Idaho Department of Environmental Quality

Implementation Plan for Cocolalla Lake, Cocolalla Creek, and Hoodoo Creek

July 16, 2004

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LIST OF ACRONYMS

ac	Acre
BLM	Bureau of Land Management
BMP	Best management practice
BPA	Bonneville Power Administration
CAFO	Confined animal feeding operation
cfs	Cubic feet per second
CWA	Clean Water Act
CWE	Cumulative Watershed Effects
EPA	United States Environmental Protection Agency
EWM	Eurasian water milfoil
FEMA	Federal Emergency Management Agency
FLEP	Forest Land Enhancement Program
ft	Foot
GIS	Geographic information system
HUC	Hydrologic Unit Code
IDEQ	Idaho Department of Environmental Quality
IDF&G	Idaho Department of Fish and Game
IDL	Idaho Department of Lands
IDWR	Idaho Department of Water Resources
IFPA	Idaho Forest Protection Act
IP	Implementation Plan
ITD	Idaho Transportation Department
kg	Kilogram
l	Liter
lb	Pound
mg	Milligram
NPDES	National Pollutant Discharge Elimination System
NPPC	Northwest Power Planning Council
NRCS	Natural Resources Conservation Service
SPZ	Stream protection zone
SWCD	Soil and Water Conservation District
TMDL	Total maximum daily load
TP	Total phosphorus
UPRR	Union Pacific Railroad
US	United States
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey
WCT	Westslope cutthroat trout
WQLS	Water quality limited segment
yr	Year

INTRODUCTION

This document represents the Implementation Plan for Cocolalla Lake, Cocolalla Creek, and Hoodoo Creek as identified in the Idaho Department of Environmental Quality (IDEQ) Draft Pend Oreille Sub-Basin Assessment and Draft Total Maximum Daily Loads (TMDL) (IDEQ, 2001). It builds upon previous documents and utilizes the specific loading and reduction values identified in the TMDL for the Pend Oreille Sub-Basin. This document outlines the basis for implementation of the sediment and phosphorus loading reductions called for in the TMDL and, while greater specificity as to source and reduction mechanisms has been provided herein, the original loading and reduction values have not been changed or revised. Within this document, a watershed-wide approach has been used to address implementation activities and changes in management practices associated with reduced discharge to Cocolalla Lake, Cocolalla Creek and Hoodoo Creek. This Implementation Plan has been compiled as a mechanism to identify and describe the specific pollutant controls and management measures to be undertaken, the mechanisms by which the selected measures will be put into action, and the individuals and entities responsible for implementation projects.

OVERVIEW/BACKGROUND INFORMATION

Cocolalla Lake, Cocolalla Creek and Hoodoo Creek are located in the Pend Oreille River Basin of northern Idaho in Bonner County (Figure 1). The Cocolalla and Hoodoo watersheds encompass approximately 101,400 acres in moderately high elevation valleys between the Bitterroot, Cabinet, and Selkirk Mountains. Major tributaries to Cocolalla Lake include Cocolalla Creek, Fish Creek, Butler Creek, Westmond Creek, and Johnson Creek. A major portion of the watershed is forested land, while the area immediately adjacent to the lake and major tributaries is predominantly gently-sloped agricultural land.

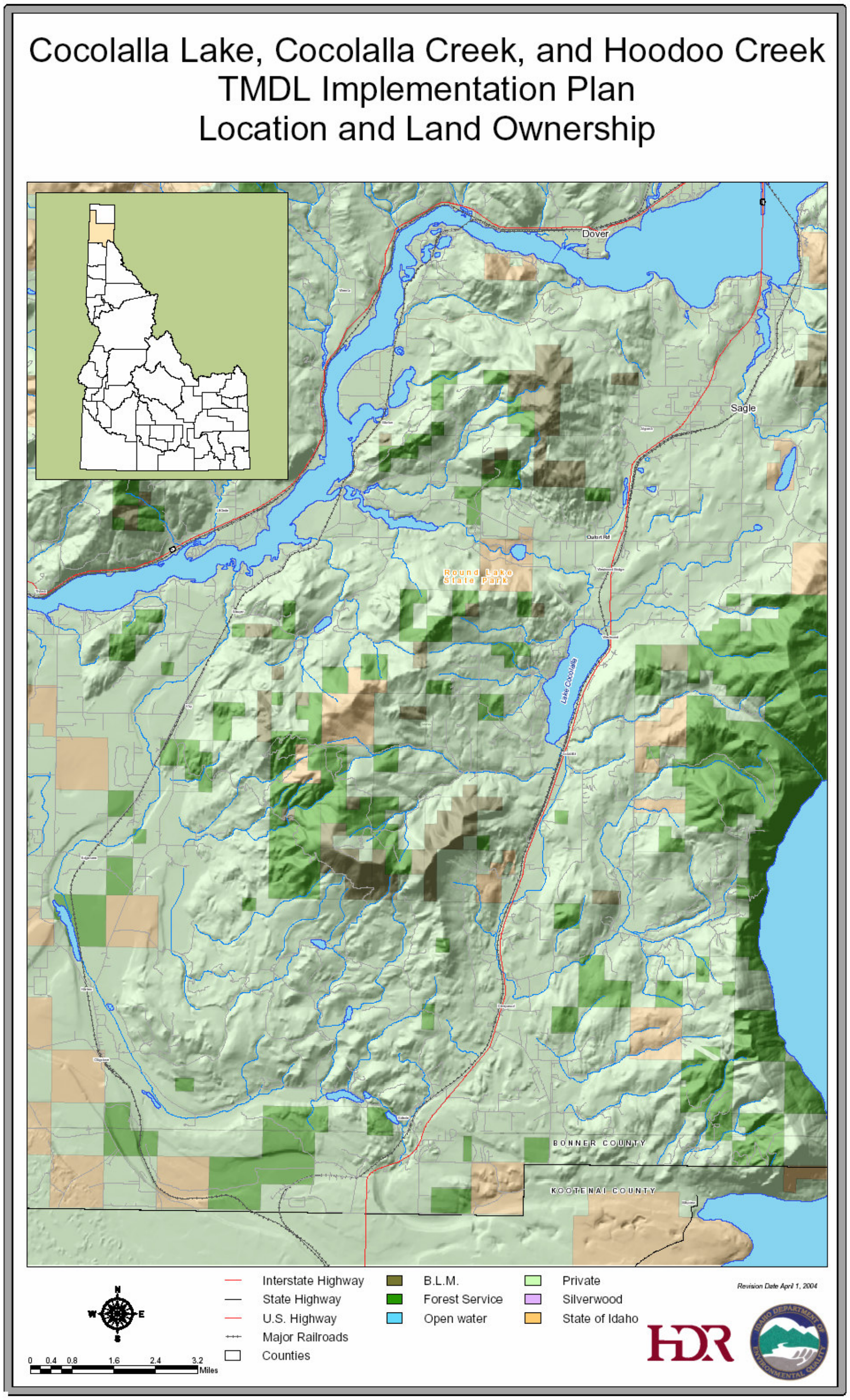

Figure 1. Location and Land Ownership Map

Setting

The setting for Cocolalla and Hoodoo watersheds is heavily forested with foothill to mountainous terrain up to 4,500 feet in elevation with slopes ranging from 15 to 50 percent (IDEQ, 2001) (Figure 1). Cocolalla Lake is at approximately 2,203 ft elevation. The lowest valleys are approximately 2,200 to 2,400 ft while the highest peaks are approximately 4,500 to 5,000 ft in elevation. Peaks in the Hoodoo Valley are generally not as high, approximately 2,000 to 3,000 ft in elevation while Hoodoo Creek and Valley is approximately 2,100 to 2,200 ft in elevation. The valleys are used for agriculture (primarily grazing), small acreage rural residences, and urban/suburban residences. The landforms were strongly influenced by the glacial Lake Missoula floods 10,000 to 12,000 years ago.

The key habitats are conifer forest, riparian, wetlands, and meadows. The uplands are mostly cedar hemlock and the lower elevations are dominated by lodgepole flats and wetland meadows. Mixed stands of western red cedar, western hemlock, douglas fir, ponderosa pine, western larch, lodgepole pine, and western white pine are common. Very wet areas support alder, willow, and other water-loving species (IDEQ, 2001).

Watershed streams are mostly ungaged. Temporary gages in the upper 25 percent of the Cocolalla Creek watershed indicated average discharge around 20 cfs (IDEQ, 2001, p.118). Hoodoo Creek likely has a similar average. Average annual precipitation in the area ranges from 25 to 40 inches with the majority of precipitation occurring as winter snowfall and spring rain. High-volume runoff occurs during spring snowmelt and major rain-on-snow events. Three major phenomena; snow-melt, rain-on-snow, and seasonal thunderstorms generate stream flow within the watershed.

Historically, Bonner County had a resource-based economy, producing timber, agricultural products, and mined minerals. However, this resource-based sector has been replaced by a growing services, retirement, and recreation-based economy (IDEQ, 2001). Currently, the watersheds, as with other areas of Bonner County, are experiencing high rates of rural development (IDEQ, 2001). An estimated 300 acres per year are subdivided in the Cocolalla watershed with the majority of the development occurring on 20 acre parcels following forest land harvest activities.

Basis for Clean Water Act 303(d) Listing and Sources

Cocolalla Lake, Cocolalla Creek, and Hoodoo Creek have been identified as water quality-limited under section 303(d) of the Clean Water Act (CWA). Water quality studies have shown that sediment, thermal modification, low dissolved oxygen, and nutrients are the pollutants of concern within the watershed. Nuisance algae growth resulting from nutrient loading has impaired the designated beneficial uses of Cocolalla Lake, specifically fishing, swimming, boating, and water supply. Internal recycling of sediment-bound phosphorus within Cocolalla Lake is also a concern. Based on the 'Conclusion of Problem Assessment' from the TMDL (IDEQ, 2001), the basis for each of the 303(d) listings is summarized in Tables 1 through 3.

The water quality concerns for Cocolalla Lake are summarized in Table 1. Cocolalla Lake dissolved oxygen data have not met Idaho's criteria for cold water biota. In the summer and winter of 1992, waters deeper than 23 ft were below the 5 mg/L dissolved oxygen criteria. At those times, these oxygen-deficient waters comprised greater than 20 percent of the water column. Blue-green algae blooms have been observed in at least five of the last 20 years, providing evidence that the lake substantially and chronically violates Idaho's narrative nutrient standard. All of Cocolalla Lake's current loadings are from nonpoint sources. Point sources were removed before the TMDL was completed and are not included in the TMDL loading. Photographs of Cocolalla Lake are shown in Figure 2. The transportation corridors and appropriate management of stormwater are of concern, especially along the eastern edge of the lake.

Table 1. Cocolalla Lake Water Quality Concerns

Segment Identifier:	WQLS 7442, HUC 17010214
Pollutants of Concern:	Dissolved Oxygen, Nutrients (Phosphorus)
Uses Affected:	Agricultural and Domestic Water Supply, Cold Water Biota, Primary and Secondary Contact Recreation, and Special Resource Water
Known Sources:	Point Sources – Sandy Beach Resort Sewage Lagoon (Abandoned in 1999)
	Nonpoint Sources – Agriculture (Dairies, Grazing, Feedlots), Forestry/Silviculture (Logging), Sewage and Septic Systems, Suburban/Rural Development (Roads), Channel Modifications, Internal Lake Recycling

Figure 2. Photographs of Cocolalla Lake

The water quality concerns for Cocolalla Creek are summarized in Table 2. For upper and lower Cocolalla Creek the water quality limit listing was based on IDEQ's waterbody assessment process including beneficial use reconnaissance data and macroinvertebrate community evaluations. Sediment data on Cocolalla Creek reflect a high percentage of cobble embeddedness, which impairs both the cold water biota and salmonid spawning beneficial uses (IDEQ, 2001). Photographs from Cocolalla Creek watershed are shown in Figure 3. Concerns include forest management, roads, agricultural practices, wetlands, and channel modifications. Photographs from Fish Creek watershed, a tributary to Cocolalla Lake and west of Upper Cocolalla Creek watershed, are shown in Figure 4. Shown are a large culvert with bars for fish passage near Cocolalla Lake and bridge crossing.

