the ad hoc watershed advisory group earlier in March. The comments received in March on the working draft were addressed in the public comment version of the document and are reflected in the final version of the draft along with the other comments received. The organizations that commented are coded below by number. This number is then referenced throughout the following sections. The comments are arranged by subject category.

No.	Date	Commentor
1	19 June 2000	Bill Love Idaho Department of Lands 3780 Industrial Ave. South Coeur d'Alene, Idaho 83815

2	20 June 2000	Bruce Bernhardt Nez Perce National Forest Route 2, Box 475 Grangeville, Idaho 83530
3	2 March 2000	Greg Haller Nez Perce Tribe PO Box 365 Lapwai, Idaho 83540
4	17 March 2000	Marci Nielsen-Gerhardt Nez Perce National Forest Route 2, Box 475 Grangeville, Idaho 83530

Beneficial Use Support Status

(1) The comment commends the assessment as recognizing limitations to using modeling and future desired conditions for listing purposes.

Response: We believe the data used in the evaluation process comparing existing conditions to future desired conditions are based in part on modeled conditions which were used in the listing process.

(2) The comment suggests EPA did not use sediment modeling as the basis for listing, instead references listings as a result of exceeding the Forest Plan standards.

Response: We believe the data used in the evaluation process comparing existing conditions to future desired conditions are based in part on modeled conditions which were used in the listing process.

(2) The comment asks for the reference for "the forest service stated ...that O'Hara Creek is providing full support of Salmonid Spawning and Cold Water Biota.

Response: The reference for the forest service's statement regarding O'Hara Creek is "The Biological Assessment, Lower Selway 4th Code HUC, Fish, Wildlife and Plants, Nez Perce National Forest," April 1999.

(3) It is unclear as to what Burp data was utilized in this document.

Response: An explanation of the data and methods used in this assessment has been added and clarified in a revised Section 4.0.

(3) I am concerned that your conclusions that the 303(d) listed streams in the Basin are meeting beneficial uses is not currently based on a legally and scientifically defensible WBAG process. We recommend that IDEQ commit to utilizing the revised WBAG before this document is finalized.

Response: The method used to determine beneficial use support status is codified in the Idaho Water Quality Standards. The Water Quality Standards provide the most current version is used. TMDL development can not be defered as the schedule was set through federal court. DEQ is committed to completing TMDL Assessments as scheduled. DEQ will require the use of the existing guidance document in order to meet the schedule. A revised version will be consulted once released for use.

(3) The conclusion, in section 4.0 that efforts in section 2.4 have minimized nonpoint source impacts appears to be unsubstantiated. Please clarify this section to describe what efforts have been applied and what effects have been observed.

Response: Section 2.4 refers to keeping sediment loads to subbasin streams in compliance with the Idaho water Quality Standards.

(3) The comment questions the validity of the 1962 Murphy and Metsker study referenced.

Response: The 1962 Murphy and Metsker study report was found to be a useful reference to document historic conditions, no other information is currently available concerning the validity of the observations made in this document for the conditions that existed at the time.

(4) When evaluating beneficial uses, it seemed to be based solely on present or absence of a couple of age groups of fish and the MBI. How is all of the other data used that was gathered during the BURP surveys?

Response: The method used to determine beneficial use support status is codified in the Idaho Water Quality Standards. Other data are used to refine conclusions based on fish health and MBI.

Tribal Treaties

(1) Comment suggests Nez Perce treaty rights should be recognized.

Response: Nez Perce treaty rights are recognized in section 1.3.1

Geographic Corrections

(2,4) A number of geographic references need to be corrected. Watershed area, map titles, distances between landmarks etc. are needing corrections.

Response: Corrections have been made..

Effects of Fire

(2) Timing of peak flows could also be related to the seral state and recovery of vegetation following fires.

Response: This was noted for the final review draft.

(2) It is incorrect to conclude that 93% of the lower subbasin burned between 1884 and 1934, since some of the fires reburned over the same area. If reburns are discounted, about 70% of the subbasin below Selway Falls burned during that period.

Response: This was noted for the final review draft.

(2) Mitigation for the prescribed burns listed in the first paragraph on page 25 includes "no ignition" in streamside riparian areas and certain identified landslides. However, these burns were ignited on some landslide prone terrain and allowed to back into streamside riparian areas.

Response: This has been noted in the final version of the document.

(4) I think that fire suppression has had a great affect basin wide in the last 60 years on the sediment regimes and also the water yield regimes, with many watersheds having fire excluded for 60 years.

Response: The final version considers the effects of the fires.