Table 2. Cocolalla Creek Water Quality Concerns

Segment Identifier:	Upper Cocolalla Creek, Headwaters to Cocolalla Lake, WQLS 3443, HUC 17010214 Lower Cocolalla Creek, Cocolalla Lake to Pend Oreille River, WQLS 3442, HUC 17010214
Pollutants of Concern:	Sediment, Water Temperature
Uses Affected:	Agricultural and Domestic Water Supply, Cold Water Biota, Primary and Secondary Contact Recreation, Special Resource Water for Lower Cocolalla Creek
Known Sources:	Point Sources – There are no known point sources discharges to the creek or tributaries.
	Nonpoint Sources – Agriculture (Grazing), Forestry/Silviculture (Logging), Suburban/Rural Development (Roads), Channel Modifications

Figure 3. Photographs from Cocolalla Creek watershed

Figure 4. Photographs from Fish Creek watershed

The water quality concerns for Hoodoo Creek are summarized in Table 3. A ‘Conclusion of Problem Assessment’ was not included in the TMDL (IDEQ, 2001) for Hoodoo Creek but the results of IDEQ’s water body assessment process indicate that the stream does not fully support designated beneficial uses and was placed on the 303(d) list due to sediment pollution. Photographs of Hoodoo Creek are shown in Figure 5. Concerns include forest management, roads, agricultural practices, wetlands, and channel modifications.

Table 3. Hoodoo Creek Water Quality Concerns

Segment Identifier:	Hoodoo Creek, Headwaters to Hoodoo Lake, WQLS 3441, HUC 17010214 Hoodoo Creek, Hoodoo Lake to Pend Oreille River, WQLS 3440, HUC 17010214
Pollutants of Concern:	Sediment, Water Temperature
Uses Affected:	Agricultural Water Supply, Cold Water Biota and Salmonid Spawning, Primary and Secondary Contact Recreation
Known Sources:	Point Sources – There are no known point source discharges to the creek or tributaries.
	Nonpoint Sources – Agriculture (Grazing), Forestry/Silviculture (Logging), Suburban/Rural Development (Roads), Channel Modifications

Figure 5. Photographs of Hoodoo Creek

No critical periods were identified related to specific seasons or flow conditions.

Water Quality Objectives and Pollutant Reduction Targets

In accordance with the section 303(d) requirements, a TMDL was established for Cocolalla Lake, Cocolalla Creek, and Hoodoo Creek. The TMDL includes estimates of the current total load and background loads. The percent reductions are from the current total load. The TMDL indicated that an 89 percent overall load reduction in total phosphorus should reduce the trophic level of the lake to a point where internal nutrient cycling will be reduced. The nutrient narrative standard will be met before the lake meets the oxygen criteria as phosphorus reductions reduce the occurrence and magnitude of algal blooms. The TMDL is an 88 percent reduction in sediment for Upper Cocolalla Creek. The TMDL is a 74 percent reduction in sediment for Lower Cocolalla Creek. For Hoodoo Creek, the TMDL is an 84 percent reduction in sediment. The water quality objectives are summarized in Table 4.

The TMDL was prepared using a load capacity of zero. The US Environmental Protection Agency (EPA) originally required a 100 percent reduction of unnatural loads with only background loads remaining. This results in very high reduction target percentages. Since the TMDL was prepared, EPA's and IDEQ's concept has changed to not more than 50 percent greater than background. This concept provides a compromise between a margin for impacts from development while meeting water quality beneficial uses. Since the TMDL has been approved by EPA, the high reduction percentages are shown along with 1.5 times background load capacity for comparison. Most importantly is to implement projects that reduce the loads to these waterbodies and use adaptive management to evaluate resulting conditions and future actions.

Table 4. Summary of Cocolalla and Hoodoo TMDL Objectives

Cocolalla Lake	
Water Quality Objective:	Dissolved oxygen at or exceeds 5 mg/L in the upper 80 percent of the lake water depth and above the hypolimnion; excess nutrients not to impair beneficial uses
Implementation Plan Objective:	Sustained annual 89% reduction in total phosphorus (TP) loadings
Nonpoint Sources:	81% reduction in TP from Fish Creek 81% reduction in TP from Johnson Creek 84% reduction in TP from Westmond Creek 95% reduction in TP from Butler Creek 82% reduction in TP from Cocolalla Creek 92% reduction in TP from Septic Systems 78% reduction in TP from Atmosphere (dust) 83% reduction in TP from internal recycling
Upper Cocolalla Creek	
Water Quality Objective:	Sediment shall not exceed quantities that impair designated beneficial uses
Implementation Plan Objective:	Sustained annual 88% reduction in sediment loads
Nonpoint Sources:	88% reduction from Land, Roads, and Banks
Lower Cocolalla Creek	
Water Quality Objective:	Sediment shall not exceed quantities that impair designated beneficial uses
Implementation Plan Objective:	Sustained annual 74% reduction in sediment loads
Nonpoint Sources:	74% reduction from Land, Roads, and Banks
Hoodoo Creek	
Water Quality Objective:	Sediment shall not exceed quantities that impair designated beneficial uses
Implementation Plan Objective:	Sustained annual 84% reduction in sediment loads
Nonpoint Sources:	84% reduction from Land, Roads, and Banks

From the TMDL, the estimated loadings for the Cocolalla Lake, Cocolalla Creek, and Hoodoo Creek are shown in Table 5. The total load is taken from the TMDL (DEQ, 2001). The percent reduction was calculated as the amount to reduce divided by the total load for each source. The reduction and target loads sum to the total load and are also from the TMDL. As established in the TMDL, estimated loads are broken down by major sources. The range of percent reductions were calculated based on allocating the total percent reduction for the major sources.

Table 5. Annual Loads to Cocolalla Lake, Cocolalla Creek, and Hoodoo Creek

Cocolalla Lake[1]	Phosphorus Load (kg/yr)	Reduction (kg/yr)	Percent Reduction (%)	Target (kg/yr)
Fish Creek	334	269	81	65
Johnson Creek	100	81	81	19
Westmond Creek	353	296	84	57
Butler Creek	114	108	95	6
Cocolalla Creek	883	727	82	156
Septic Systems	118	108	92	10
Atmosphere	242	188	78	54
Internal Recycling	1100	916	83	184
Total	3,244	2,693	83	551

Upper Cocolalla Creek[1]	Sediment Load (tons/yr)	TMDL Target (tons/yr)[2]	IP Target (tons/yr)[3]	IP Percent Reduction (%)
Lands	734.4	--	--	51 – 82
Roads	3,560.5	--	--	87 – 95
Banks	1,451	--	--	87 – 95
Total	5,745.9	674	1,010	82
Lower Cocolalla Creek[1]	**Sediment Load (tons/yr)**	**TMDL Target (tons/yr)[2]**	**IP Target (tons/yr)[3]**	**IP Percent Reduction (%)**
Lands	1,415.2	--	--	49 – 62
Roads	2,438.4	--	--	67 – 95
Banks	832.1	--	--	67 – 95
Total	4,685.7	1,203	1,804	62
Hoodoo Creek[1]	**Sediment Load (tons/yr)**	**TMDL Target (tons/yr)[2]**	**IP Target (tons/yr)[3]**	**IP Percent Reduction (%)**
Lands	1,146.7	--	--	55 – 75
Roads	3,540	--	--	80 – 95
Banks	1,464.2	--	--	80 – 95
Total	6,150.9	1,013	1,519	75

1-IDEQ, 2001, Draft Pend Oreille Sub-Basin Assessment and Draft TMDL for loads, percent reductions calculated
2-TMDL Target from 2001 TMDL based on background
3-Implementation Plan (IP) Target based on 1.5*background

Sediment and Phosphorus Forms

Sediment is the general term for soil particles that can be moved by erosion, runoff, wind, and waves to cloud a water body and smother aquatic plants and animals. Sediments can also carry chemical contaminants and nutrients such as phosphorus. During rain or snowmelt, sediment can be moved off the land into nearby streams and rivers. Winds and water currents and waves can also stir up bottom sediments within lakes.

Phosphorus concentrations generally limit the growth of algae in most freshwaters. Phosphorus occurs in either a particulate phase or a dissolved phase. Particulate phosphorus includes that contained in living and dead plankton (algae and zooplankton), organic detritus of terrestrial and aquatic origin, precipitates of phosphorus, and phosphorus adsorbed to particulates (clay, silt, or detritus). The dissolved phase includes inorganic phosphorus, generally in the soluble orthophosphate or organic metaphosphates form, and is the form of phosphorus readily used by algae. Particulate phosphorus is not easily used by algae until released in soluble form.

Nonpoint sources of phosphorus to lakes include natural sources (such as phosphate-rich rocks), runoff from agricultural, forested, urban, and paved (roads) lands, or streambank erosion. Feedlot runoff has very high proportions and concentrations of dissolved phosphorus, which can more quickly produce algal blooms (and lead to higher levels of algae) when compared with phosphorus that enters the lake in the particulate form. Runoff from other agricultural and forestry sources generally has low soluble phosphorus since most of its high total phosphorus concentrations are in the particulate phase, being adsorbed on fine soil particles and particulate organics. The forms of phosphorus change back and forth from the particulate to dissolved phases. For example, dissolved phosphorus that is taken up by algae changes back to a particulate organic form of phosphorus, which will then be released to the water column again as soluble phosphorus with mineralization of the plant material upon decomposition.

Lakes and aerobic reservoir sediments typically serve as phosphorus sinks storing most incoming phosphorus. A portion of the phosphorus in the sediments may re-enter the water column with mineralization in anaerobic sediments. For example, lakes that experience zero oxygen near the bottom during the summer months or under winter ice cover may stimulate the release of dissolved phosphorus from the sediments. This recycling of phosphorus can result in spring and fall algal blooms after water column overturn and re-supply of dissolved phosphorus to sunlit surface waters.

SUMMARY OF PRESENT POLLUTANT LOADS

Present loads in the Cocolalla and Hoodoo watersheds are discussed under the pollutant source inventory and source analysis in the TMDL (IDEQ, 2001). The sources were summarized as determined in the TMDL loading analysis for completeness. The source loads were divided into categories: forestry, agricultural, urban/suburban (including suburban and rural development), and internal recycling for the Implementation Plan. Sources such as groundwater, miscellaneous, and other unidentified sources are assumed to be part of the forestry, agricultural, and urban/suburban loadings.

The United States Geological Survey (USGS) has identified watersheds and classified them by hydrologic unit code. The Idaho Department of Lands (IDL) further subdivided some of the watersheds in the Cocolalla Creek watershed into sub-watersheds. These watersheds were further sub-divided to identify all the tributary watersheds listed in the TMDL. The watersheds and sub-watersheds are shown in Figure 6.

The USGS has also identified land use in the Sandpoint, Idaho region. These areas were overlaid with the watersheds to identify forestry, agricultural, and urban/suburban land use areas in acres. The land use is shown in Figure 7.

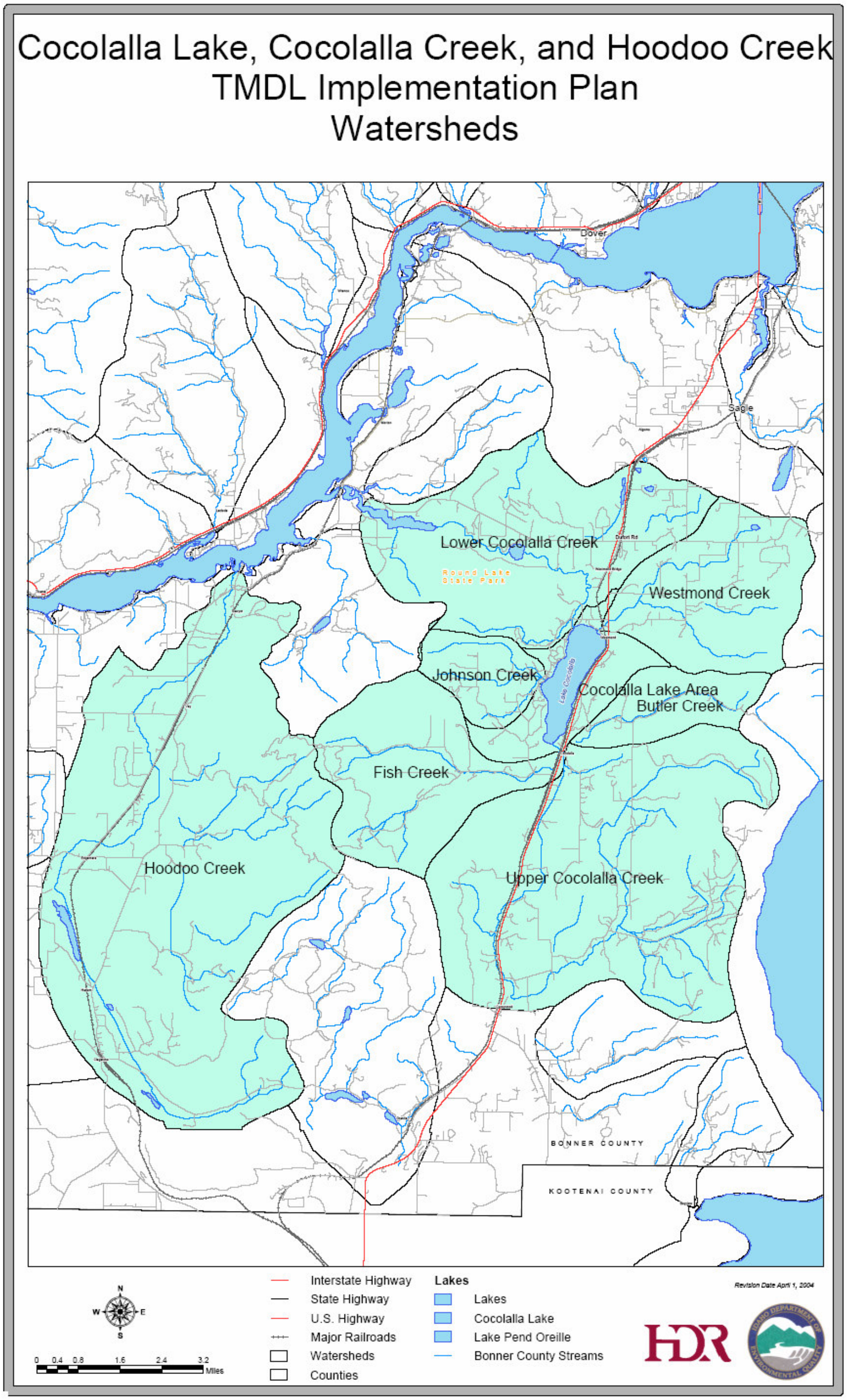

Figure 6. Watershed Map

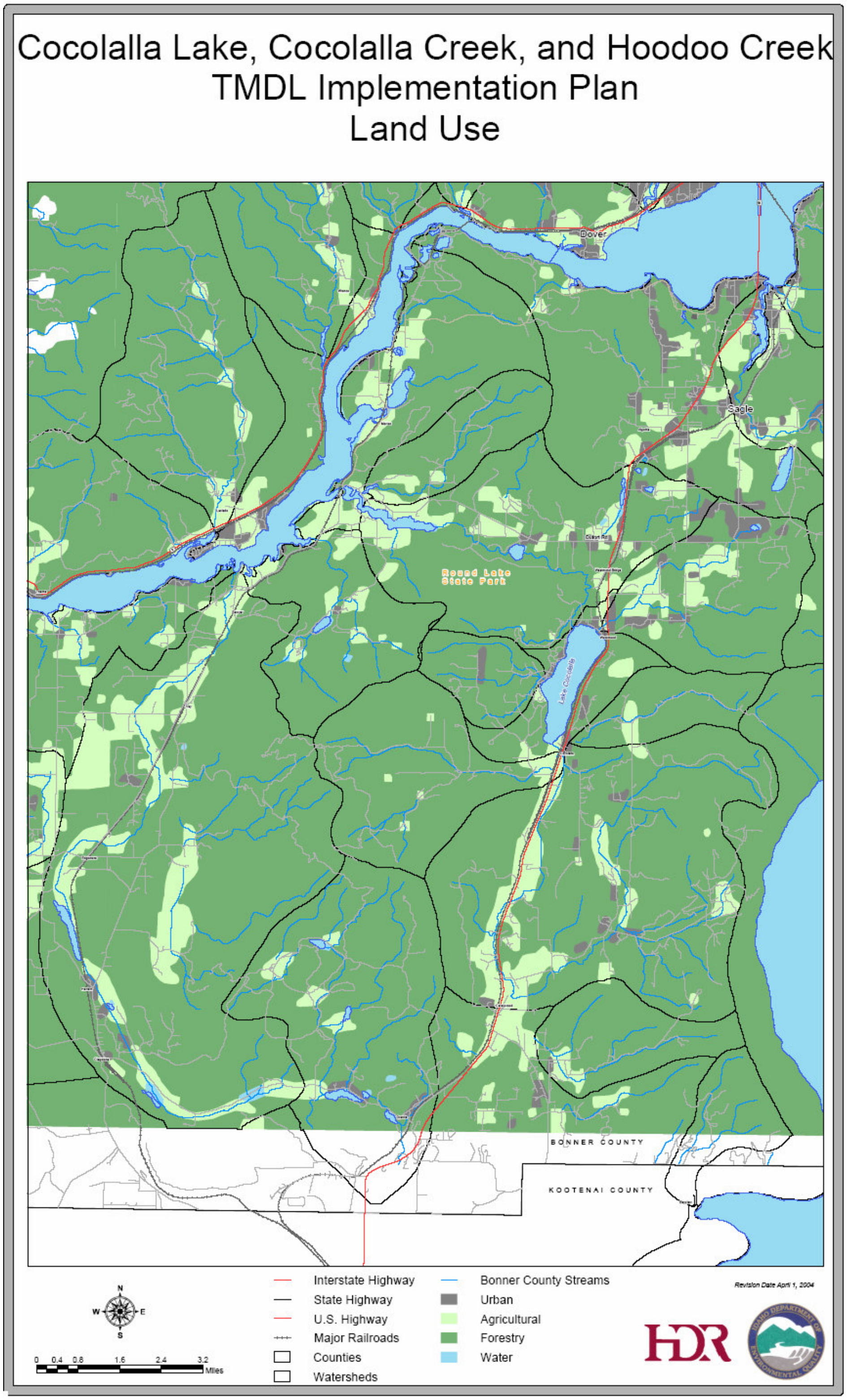

Figure 7. Land Use Map

Cocolalla Lake

Present pollutant loadings to Cocolalla Lake include bank destabilization in agricultural lands, overland runoff from more heavily used agricultural lands such as feedyards and high-density equipment use areas, forest harvesting, urban/suburban growth including septic systems and stormwater, poorly constructed/maintained roads, atmospheric fallout, and internal nutrient recycling. Tributaries contributed 55 percent of the total phosphorus load and lake internal nutrient cycling accounted for 34 percent (IDEQ, 2001). The remaining percentage is from other sources including septic systems and atmospheric fallout. The TMDL does not identify sources and does not divide the sub-watershed loads into the categories. The load reductions for the tributaries are assigned to the forestry, agricultural and urban/suburban categories based on their relative land use percentages. Land uses are identified as 83 percent forest, 10 percent agricultural, and 7 percent urban/suburban (IDEQ, 2001). The urban/suburban loads also include the loads identified as septic systems and atmospheric fallout. Internal recycle loadings are the phosphorus loads from the breakdown of organic matter in the lake and bottom sediments. Presently, the phosphorus loading from recycling contributes to the impairment of the lake, including algae blooms and depressed dissolved oxygen concentrations. Present loading from atmospheric fallout is a small fraction of the total loading but will become proportionately more important as the total loading is reduced to meet the water quality target. A summary of the present phosphorus loads by tributary to Cocolalla Lake is shown in Table 6 (IDEQ, 2001, p.121). A majority of the phosphorus loading comes from the tributaries, in particular Cocolalla Creek, and internal loading.

Table 6. Cocolalla Lake Summary of Phosphorus Loads by Tributary

Cocolalla Lake[1]	Present Phosphorus Load (kg/yr)	Percent of Total Load (%)	Reduction Target Load (kg/yr)	Percent Reduction (%)	Remaining Target Load (kg/yr)	Percent Remaining (%)
Tributary						
Fish Creek	334	10	269	81	65	19
Johnson Creek	100	3	81	81	19	19
Westmond Creek	353	11	296	84	57	16
Butler Creek	114	4	108	95	6	5
Cocolalla Creek	883	27	727	82	156	18
Subtotal	1,784	55	1,481	83	303	17
Septic Systems	118	4	108	92	10	8
Atmosphere	242	7	188	78	54	22
Internal Loading	1,100	34	916	83	184	17
Total	3,244	100	2,693	83	551	17

1-IDEQ, 2001, Draft Pend Oreille Sub-Basin Assessment and Draft TMDL for loads, percentages calculated

Using the land use percentages in the TMDL, the total load was apportioned by the land use (Table 7). The percentage of each load category was calculated. The reduction target load was apportioned by the land use percentages. In terms of land use, a majority of the phosphorus loading comes from forested lands and internal loading. In terms of phosphorus reduction to Cocolalla Lake, efforts focused on forested lands in the Cocolalla Creek drainage and internal recycling may have the most potential impact.

Table 7. Cocolalla Lake Summary of Phosphorus Loads by Category

Cocolalla Lake[1]	Present Phosphorus Load (kg/yr)	Percent of Total Load (%)	Reduction Target Load (kg/yr)	Percent Reduction (%)	Remaining Target Load (kg/yr)
Forestry	1,682	52	1,385	82	296
Agricultural	203	6	167	82	36
Urban/Suburban	260	8	225	87	35
Internal Recycling	1,100	34	916	83	184
Total	3,244	100	2,693	83	551

1-Adapted from IDEQ, 2001, Draft Pend Oreille Sub-Basin Assessment and Draft TMDL; loads apportioned by land use percentages

The area of each land use category by tributary for the sub-watersheds was calculated. The proportional land use areas for the total watershed are similar to the TMDL and generally the area is heavily forested (Table 8).

Table 8. Cocolalla Lake Approximate Category Areas by Tributary

Cocolalla Lake[1]	Area (acres)	Water Area	Forestry Area		Agricultural Area		Urban/Suburban Area	
		(acres)	(acres)	(%)	(acres)	(%)	(acres)	(%)
Tributary								
Fish Creek	6,430	<1	6,153	96	277	4	<1	<1
Johnson Creek	2,004	<1	1,927	96	<1	<1	77	4
Westmond Creek	5,871	13	4,450	76	852	15	556	9
Butler Creek	2,332	<1	2,190	94	140	6	2	<1
Cocolalla Creek	17,276	1	14,710	85	2,315	13	250	1
Cocolalla Lake Area	2,989	681	1,722	58	306	10	280	9
Total	36,902	695	31,152	84	3,890	11	1,165	3

1-from GIS and calculations

The area of tributary watersheds was not included in the TMDL. Since the areas were not reported but are useful for understanding the magnitude of mass per area, the area of the watersheds was calculated using watershed delineations from IDL as shown in Figure 6. Using these areas, the loading per unit area was calculated by dividing the load by the area (Table 9). The atmospheric load was divided by the entire watershed area including Cocolalla Lake.

Table 9. Cocolalla Lake Summary of Phosphorus Loads by Area

Cocolalla Lake[1]	Area (acres)	Present Phosphorus Load per Area (lb/yr/ac)	Reduction Target Load per Area (lb/yr/ac)	Remaining Target Load per Area (lb/ac/yr)
Tributary				
Fish Creek	6,430	0.11	0.09	0.02
Johnson Creek	2,004	0.11	0.09	0.02
Westmond Creek	5,871	0.13	0.11	0.02
Butler Creek	2,332	0.11	0.10	0.01
Cocolalla Creek	17,276	0.11	0.09	0.02
Subtotal	33,913	0.12	0.10	0.02
Septic Systems	2,989	0.09	0.08	0.01
Atmosphere	36,902	0.01	0.01	0.003
Internal Loading	681	3.56	2.97	0.60

1-IDEQ, 2001, Draft Pend Oreille Sub-Basin Assessment and Draft TMDL for loads; areas from GIS, other calculated

Generally, the loadings per area are similar with the exception of internal loading which appears disproportionately high on a unit area basis. Internal loading will either need to be reduced using a technology or a schedule accepted along with greater watershed reductions to allow natural reduction of the internal loading. The results do not suggest a tributary priority for phosphorus reductions efforts based on area loadings. Efforts will be needed throughout the watershed.