Sediment

(1) The discussion correctly notes that periodic landslides are a natural source of sediment (a natural part of the geomorphic cycle) in this environment. This very important point is not specifically described in this kind of a report often enough.

Response: Your comment has been noted.

(1) The discussion of the cobble embeddedness "data", the limitations of the concept, and how it has been misinterpreted in the past was especially striking. The report does a noteworthy job of expressing the limitations and shortcomings often associated with cobble embeddedness data collection and interpretation.

Response: Your comment has been noted.

(2) Cooler wetter conditions that prevailed from 1950 through 1975 do not necessarily translate to general aggradation in streams of the Selway subbasin. Higher runoff tends to induce erosion in headwater and steep channels and deposition behind obstructions and in slower reaches. However, in the Selway subbasin the overall sediment budgets of cool, wet periods, relative to warm, dry periods, are largely the subject of speculation.

Response: We have attempted to justify any conclusions stated in the final version.

(2) It should be noted that the management-derived sediment yield cited from the NEZSED model represents current conditions. The estimated yields would be higher at times in the past, closer to the time that active road construction and timber harvest were occurring.

Response: We agree

(2) Cobble embeddedness is not measured relative to the long axis of a particle, but rather its horizontal axis as it lays in the stream.

Response: This has been noted in the final version

(2) From the information presented, it is not possible to infer that water quality in Slide and Island Creeks has improved since 1958.

Response: The presence of naturally reproducing steelhead in a waterway previously considered to be of no-use to anadromous fish is considered an improvement by DEQ.

(2) The road obliteration work in Island Creek has been indefinitely deferred.

Response: The reference to road obliteration work in Island Creek has been revised.

(2) In addition to average suspended sediment concentrations, peak concentrations should be displayed and their effects on beneficial uses analyzed.

Response: This is discussed in section 3.1.

(2) The assessment fails to adequately describe the impact of roads to sediment loading in the basin.

Response: This is discussed in section 3.1 and 3.2.

(2) The assessment fails to properly describe the impact of legacy and current timber harvesting activities in the basin.

Response: This is discussed in section 3.1 and 3.2.

(3) Section 2.3.1 states that nonpoint sources affecting sediment discharges include timber harvest and roads. The assessment stated that two-thirds of landslides in the basin were related to management activities, primarily roads. The assessment states that the "precise pollutant contribution from each of these nonpoint sources to the subbasin are unknown." Given this uncertainty, a TMDL for sediment should be conducted.

Response: This report attempts to document whether beneficial uses have been impacted, if so, a load allocation would be provided to Nonpoint Source. Even if beneficial uses were not supported a TMDL is not required to identify precise contributions from each potential nonpoint source, only to allocate for nonpoint sources.

(2) Section 3.2 refers to a Clearwater National Forest study that found that Post Office Creek, and unmanaged drainage in the Lochsa Basin, had the highest sediment levels. What data or studies support this conclusion for the Selway River Basin?

Response: Section 3.2 discusses Slide Creek as it relates to this topic data.

(3) On page ii, the assessment states that the sedimentation of the streams in the Basin is "within the normal variability that would be expected here." What is the conclusion based upon? What is the range of variability that would be normally expected?

Response: This is discussed in revised sections 3.0, 3.1 and 3.2.

(4) Natural sediment regimes are probably more affected by large wildfires in the basin more than any other factor.

Response: We agree wildfires are a component.

(4) What does the comment about sediment concentrations will approach the average concentrations with the return of more normal climatic conditions mean? What is a more normal climate condition? Streams recover and adjust to sediment pulses after landslides under a wide variety of yearly climatic fluctuations. This has been going on for thousands of years.

Response: We agree. The reference to conditions is relative to the cycles you suggest.

Variability Of Peak Discharges

(1) The report provides an excellent discussion of the importance of rain-on-snow events and their climatically driven processes, both in providing sediment to the streams and in having a major influence on the "range of variability" inherent in these hydrologic systems.

Response: Your comment has been noted.

(2) Is the data utilized to make conclusons in this document thorough enough to capture the changing stream conditions resulting from this variability of peak discharges? Does the BURP data capture this annual variability?

Response: This is addressed in section 3.0.

Temperature

(2) Water temperature is known to exceed State Water Quality Standards in many streams within the subbasin at certain times of the year. In most cases, this is a natural condition that cannot realistically be improved by restoration activities.

Response: We agree.

(2) It is our belief that aquatic conditions in the Selway River subbasin can be maintained and improved with a relatively modest investment in aquatic restoration in the short term. Given its largely wilderness and roadless character, this subbasin will contiue to be a model for minimum human intervention with natural processes.

Response: We agree.