Cocolalla Creek

Present sediment load sources to Upper and Lower Cocolalla Creek as identified in the TMDL include silviculture, agriculture and grazing, roads, and residential development (urban/rural interface). Most of the land is under private ownership and a significant portion has been selectively logged (IDEQ, 2001). Land ownership includes US Forest Service, US Bureau of Land Management (BLM), IDL, corporate, and private ownership. Pastures and stream zones are assumed to be generally in good condition, however, many of the channels have been physically altered or straightened. Roads are a source of sediment because drainage facilities and other sediment control measures have not been installed in many areas (IDEQ, 2001). Ordinances and enforcement weakly regulate the construction and development of residential sites with minimal planning and implementation of erosion and sedimentation control and storm water management plans for new construction. The TMDL load reductions are assigned to the forestry, agricultural, and urban/suburban categories based on the land use percentages. Land uses identified for Upper Cocolalla Creek are 83 percent forested, 15 percent agricultural, and 2 percent urban/suburban. Land uses identified for Lower Cocolalla Creek are 94 percent forested, 3 percent agricultural, and 3 percent urban/suburban. A summary of the present sediment loads to Upper and Lower Cocolalla Creeks is shown in Tables 10 and 11, respectively (IDEQ, 2001, p.131 inserts and p.149 inserts).

The TMDL identified five general land uses in these areas: Pasture; Forest Land; Unstocked Forest; Highway; and Double Fires. Pasture land includes hay fields, grazing pastures and any low elevation treeless land. Unstocked Forest includes natural openings and 90 to 100% cut-over forest. Highways are paved and contribute less sediment than a gravel road and, therefore, have a lower sediment yield rate. Double Fires are areas burned by two large wildfires (IDEQ, 2001, p.170). The period when the last two fires occurred was not provided in the TMDL document.

Table 10. Upper Cocolalla Creek Summary of Sediment Loads

Upper Cocolalla Creek[1]	Present Sediment Load (tons/yr)	Percent of Total Load (%)	TMDL Target (tons/yr)[2]	IP Target (tons/yr)[3]	IP Percent Reduction
Pasture	157.8	3	--	--	51 – 82
Forest	547.5	10	--	--	51 – 82
Unstocked Forest	18.8	0.3	--	--	87 – 95
Highway	2.7	0.05	--	--	87 – 95
Double Fires	7.6	0.1	--	--	87 – 95
Watershed Subtotal	734.4	13	--	--	
Forest Roads	350	6	--	--	87 – 95
County and Private Roads	3,210.5	56	--	--	87 – 95
Roads Subtotal	3,560.5	62	--	--	
Bank poor condition	1,047.7	18	--	--	87 – 95
Bank good condition	403.3	7	--	--	87 – 95
Streambank Subtotal	1,451	25	--	--	
Total	5,746	100	674	1,010	82

1-IDEQ, 2001, Draft Pend Oreille Sub-Basin Assessment and Draft TMDL for loads, percentages calculated
2-TMDL Target from 2001 TMDL based on background
3-IP Target based on 1.5*background

Table 11. Lower Cocolalla Creek Summary of Sediment Loads

Lower Cocolalla Creek[1]	Present Sediment Load (tons/yr)	Percent of Total Load (%)	TMDL Target (tons/yr)[2]	IP Target (tons/yr)[3]	IP Percent Reduction
Pasture	588.8	13	--	--	49 – 62
Forest	754.8	16	--	--	49 – 62
Unstocked Forest	67.6	1	--	--	67 – 95
Highway	4	0.1	--	--	67 – 95
Double Fires	0	0	--	--	
Watershed Subtotal	1,415.2	30	--	--	
Forest Roads	552	12	--	--	67 – 95
Forest Road Failure	95.8	2	--	--	67 – 95
County and Private Roads	1,734	37	--	--	67 – 95
County and Private Road Failure	56.6	1	--	--	67 – 95
Roads Subtotal	2,438.4	52	--	--	
Bank poor condition	532.2	11	--	--	67 – 95
Bank good condition	299.9	6	--	--	67 – 95
Streambank Subtotal	832.1	18	--	--	
Total	4,686	100	1,203	1,804	62

1-IDEQ, 2001, Draft Pend Oreille Sub-Basin Assessment and Draft TMDL for loads, percentages calculated
2-TMDL Target from 2001 TMDL based on background
3-IP Target based on 1.5*background

The land use reported in the TMDL is shown in Table 12. Using the land use percentages in the TMDL, the sediment loads were computed by the land use categories (Tables 13 and 14). The total load was apportioned by the land use percentages. The reduction percentage was then used to calculate the reduction and remaining target load. A majority of the sediment loading comes from forested lands.

Table 12. Upper and Lower Cocolalla Creek TMDL Land Use

	Upper Cocolalla Creek[1]			Lower Cocolalla Creek[1]		
	Area (acres)	**Percent (%)**	**Present Sediment Load per Area (lb/yr/ac)**	**Area (acres)**	**Percent (%)**	**Present Sediment Load per Area (lb/yr/ac)**
Pasture	2,869	15	110	10,705	31	110
Forest	14,407	76	76	19,864	57	76
Unstocked Forest	1,109	6	34	3,974	12	34
Highway	80	0.4	68	11	0.03	734
Double Fires	448	2	34	0	0	0
Watershed Subtotal	18,913	100	78	34,554	100	82
	Length (miles)	**Percent (%)**	**Present Sediment Load per Mile (lb/yr/mi)**	**Length (miles)**	**Percent (%)**	**Present Sediment Load per Mile (lb/yr/mi)**
Forest Roads	92.1	42	7,600	115	63	9,600
County and Private Roads	126	58	50,960	68	37	51,000
Roads Subtotal	218	100	32,650	183	100	26,649
Bank poor condition	6.3	45	332,603	3.2	36	332,600
Bank good condition	7.8	55	103,410	5.8	64	103,414
Streambank Subtotal	14.1	100	205,816	9	100	184,902

1-IDEQ, 2001, Draft Pend Oreille Sub-Basin Assessment and Draft TMDL for loads, areas from GIS, other calculated

Table 13. Upper Cocolalla Creek Summary of Sediment Loads by Category

Upper Cocolalla Creek[1]	Present Sediment Load (tons/yr)	Percent of Total Load (%)	Reduction Target Load (tons/yr)	Percent Reduction (%)	Remaining Target Load (tons/yr)
Forestry	4,850	84	4,231	87	618.5
Agricultural	872	15	817	94	55
Urban/Suburban	24	0.4	24	100	0
Total	5,746	100	5,072	88	673.5

1-Adapted from IDEQ, 2001, Draft Pend Oreille Sub-Basin Assessment and Draft TMDL, loads apportioned by land use percentages

Table 14. Lower Cocolalla Creek Summary of Sediment Loads by Category

Lower Cocolalla Creek[1]	Present Sediment Load (tons/yr)	Percent of Total Load (%)	Reduction Target Load (tons/yr)	Percent Reduction (%)	Remaining Target Load (tons/yr)
Forestry	3,233	69	2,092	65	1,140
Agricultural	1,452	31	1,389	96	62
Urban/Suburban	1.5	0.03	1	99	0.01
Total	4,686	100	3,483	74	1,202.5

1-Adapted from IDEQ, 2001, Draft Pend Oreille Sub-Basin Assessment and Draft TMDL, loads apportioned by land use percentages

The areas of each land use within the watershed were calculated. The percentages for the total watershed are similar to the TMDL for Upper Cocolalla Creek, while generally there are less forested lands and more agriculture lands for the Lower Cocolalla Creek. Generally, the areas are heavily forested (Table 15).

Table 15. Cocolalla Creek Approximate Category Areas

Watershed[1]	Area (acres)	Water Area	Forestry Area		Agricultural Area		Urban/Suburban Area	
		(acres)	(acres)	(%)	(acres)	(%)	(acres)	(%)
Upper Cocolalla Creek	17,276	1	14,710	85	2,315	13	250	1
Lower Cocolalla Creek	10,311	256	8,112	79	1,626	16	317	3

1-from GIS and calculations

The areas of the watersheds were calculated based on GIS data. Using these areas and the total loading, the loading per area was calculated as shown in Table 16. The reduction and remaining target loads were then calculated.

Table 16. Cocolalla Creek Summary of Sediment Loads by Area

Watershed[1]	Area (acres)	Present Sediment Load per Area (lb/yr/ac)	Reduction Target Load per Area (lb/yr/ac)	Remaining Target Load per Area (lb/ac/yr)
Upper Cocolalla Creek	17,276	665	587	78
Lower Cocolalla Creek	10,311	909	676	233

1-IDEQ, 2001, Draft Pend Oreille Sub-Basin Assessment and Draft TMDL for loads; areas from GIS, other calculated

The reduction target load is greater for Lower Cocolalla Creek but the remainder is higher which will be more easily attainable. The remaining target load is lower for Upper Cocolalla Creek but is important to both water quality within Cocolalla Creek and downstream.

Hoodoo Creek

Present loads to Hoodoo Creek include sediment generated from roads, skid trails, overland runoff from high density use areas, and mass wasting along with roads and agriculture. The load reductions are assigned to the forestry, agricultural, and urban/suburban categories based on the land use percentages. Land uses identified for Hoodoo Creek are 82 percent forestry, 13 percent agricultural, and 5 percent suburban/rural (IDEQ, 2001). A summary of the present sediment loads to Hoodoo Creek is shown in Table 17 (IDEQ, 2001, p.155 inserts).

Table 17. Hoodoo Creek Summary of Sediment Loads

Hoodoo Creek[1]	Present Sediment Load (tons/yr)	Percent of Total Load (%)	TMDL Target (tons/yr)[2]	IP Target (tons/yr)[3]	IP Percent Reduction
Pasture	260.9	4	--	--	55 – 75
Forest	815.4	13	--	--	55 – 75
Unstocked Forest	58.5	1	--	--	80 – 95
Highway	0	0	--	--	80 – 95
Double Fires	11.9	0	--	--	80 – 95
Watershed Subtotal	1,146.7	19	--	--	
Forest Roads	531	9	--	--	80 – 95
County and Private Roads	3,009	49	--	--	80 – 95
Roads Subtotal	3,540	58	--	--	
Bank poor condition	1,205.7	20	--	--	80 – 95
Bank good condition	258.5	4	--	--	80 – 95
Streambank Subtotal	1,464.2	24	--	--	
Total	6,151	100	1,013	1,519	75

1-IDEQ, 2001, Draft Pend Oreille Sub-Basin Assessment and Draft TMDL for loads, percentages calculated
2-TMDL Target from 2001 TMDL based on background
3-IP Target based on 1.5*background

The land use reported in the TMDL is shown in Table 18. Using the land use percentages in the TMDL, the sediment loads were computed by the land use categories (Table 19). The total load was apportioned by the land use percentages. The reduction percent was then used to calculate the reduction and remaining target load. A majority of the sediment loading comes from forested lands.

Table 18. Hoodoo Creek TMDL Land Use

Hoodoo Creek[1]	Area (acres)	Percent (%)	Present Sediment Load per Area (lb/yr/ac)
Pasture	4,744	16	110
Forest	21,457	71	76
Unstocked Forest	3,442	11	34
Highway	0	0	0
Double Fires	699	2	34
Watershed Subtotal	30,342	100	76
	Distance (miles)	**Percent (%)**	**Present Sediment Load per Mile (lb/yr/mi)**
Forest Roads	118	50	9,000
County and Private Roads	118	50	51,000
Roads Subtotal	236	100	30,000
Bank poor condition	7.25	59	332,607
Bank good condition	5	41	103,400
Streambank Subtotal	12.25	100	239,053

1-IDEQ, 2001, Draft Pend Oreille Sub-Basin Assessment and Draft TMDL for loads, areas from GIS, other calculated

Table 19. Hoodoo Creek Summary of Sediment Loads by Category

Hoodoo Creek[1]	Present Sediment Load (tons/yr)	Percent of Total Load (%)	Reduction Target Load (tons/yr)	Percent Reduction (%)	Remaining Target Load (tons/yr)
Forestry	5,189	84	4,232	82	957.7
Agricultural	962	16	907	94	55
Urban/Suburban	0	0	0	0	0
Total	6,151	100	5,138	84	1,012.7

1-Adapted from IDEQ, 2001, Draft Pend Oreille Sub-Basin Assessment and Draft TMDL, loads apportioned by land use percentages

The category areas were calculated as shown in Figure 7. The percentages for the total watershed are similar to the TMDL. Generally, the areas are heavily forested (Table 20). The areas were calculated as shown in Figure 6. Using these areas the loading per area was calculated as shown in Table 21. Hoodoo Creek has a lower reduction target load which will be easier to attain although the remaining target load is low.

Table 20. Hoodoo Creek Approximate Category Areas

Watershed[1]	Area (acres)	Water Area	Forestry Area		Agricultural Area		Urban/Suburban Area	
		(acres)	(acres)	(%)	(acres)	(%)	(acres)	(%)
Hoodoo Creek	26,201	140	21,481	82	4,400	17	180	1

1-from GIS and calculations

Table 21. Hoodoo Creek Summary of Sediment Loads by Area

Watershed[1]	Area (acres)	Present Sediment Load per Area (lb/yr/ac)	Reduction Target Load per Area (lb/yr/ac)	Remaining Target Load per Area (lb/ac/yr)
Hoodoo Creek	26,201	470	392	77

1-IDEQ, 2001, Draft Pend Oreille Sub-Basin Assessment and Draft TMDL for loads, areas from GIS, other calculated

Watershed Summary

The watershed summary includes basic information on land ownership and land use, including miles of roads and streams. This information may provide data for setting priorities for the location of projects and best management practices (BMPs) for pollutant load reductions. The data helps in identifying key owners, land use, and proximity to water. A map of land ownership and land use overlaid along with a 500 ft buffer drawn around the streams is shown in Figure 8. The number of acres and miles of roads and streams for each of the categories were calculated from the map in Figure 8. While the following is an extensive breakdown of land use information, the details provide insight and understanding to the situation of the watersheds. Understanding the components is critical to deciding how to approach and address the water quality issues within the watersheds.

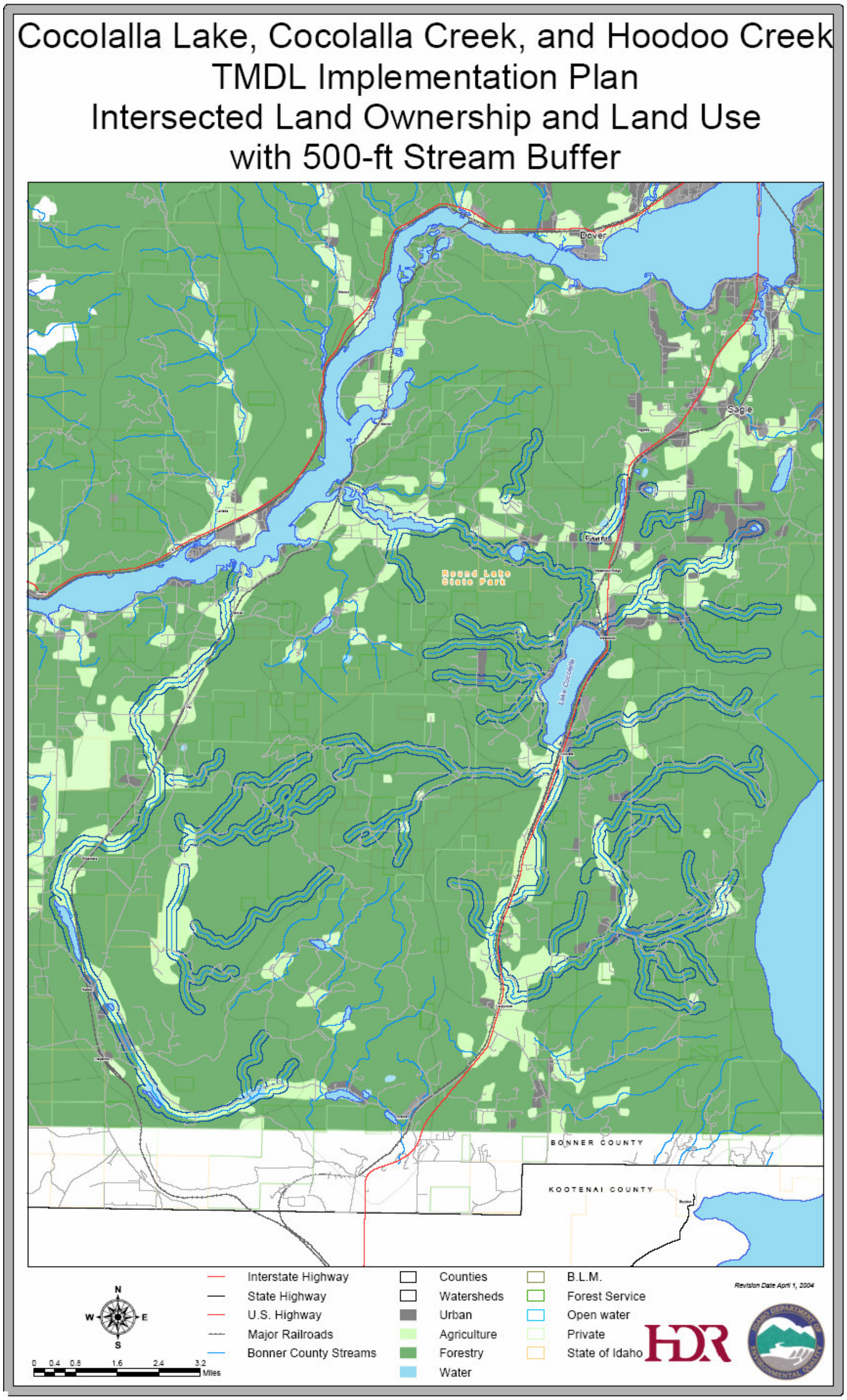

Figure 8. Land Use and Ownership with 500-ft Stream Buffer Map

Land Use

The land use and land ownership maps were overlaid to characterize the ownership of the different land uses within the watersheds. For example, a State of Idaho agency may own 100 acres of which 80 acres are forested, 15 acres are in agriculture, and 5 acres are developed. A 500 ft buffer around all streams further subdivided the areas. The distance of 500 ft was selected as more than protective of the stream and riparian area. Erosion of streams is one of the greatest sources of sediment, based on the percent of total load, and is a direct delivery source to the water.

Landowners will be responsible for reducing the pollutant loadings. Federal and State land managers will be required to adhere to the laws of the land and work towards improving water quality. Private landowners will be encouraged to voluntarily participate to make improvements with their land stewardship. How landowners and managers use and maintain their land results in the total sediment and phosphorus loads in the watershed. They may want to know how many acres they own, how close those acres are to the water courses, and the general land use activities occurring in each watershed. Knowing the general land use will help with identifying potentially supporting agencies, funding sources, and applicable BMPs. Knowing the proximity to waterways is a means of ranking priority areas. These breakdowns are shown in Tables 22 through 26. The areas of land ownership and use were also calculated as percentages. The percentages indicate mostly forest in all but the Cocolalla Lake Area. These percentages are included in Tables 22 through 26.

Table 22. State of Idaho Land Ownership and Use

Watershed	Forestry (acres)		Agricultural (acres)		Urban/Suburban (acres)		Water (acres)	Total (acres)
Distance to water	< 500 ft	> 500 ft	< 500 ft	> 500 ft	< 500 ft	> 500 ft		
Cocolalla Lake Area	0	0	0	0	0	0	806	806
Fish Creek	89	448	0	0	0	0	0	537
Johnson Creek	0	0	0	0	0	0	0	0
Westmond Creek	0	237	0	1	0	0	13	251
Butler Creek	22	292	6	30	0	0	0	349
Upper Cocolalla Creek	119	502	0	45	0	0	1	667
Lower Cocolalla Creek	151	451	0	11	7	20	256	896
Hoodoo Creek	70	960	0	450	0	1	140	1622
Watershed	**Forestry (%)**		**Agricultural (%)**		**Urban/Suburban (%)**		**Water (%)**	**Total (%)**
Cocolalla Lake Area	0	0	0	0	0	0	100	100
Fish Creek	16	84	0	0	0	0	0	100
Johnson Creek	0	0	0	0	0	0	0	100
Westmond Creek	0	94	0	0	0	0	6	100
Butler Creek	6	84	2	8	0	0	0	100
Upper Cocolalla Creek	18	75	0	7	0	0	0	100
Lower Cocolalla Creek	17	50	0	1	1	2	29	100
Hoodoo Creek	4	59	0	28	0	0	9	100

Land owned by the State of Idaho is predominantly forested land. The State of Idaho does have some acres of urban/suburban land primarily near Round Lake State Park in the Lower Cocolalla Creek watershed. There are some agricultural lands owned by the State of Idaho, mostly in Hoodoo Valley and away from the creeks. On State of Idaho lands, the main areas to focus water quality commitments appear to be to the infrastructure at Round Lake State Park and management of forested lands.

Table 23. Federal, Forest Service Land Ownership and Use

Watershed	**Forestry (acres)**		**Agricultural (acres)**		**Urban/Suburban (acres)**		**Water (acres)**	**Total (acres)**
Distance to water	< 500 ft	> 500 ft	< 500 ft	> 500 ft	< 500 ft	> 500 ft		
Cocolalla Lake Area	0	135	0	3	0	0	0	138
Fish Creek	266	880	0	0	0	0	0	1146
Johnson Creek	128	257	0	0	0	0	0	385
Westmond Creek	226	1169	0	19	0	0	0	1414
Butler Creek	42	699	0	0	0	0	0	741
Upper Cocolalla Creek	570	2218	0	31	0	0	0	2819
Lower Cocolalla Creek	84	728	0	4	0	0	0	816
Hoodoo Creek	630	3110	65	10	0	0	0	3814
Watershed	**Forestry (%)**		**Agricultural (%)**		**Urban/Suburban (%)**		**Water (%)**	**Total (%)**
Cocolalla Lake Area	0	98	0	2	0	0	0	100
Fish Creek	23	77	0	0	0	0	0	100
Johnson Creek	33	67	0	0	0	0	0	100
Westmond Creek	16	83	0	1	0	0	0	100
Butler Creek	6	94	0	0	0	0	0	100
Upper Cocolalla Creek	20	79	0	1	0	0	0	100
Lower Cocolalla Creek	10	89	0	0	0	0	0	100
Hoodoo Creek	17	82	2	0	0	0	0	100

Land owned by the Forest Service is almost entirely forested land. Less than 2 percent of Forest Service land is agricultural. The Forest Service will need to commit to go above and beyond their generally prescribed BMPs in these TMDL watersheds to reduce the sediment and phosphorus loads. Lands nearest creeks are highest priority to minimize load sources and protect the stream channel.

Table 24. Federal, BLM Land Ownership and Use

Watershed	Forestry (acres)		Agricultural (acres)		Urban/Suburban (acres)		Water (acres)	Total (acres)
Distance to water	< 500 ft	> 500 ft	< 500 ft	> 500 ft	< 500 ft	> 500 ft		
Cocolalla Lake Area	0	19	0	0	0	0	0	19
Fish Creek	0.2	810	0	0	0	0	0	810
Johnson Creek	3	34	0	0	0	0	0	37
Westmond Creek	0	126	0	0	0	0	0	126
Butler Creek	0	16	0	0	0	0	0	16
Upper Cocolalla Creek	0	312	0	0	0	17	0	330
Lower Cocolalla Creek	39	415	0	0	0	0	0	453
Hoodoo Creek	50	450	0	0	0	0	0	501
Watershed	**Forestry (%)**		**Agricultural (%)**		**Urban/Suburban (%)**		**Water (%)**	**Total (%)**
Cocolalla Lake Area	0	100	0	0	0	0	0	100
Fish Creek	0	100	0	0	0	0	0	100
Johnson Creek	9	91	0	0	0	0	0	100
Westmond Creek	0	100	0	0	0	0	0	100
Butler Creek	0	100	0	0	0	0	0	100
Upper Cocolalla Creek	0	95	0	0	0	5	0	100
Lower Cocolalla Creek	9	91	0	0	0	0	0	100
Hoodoo Creek	10	90	0	0	0	0	0	100

The BLM owns some acres in the watershed, although much less than most other agencies and private ownership. Their ownership is almost completely forested lands. There is a small amount of unknown urban/suburban development in the Upper Cocolalla Creek watershed near Cocolalla Creek above Kreiger Creek. Most of the forested lands are in the upper elevations of the watersheds and away from creeks. The BLM will need to ensure practices are in place to minimize pollutant loads, especially from steeper erodable terrain.

Table 25. Private Land Ownership and Use

Watershed	Forestry (acres)		Agricultural (acres)		Urban/Suburban (acres)		Water (acres)	Total (acres)
Distance to water	< 500 ft	> 500 ft	< 500 ft	> 500 ft	< 500 ft	> 500 ft		
Cocolalla Lake Area	206	1323	60	231	120	85	0	2025
Fish Creek	753	2907	148	128	0.03	0	0	3936
Johnson Creek	610	895	0.7	0	28	48	0	1582
Westmond Creek	397	2295	327	505	144	411	0	4080
Butler Creek	410	709	35	70	2	0	0	1225
Upper Cocolalla Creek	2455	8534	837	1402	61	171	0	13460
Lower Cocolalla Creek	1266	4979	378	1232	80	210	0	8145
Hoodoo Creek	2120	14091	1630	2245	86	92	0	20264
Watershed	**Forestry (%)**		**Agricultural (%)**		**Urban/Suburban (%)**		**Water (%)**	**Total (%)**
Cocolalla Lake Area	10	65	3	11	6	4	0	100
Fish Creek	19	74	4	3	0	0	0	100
Johnson Creek	39	57	0	0	2	3	0	100
Westmond Creek	10	56	8	12	4	10	0	100
Butler Creek	33	58	3	6	0	0	0	100
Upper Cocolalla Creek	18	63	6	10	0	1	0	100
Lower Cocolalla Creek	16	61	5	15	1	3	0	100
Hoodoo Creek	10	70	8	11	0	0	0	100

Private ownership includes land in all the categories: forestry, agricultural, and urban/suburban both near and distant from waterways. A majority of the private ownership is forested lands, as with the State and Federal lands, but there are also large acreages of agriculture and urban/suburban land use. The watersheds have many different landowners. A wide range of projects and programs for this broad land ownership will be necessary to achieve the high reduction percentages presented in the TMDL.

Table 26. Total Land Use

Watershed	**Forestry (acres)**			**Agricultural (acres)**			**Urban/Suburban (acres)**			**Water (acres)**	**Total (acres)**
Distance to water	< 500 ft	> 500 ft	Total	< 500 ft	> 500 ft	Total	< 500 ft	> 500 ft	Total		
Cocolalla Lake Area	206	1477	1683	60	235	295	120	85	205	806	2989
Fish Creek	1108	5045	6153	148	128	277	0	0	0	0	6430
Johnson Creek	741	1186	1927	1	0	1	28	48	77	0	2004
Westmond Creek	623	3827	4450	327	525	852	144	411	556	13	5871
Butler Creek	474	1716	2190	40	99	140	2	0	2	0	2332
Upper Cocolalla Creek	3144	11566	14710	837	1478	2315	61	189	250	1	17276
Lower Cocolalla Creek	1540	6572	8112	378	1247	1626	86	230	317	256	10311
Hoodoo Creek	2870	18611	21481	1694	2705	440	86	94	180	140	26201
Watershed	**Forestry (%)**			**Agricultural (%)**			**Urban/Suburban (%)**			**Water (%)**	**Total (%)**
Cocolalla Lake Area	7	49	56	2	8	10	4	3	7	27	100
Fish Creek	17	78	96	2	2	4	0	0	0	0	100
Johnson Creek	37	59	96	0	0	0	1	2	4	0	100
Westmond Creek	11	65	76	6	9	15	2	7	9	0	100
Butler Creek	20	74	94	2	4	6	0	0	0	0	100
Upper Cocolalla Creek	18	67	85	5	9	13	0	1	1	0	100
Lower Cocolalla Creek	15	64	79	4	12	16	1	2	3	2	100
Hoodoo Creek	11	71	82	6	10	17	0	0	1	1	100

The total acres for each land use indicate that forested lands accounted for 56 to 96 percent of the land use in the watersheds. Almost all the watersheds have some agricultural and urban/suburban land use as well (0 to 17 percent). These values were computed from the figures of the watershed land ownership and use.

Miles of Roads and Streams

The land uses that road and streams cross were identified. The overlay of land ownership and use with roads and streams was used to calculate the road miles. Responsibility for maintenance of these may, or may not, be the same as the land ownership. For example, a forest road on forest land may be the responsibility of the Forest Service or IDL, while other roads while be the responsibility of local road districts.

The major landowners in each watershed might want to know the miles of roads and streams on their land. Landowners will be responsible for reducing the pollutant loadings. Knowing the miles of the two largest identified sources of pollutants may assist in targeting reductions. The breakdowns are shown in Tables 27 through 31. Percentages of road and stream miles for each of the land ownership and land use were calculated and are also shown in Tables 27 through 31. These values will be useful for material and cost planning estimates for treatment and enhancement of roads and streams. For example, 2 miles of streams with a 75 ft buffer is an area of nearly 40 acres; using a density of 1 tree per 400 square ft would require nearly 4,000 trees.

Table 27. Miles of Roads and Streams Crossing State of Idaho Land

Watershed	**Road (miles)**				**Stream (miles)**			
Land Use	Forestry	Ag	Urban/ Sub	Total	Forestry	Ag	Urban/ Sub	Total
Cocolalla Lake Area	0	0	0	0	0	0	0	0
Fish Creek	0	0	0	0	0.75	0	0	0.75
Johnson Creek	0	0	0	0	0	0	0	0
Westmond Creek	0.05	0	0	0.05	0	0	0	0
Butler Creek	0.36	0.48	0	0.84	0.14	0.01	0	0.15
Upper Cocolalla Creek	1.69	0.29	0	1.98	1.03	0	0	1.03
Lower Cocolalla Creek	2.15	0.14	0.59	2.88	1.21	0	0	1.21
Hoodoo Creek	3.40	0.22	0.05	3.67	0.48	0	0	0.48
Watershed	**Road (%)**				**Stream (%)**			
Cocolalla Lake Area	0	0	0	0	0	0	0	0
Fish Creek	0	0	0	0	100	0	0	100
Johnson Creek	0	0	0	0	0	0	0	0
Westmond Creek	100	0	0	100	0	0	0	0
Butler Creek	43	57	0	100	95	5	0	100
Upper Cocolalla Creek	85	15	0	100	100	0	0	100
Lower Cocolalla Creek	75	5	20	100	100	0	0	100
Hoodoo Creek	93	6	1	100	100	0	0	100

There are roughly between 0 to 4 miles of roads and 0 to 2 miles of streams crossing State of Idaho land within each of the drainages. Most of these miles generally are through forested lands, corresponding to the high percentage of forested land use. All road miles will need some form of dust and erosion control measures either by the State or in cooperation with transportation agencies. All of the stream miles will need stream bank and riparian zone protection, and possibly enhancement.

Table 28. Miles of Roads and Streams Crossing Federal, Forest Service Land

Watershed	**Road (miles)**				**Stream (miles)**			
Land Use	Forestry	Ag	Urban/ Sub	Total	Forestry	Ag	Urban/ Sub	Total
Cocolalla Lake Area	0	0	0	0	0	0	0	0
Fish Creek	5.77	0	0	5.77	2.11	0	0	2.11
Johnson Creek	0.88	0	0	0.88	1.23	0	0	1.23
Westmond Creek	0.02	0	0	0.02	1.55	0	0	1.55
Butler Creek	0.11	0	0	0.11	0.11	0	0	0.11
Upper Cocolalla Creek	5.04	0.06	0	5.10	4.63	0	0	4.63
Lower Cocolalla Creek	1.80	0.03	0	1.83	0.51	0	0	0.51
Hoodoo Creek	10	0.01	0	9.56	5.03	1.19	0	6.22
Watershed	**Road (%)**				**Stream (%)**			
Cocolalla Lake Area	0	0	0	0	0	0	0	0
Fish Creek	100	0	0	100	100	0	0	100
Johnson Creek	100	0	0	100	100	0	0	100
Westmond Creek	100	0	0	100	100	0	0	100
Butler Creek	100	0	0	100	100	0	0	100
Upper Cocolalla Creek	99	1	0	100	100	0	0	100
Lower Cocolalla Creek	98	2	0	100	100	0	0	100
Hoodoo Creek	100	0	0	100	81	19	0	100

Forest Service land has between roughly 0 to 10 miles of roads and between 0 and 7 miles of streams crossing Federal land within each of the drainages. Most of these road miles are generally through forested lands, corresponding to the high percentage of forested land use. Similar to the State lands, Federal lands will require dust and erosion control measures for roads and stream bank and riparian zone protection for streams.

Table 29. Miles of Roads and Streams Crossing Federal, BLM Land

Watershed	**Road (miles)**				**Stream (miles)**			
Land Use	Forestry	Ag	Urban/ Sub	Total	Forestry	Ag	Urban/ Sub	Total
Cocolalla Lake Area	0	0	0	0	0	0	0	0
Fish Creek	0.32	0	0	0.32	0	0	0	0
Johnson Creek	0	0	0	0	0	0	0	0
Westmond Creek	0	0	0	0	0	0	0	0
Butler Creek	0	0	0	0	0	0	0	0
Upper Cocolalla Creek	0.09	0	0.17	0.27	0	0	0	0
Lower Cocolalla Creek	0	0	0	0	0.32	0	0	0.32
Hoodoo Creek	0.92	0	0	0.92	0.38	0	0	0.38
Watershed	**Road (%)**				**Stream (%)**			
Land Use	Forestry	Ag	Urban/ Sub	Total	Forestry	Ag	Urban/ Sub	Total
Cocolalla Lake Area	0	0	0	0	0	0	0	0
Fish Creek	100	0	0	100	0	0	0	0
Johnson Creek	0	0	0	0	0	0	0	0
Westmond Creek	0	0	0	0	0	0	0	0
Butler Creek	0	0	0	0	0	0	0	0
Upper Cocolalla Creek	35	0	65	100	0	0	0	0
Lower Cocolalla Creek	0	0	0	0	100	0	0	100
Hoodoo Creek	100	0	0	100	100	0	0	100

BLM land has between roughly 0 to 1 mile of roads and 0 to 1 mile of streams crossing Federal land within each of the drainages. The BLM has very few miles to treat for dust and erosion control measures for roads and stream bank and riparian zone protection for streams. However, the condition of these roads and streams should be reviewed and appropriate measures taken.

Table 30. Miles of Roads and Streams Crossing Private Land

Watershed	**Road (miles)**				**Stream (miles)**			
Land Use	Forestry	Ag	Urban/ Sub	Total	Forestry	Ag	Urban/ Sub	Total
Cocolalla Lake Area	11.14	2.07	3.19	16.41	0.72	0.33	2.01	3.07
Fish Creek	11.69	2.13	0	13.82	6.44	1.51	0	7.95
Johnson Creek	7.41	0.04	0.44	7.88	5.11	0	0.30	5.41
Westmond Creek	11.92	4.47	4.32	20.70	3.30	2.93	1.05	7.27
Butler Creek	4.55	0.28	0	4.83	3.65	0.31	0.06	4.02
Upper Cocolalla Creek	42.94	15.47	1.99	60.40	19.25	8.04	0.69	27.98
Lower Cocolalla Creek	20.99	12.71	3.24	36.94	10.00	2.43	0.60	13.03
Hoodoo Creek	49.02	18.12	1.52	68.66	16.45	12.71	0.92	30.09
Watershed	**Road (%)**				**Stream (%)**			
Land Use	Forestry	Ag	Urban/ Sub	Total	Forestry	Ag	Urban/ Sub	Total
Cocolalla Lake Area	68	13	19	100	24	11	66	100
Fish Creek	85	15	0	100	81	19	0	100
Johnson Creek	94	0	6	100	94	0	6	100
Westmond Creek	58	22	21	100	45	40	14	100
Butler Creek	94	6	0	100	91	8	1	100
Upper Cocolalla Creek	71	26	3	100	69	29	2	100
Lower Cocolalla Creek	57	34	9	100	77	19	5	100
Hoodoo Creek	71	26	2	100	55	42	3	100

There are approximately 5 to 70 miles of road crossing or adjacent to private land and nearly 4 to 31 miles of streams within each of the drainages. These are the greatest lengths of road and stream for the identified land ownerships. The responsible agencies will need to work with these private landowners to improve and maintain the condition of these road and stream miles. These road and stream miles cross all land use types.

Table 31. Total Miles of Roads and Streams

Watershed	**Road (miles)**				**Stream (miles)**			
Land Use	Forestry	Ag	Urban Sub	Total	Forestry	Ag	Urban/ Sub	Total
Cocolalla Lake Area	11.14	2.07	3.19	16.4	0.72	0.33	2.01	3.1
Fish Creek	17.78	2.13	0	19.9	9.30	1.51	0	10.8
Johnson Creek	8.29	0.04	0.44	8.8	6.34	0	0.30	6.6
Westmond Creek	11.98	4.47	4.32	20.8	4.85	2.93	1.05	8.8
Butler Creek	5.03	0.76	0	5.8	3.90	0.32	0.06	4.3
Upper Cocolalla Creek	49.76	15.82	2.16	67.7	24.91	8.04	0.69	33.6
Lower Cocolalla Creek	24.94	12.88	3.83	41.6	12.03	2.43	0.60	15.1
Hoodoo Creek	62.88	18.35	1.57	82.8	22.34	13.90	0.92	37.2
Watershed	**Road (%)**				**Stream (%)**			
Cocolalla Lake Area	68	13	19	100	24	11	66	100
Fish Creek	889	11	0	100	86	14	0	100
Johnson Creek	95	0	5	100	95	0	5	100
Westmond Creek	58	22	21	100	55	33	12	100
Butler Creek	87	13	0	100	91	8	1	100
Upper Cocolalla Creek	73	23	3	100	74	24	2	100
Lower Cocolalla Creek	60	31	9	100	80	16	4	100
Hoodoo Creek	76	22	2	100	60	37	2	100

The total miles of roads and streams identified from the maps are shown in Table 31 and amount to nearly 265 miles of roads and 120 miles of streams. More miles of roads and streams may exist in the watershed beyond that shown in Table 31 because they are either not mapped or are new. All of these road miles should be reviewed and evaluated for improvements to reduce sediment and phosphorus loads.

Cumulative Watershed Effects

Cumulative watershed effects (CWE) assessments have been performed by the IDL for Cocolalla Creek, Fish Creek, and Hoodoo Creek (Appendix A). “Until 1991, the Idaho Forest Protection Act (IFPA) had no provision for the control of the cumulative effects of multiple forest practices. The concept of cumulative effects suggests that, while impacts from any single forest practice will be insignificant if BMPs are properly applied, impacts of a series of practices may accumulate” (IDL, 2000a). The management prescriptions and recommendations from the CWE reports state the following potentially adverse conditions:

- Cocolalla Creek - canopy closure/stream temperature
- Fish Creek – canopy closure/stream temperature
- Hoodoo Creek –canopy closure/stream temperature and nutrients

These results indicate that segments of the creeks do not have adequate canopy cover to maintain stream temperatures. Repairs and improvements to the riparian zone including canopy closure with shrubs and trees would provide benefits to reduce stream water temperatures. The IFPA Coordinator is to serve as the facilitator to work with the affected landowners to develop CWE site-specific BMPs.

WATERSHED PRIORITIES

Watershed priorities aid in the selection of the most efficient activities to implement, guide the implementation of water quality activities over time, and direct available funds to the most important and beneficial projects. Some factors that may be considered when defining priorities include: landowner/community acceptance, benefits, cost effectiveness, availability of funds, and ease of implementation. Watershed priorities are also based on past and present pollution control efforts as given in the TMDL (IDEQ, 2001). These may include the following (IDEQ, 2001):

1. Reduce phosphorus loading from existing septic systems;
2. Restrict increased phosphorus and sediment loading from future development;
3. Minimize nonpoint source pollution associated with urban and residential land use runoff entering the tributaries and lake;
4. Minimize nonpoint source pollution associated with pasture and hayland uses; and
5. Minimize nonpoint source pollution associated with forest land uses.

Current sub-watershed priority rank designations may be assigned through the evaluation of several criteria including: proximity and delivery efficiency on a source-specific basis, and data available to target specific treatment areas and mechanisms. The relative proportion of management load to total load (i.e. cost efficiency considerations and cost-benefit analyses), previous load reduction efforts, and development status were also considered, as were pollutant load reductions from previously completed activities. These factors represent the primary mechanism for priority rank assignment.

Since it is recognized that new development often results in a land-use change and represents the potential to introduce additional pollutant loadings from construction impacts, areas exhibiting substantial new growth were given priority consideration as well. As outlined in the sections of this document specific to urban/suburban implementation and land-use changes, the cost of requiring new construction to meet designated load criteria is significantly lower than that of retrofitting existing development. Therefore, the establishment of policy, resolutions and ordinances addressing the water-quality impacts of new development should be given priority status within the watershed. When the appropriate policies, resolutions and ordinances are in place for new development, priority will then be given to address existing development sources.

Project-specific priority ranking has been identified according to the existing loadings as identified for forestry, agricultural and urban/suburban sources and outlined in general fashion in the following sections. Based on the tables summarizing present loads for each watershed, especially the pollutant load coefficients (estimates of pollutant load in mass/time/area) the greatest sources were identified. The largest single source of phosphorus loading to Cocolalla Lake is internal recycling. This loading will not decrease with time if watershed loads are not significantly reduced. The pollutant load coefficient for the Westmond Creek watershed is highest of the tributaries. The

Westmond Creek watershed also has the highest percentage of agriculture and urban/suburban land use of the Cocolalla Creek tributaries; i.e., a high proportion of soluble phosphorus. According to the TMDL, sediment loads in the Cocolalla and Hoodoo Creeks are dominated by bank mass wasting followed by roads. Focusing priority activities on the largest load coefficients with the most biological available phosphorus forms may provide the greatest possible benefits in the least amount of time.

Cocolalla Watershed Issues

Cocolalla is a large watershed with many sub-watersheds. Issues within the watershed are generally similar to many others in northern Idaho and include stream bank conditions, road conditions, and land use including forest, agriculture, and urban/suburban impacts.

The general attitude towards water quality improvement programs in the watershed is supportive and the community may be receptive to learning about available programs. Extension agents may be successful in educating landowners about available programs and working towards comprehensive packages of water quality improvement projects.

Organization

The Cocolalla Lake Association is a strong organization working to improve water quality conditions. The group is well organized and has completed some projects within the watershed. The Implementation Plan should help provide a broader awareness of the entire watershed and interconnected impacts beyond Cocolalla Lake alone.

It is recommended that Association members continue to pursue potential water quality improvement opportunities and discuss them with the appropriate resource agencies. The Association may be successful in assisting the resource agencies in the identification of potential water quality problems for review and in the development of water quality improvement projects. It is recommended that the Association continue to educate the landowners in the watershed about water quality protection. Various methods include: interpretive information, signs to identify water quality projects, newsletters, and programs at the schools. Education about minimizing pollution and activities to reduce pollutant loading are important to sustaining water quality improvements.

Point Sources

The sewage from Sandy Beach resort is the only identified point source within the watershed. The relatively new sewage treatment system at the Sandy Beach resort may be accounted for as a pollutant load reduction activity in meeting the TMDL requirements. However, the current condition and function of the system is questionable and has been observed to be directly contributing pollutants to the lake. The system needs to be maintained and operated properly in order to protect public health and eliminate pollutant loadings to Cocolalla Lake. An operator responsible for maintaining the system is necessary, as is adequate financial resources to fund operation and maintenance.

Channel Conditions

Channel conditions vary widely throughout the watershed including high to low gradient, channel variations, encroachment by roads and railroads, and various land use impacts from forestry, agriculture, and urban/suburban areas. Many of the tributaries to Lake Cocolalla should be monitored and IDEQ should continue to sponsor streamwalks for all tributaries. The condition of the tributaries above the confluence with Lake Cocolalla is critical to lake water quality. These areas provide direct pollutant loading sources to the lake and may also be the areas most impacted by land use activities. One critical subwatershed with substantial agricultural activity and tributary to Lake Cocolalla is the Westmond Creek drainage with its heavy livestock grazing use. Forest grazing may be an increasingly important issue in meadow/forest transition areas as stock will graze across all of smaller stream channels located in these areas.

There are reportedly some new water use projects within the watershed, including diversions and returns for agriculture and personal uses. It is recommended that the Idaho Department of Water Resources (IDWR) continue to document all water uses and potential water quantity and quality impacts in the watershed. Diversions can reduce in-stream flows and concentrate pollutants. Return flows can carry high sediment and nutrient loads. BMPs to treat return flows are recommended to mitigate the delivery of pollutants back into the watershed.

The smaller channels and waterbodies freeze and thaw during the winter. The effects of these cycles are unknown on water quality conditions.

Fisheries and Wildlife Conditions

The Cocolalla Lake fishery is reported to be in good condition and the lake is stocked by the Idaho Department of Fish and Game (IDF&G). The lake fishery includes crappie, bass, perch, bluegill, catfish, and a variety of trout.

The impacts from concentrated waterfowl on the lake are unknown. Excessive bird droppings in watercourses could contribute to high nutrient loads. Waterfowl management areas generally include wetlands areas that help reduce the loading to surface waters.

Forest Conditions

Logging activities are occurring throughout the watershed. Unfortunately, instances of poor forestry practices can be readily found in the watershed, including a lack of buffers around streams and the dragging of logs across stream channels. At a minimum, IFPA requirements will need to be met in order to reduce the sediment and phosphorus loads. Programs sponsored by the Forest Service and IDL to improve water quality are recommended to achieve pollutant load reduction. Since this is a TMDL watershed, forest management practices beyond the general BMPs may be necessary to attain the required pollutant load reductions. Projects undertaken by the Forest Service in the last few years may be accounted for as pollutant load reduction activities in meeting the TMDL requirements.

Additionally, much of the land in the watershed is privately owned and logged. Outreach and education of the private landowners and logging groups on water quality protection and forest land BMPs may be effective in improving watershed conditions.
New forest roads are substantial sediment sources and disturbed earth in cut and fill slopes leads to direct runoff of sediment to surface water. Minimizing new road construction and adherence to all IFPA construction requirements and BMPs for the control of sediment is recommended. Roads should be developed during the periods of least likely precipitation and should be stabilized as much as possible at the time of construction.

Agricultural Conditions

Agriculture in the area is generally livestock grazing and hay production. Many areas have stock grazing to the water line and trampling the bank (with livestock in the stream in some cases) and tilling to the stream bank. Agricultural BMPs to protect the stream banks and water quality are recommended. The Cocolalla Lake Association can work to identify these areas and work with the landowners and the Natural Resources Conservation Service (NRCS) to identify programs to improve conditions.

There are highly visible areas along US-95 that include cattle, buffalo, and horses permitted to graze the vegetation to the ground and walk in the stream. Changes to the road system may impact these areas. Either way, the high visibility of these areas and the proximity to Cocolalla Lake make these priority areas for projects.

Additional priority areas are those intermittently inundated floodplains. Some of these flood areas include highly visible areas. A key stretch is the reach upstream from Cocolalla Lake on Cocolalla Creek (approximately 3 miles of stream channel on these lower floodplains). The problems with flooded areas are that manure and other nutrients are solubilized then flushed downstream. Manure provides a readily available form of phosphorus, soluble reactive phosphorus. Soluble reactive phosphorus entering the lake would be immediately bioavailable for uptake by algae and periphyton. This reach above Cocolalla Lake has also been straightened and could be restored to include some more natural meanders and riparian areas. A complete stream restoration would be beneficial including channel capacity, modified flow regimes, and wildlife and aquatic habitat. Unifying the landowners along this reach to complete one project may be challenging. Funding sources including Trout Unlimited, Ducks Unlimited, Bonneville Power Administration (BPA), and the Corps of Engineers may be options.

Urban/Suburban Conditions

Urban and suburban conditions impact water quality. Key areas are; stormwater BMPs for existing and future development, BMPs during construction, code enforcement, and education for construction site erosion and sedimentation control. Stormwater and construction requirements must be uniformly applied to be economically equitable for all contractors and to ensure broad coverage of similar BMPs. Poor construction practices a visible throughout the watershed. Contractors may be amenable to compliance with construction site erosion and sedimentation control requirements established by local ordinance. Silt fences, hydroseeding and control of disturbed soils must be implemented. Properly designed and installed culverts are necessary for stormwater and creek flows. Control and treatment of stormwater is necessary due to the increased runoff from urban/suburban areas, the increased sediment due to atmospheric loading, and dust from roads and human activities.

The subdivision of large parcels into smaller lots may also contribute to water quality impairment and reduce the opportunities for projects to improve water quality. One option is conservation easements that restrict future subdivision and development. This maintains one large parcel that may be managed with conservation efforts.

Transportation and Stream Crossing Conditions

The side casting of snow and gravel from roads and highways is a watershed-wide problem. A specific location identified is Cocolalla Loop Road at Fish Creek. The agencies responsible for road maintenance and snow plowing should implement policies and procedures that discontinue the pushing of grading materials and snow into the drainages. This is a direct pollutant loading to surface water. Education of the agencies' personnel may be one method to reduce the load. Stream crossing may be marked with mileposts, signs, rods or other means. Road personnel would then be alerted to the critical locations and could avoid side castings. However, this will only work when the blade is movable and the operator has been educated and instructed to minimize side casting. A more expensive but effective method would be to pave the road section near the crossing and install concrete curb or barriers to prevent materials from being pushed, or washed into the channel. New bridges should have roadways adequately elevated so that they are not the focal point for drainage and funneling road runoff directly into the stream. Runoff flowing down slope toward streams should be diverted into roadside swales *before* reaching the bridge. Funding of these expenses would likely come from the road district and other transportation agencies.

Road encroachment on stream channels is a major contributor to the sediment load of streams in the project area. The encroachment may cause the stream to erode because the stream channel has been de-stabilized. Additionally the encroachment may cause direct sediment loading from the road from side castings, road washings, and slope erosion. Association, IDEQ, and road districts should work together to identify the priority area of stream reach encroachment. They should then work together to review road realignment options, bank stabilization, silt fencing, curbing and runoff channeling, road closure, or other options to reduce the sediment load.

Riparian Buffers

The Lake Association has worked on at least one riparian buffer project along lower Fish Creek. Riparian buffers vary throughout the watershed from well developed, to disturbed, or even completely eliminated. Repair of these riparian buffers would be beneficial for the creek, water quality, fisheries, and wildlife by increasing long-term channel stability. Riparian enhancement programs such as NRCS programs for grasses and shrubs and the IDL programs for trees along riparian buffers would assist restoring these reaches.

Internal Lake Recycling of Phosphorus

Internal recycling contributes a significant load of phosphorus to Cocolalla Lake. Targeting the reduction of the internal recycling load is difficult but necessary to reach the load reduction target. Options for reducing the load include: reduction of external inputs over time to result in lower total phosphorus concentrations in lake sediments, alum treatment, hypolimnetic aeration, water column circulation, and hypolimnetic siphoning directly out of the lake. Alum treatment is highly effective but may be detrimental to a balanced ecosystem and good fishery, could be costly, and might be effective for only 3 - 5 years before re-treatment is necessary. This is based on reference applications in other locations prior to 1999. The latest techniques appear to be producing better results and should be investigated further before dismissing this alternative.

Aeration is quite feasible for a modest-sized lake such as Cocolalla but involves capital development of aeration lines and pumping stations, as well as ongoing maintenance and operations. A shallow lake such as Cocolalla is difficult to aerate and still retain desired summer and winter stratification. Since the lake is phosphorus-limited, summer overturn would likely result in more intense internal phosphorus recycling with associated summer algal blooms. Successful aeration is possible with careful calculation of required oxygen and energy input. The aeration would need to just bring surficial sediment oxygen levels to ~1 mg/l to suppress soluble phosphorus release to the deep water column yet release air or oxygen bubbles up through the metalimnion. Lake circulation is not a desirable option for the same reasons. Circulation of deep, higher nutrient, oxygen-deficient waters to the sunlit, warmer epilimnion in the summer is not desirable.

Siphoning of hypolimnetic waters through the outlet during summer and winter stratification would be technically and economically feasible for this lake because of the relatively small volumes of water required to be removed as well as the low energy requirements of this option. Hypolimnetic siphoning has been an effective long-term solution in Lake Ballinger, Montlake Terrace, Washington where comparable morphometry and flushing rates indicate a potential for successful application in Cocolalla Lake. An excellent engineering, economic, and environmental response record for Lake Ballinger is available for reference. An implementation approach may begin with pursuit of funding sources and acquiring funds, investigating system designs, and monitoring the lake concurrently with land use projects. If a project is still needed in future years then it will be ready for implementation with pilot testing.

Noxious Weeds

Eurasian water milfoil (EWM) is now in regional lakes and may be introduced into Cocolalla Lake. Milfoil could be a serious problem since Cocolalla Lake offers suitable shallow habitat with a significant part of it's area in the 2-5 m depth range, clear water, soft waters with adequate nutrient loading, and nutrient-rich, fine sediments. Key items for the Association to consider for reducing the potential for EWM are:

- Wash stations for boats to minimize cross-contamination from other lakes and waterbodies;
- Education on identifying milfoil so that casual observance by lake users can lead to rapid response;
- Routine surveys several times a year around the lake for EWM. When it is found, divers can manually remove the perennial plants to retard spreading. This has greatly slowed the spread of EWM in Hayden Lake, to the south in Kootenai County. While milfoil is not a target of the Implementation Plan, it is part of the overall health of the lake and should be monitored.
- Reduction of sediment and nutrient loads to the lake will help reduce sediment nutrient levels for milfoil.

Hoodoo Watershed Issues

One of the issues in the Hoodoo Valley will be overcoming a perceived negative connotation of conservation programs and BMPs. Changing this perception will be important to be able to initiate and complete projects. Explanation of various programs and the required documents by local staff from NRCS, Sandpoint, Idaho office, and the Bonner County Soil and Water Conservation District (SWCD) will be a key step in getting landowners to commit to projects on their land. Tours of demonstration projects with local landowners will be important for showing the expected results.

Many of the projects completed under various programs are kept confidential, which limits the potential for NRCS and Bonner County SWCD to publicize projects.
Another issue in the Hoodoo Valley is the viewpoint held by some that Hoodoo Creek is a drainage ditch. A Drainage District exists along most of the length of Hoodoo Creek. The Drainage District collects fees and has historically done some modifications to the creek. Determining whether the creek existed historically, or not, and whether Hoodoo is a creek or a ditch may be counterproductive to making water quality improvements. Historic wetland functions in the Hoodoo Creek floodplain have largely been lost with this drainage. Hoodoo Creek may be best considered as an integrated stream/floodplain system that historically has provided a host of desirable amenities to the system and water quality. It still provides some of these, but could provide many more amenities along with some of the benefits traditionally provided by the Drainage District, including improved drainage, reduced flooding, and higher base flows, thereby enhancing water diversion options.

Organization

Organization already exists for Hoodoo Creek with the Drainage District having approximately 115 members. The Drainage District provides a good starting point for an effective organization with a mailing list. The district may be influential in supporting water quality programs. Agencies will be more likely to commit to a project if there is an objective-oriented organization supporting a complete stream restoration package. Agencies will likely support projects that reduce flood damages, improve both terrestrial and aquatic habitat, and improve water quality as they have multiple benefits.

Development in the Hoodoo Valley appears to be less agricultural and increasingly urban/suburban with more subdivision into small lots including ranchettes and weekend cabins. It is understood that there are fewer agricultural users and water diversions from Hoodoo Creek and there may only be two or three remaining withdrawals from the creek. The Drainage District should consider including objectives to improve flow conditions (reducing flooding and increasing base flow), meet water quality standards, and restore riparian zones and overall aesthetics. These objectives may also increase property values throughout the valley.

The Drainage District may want to consider an increase in fees, either a permanent increase or a temporary increase to be reviewed every year. Increasing fee collections would provide a funding mechanism to coordinate restoration projects in the valley or provide a local funding source to match cost-share programs. A short-term increase in fees could provide a means to initiate critical projects.

Channel Conditions

The flow in the channel has been observed to have a slower velocity with lower water levels and less water in recent years. It is unknown if the lower flows are year round or after the spring snowmelt when most of the flow is base flow. This may have resulted from land use changes, wetlands drainage, riparian loss, increased aquifer use, and long-term drought cycles. Lower flows may have reduced the current sediment delivery but increase the potential sources for sediment movement during the next high flows. The creek needs to be managed to handle a wide range of flow conditions.

The creek has a low gradient in a flat valley with a gradient of approximately two inches per mile. This low gradient lacks the ability to flush sediments from the channel. A stream restoration study would be required to evaluate the gradient, channel capacity and sediment flushing ability. Projects that impact the channel dimensions and/or slope need to consider the upstream and downstream impacts of channel modifications. Changes in one reach of channel may result in greater erosion in another reach.

The origins of the watershed is unknown; flow may start as far upstream as Kelso Lake in wet years and far downstream as near Clagstone, Idaho, in dry years. Much of this reach is wetlands, based on visual inspection and the USGS topographic map. Wetlands generally trap sediment so irrespective of whether there is flow through this reach, this upstream reach is not a major source of sediment. The reaches downstream of these wetlands should be considered for restoration.

Some have expressed a desire to dredge the channel within the Drainage District boundaries from near Hoodoo Lake to approximately 1-mile north of Vay, Idaho. If a dredging project is undertaken, side casting of dredging materials should be avoided. The side cast material will runoff back into the channel becoming a source of sediment load and redeposit downstream. Dredge material should be transported away from the channel and deposited in a manner that will minimize erosion back into the channel. Possibilities include fill in a location away from the channel, tilling into a field, or spreading in an area to be reforested.

Channel-dredging funds will be difficult to obtain from outside funding sources since dredging is now recognized as adverse to most stream restoration and water quality management/enhancement goals. Dredging sections of the channel or rebuilding the channel may be possible as part of a complete stream restoration package to achieve specific sub-project goals.

Improving channel conditions should include the riparian area. Programs sponsored by IDL could be used to improve the streamside riparian areas and provide for the planting of trees. The Forest Stewardship Program assists non-industrial private forest landowners by providing high quality management of natural resources. The Stewardship Incentive Program is a cost-share assistance program designed to help landowners accomplish their individual forest management objectives. The Forest Legacy Program is a program that includes the goals of maintaining riparian areas and protecting and enhancing water quantity and quality. Most of the middle and upper reaches of Hoodoo Creek are currently bare of trees and shrubs along the banks. Some portions of the creek already have buffers that are not farmed or grazed. These are prime areas for the planting of trees and shrubs. Various soft and hardwoods could be planted nearest the creek and some pines and native species further away to create a buffer of varied vegetation. The conservation staff assisting with the project should be able to assist with identifying an appropriate tree and shrub mix for specific site restoration. Trees help stabilize streambanks from erosion at high flows, create a buffer from water and wind erosion, provide critical habitat for wildlife and birds, improve in-stream stability by supplying woody debris for pool/riffle formation, and provide shade to keep the water cool.

With continued subdivision of parcels in the watershed there will be increased pressures on the creek as more buildings are built closer to the water and there are more road/driveway interactions with the creek. Nutrient and sediment loading to surface streams in the drainage will soar with more graveled road surface and stream crossings. Bonner County Planning and Zoning may want to look carefully at floodplain restrictions and environmental protection with each construction project. Increases in impervious areas, including buildings and roads, in the floodplain can have negative impacts on the creek including increased runoff, increased pollutant loading, flooding both near the construction, and disturbance of flow patterns resulting in flooding up and/or downstream. Flood Emergency Management Agency (FEMA) requirements for the floodway and floodplain should be adhered to as the best plan for future changes in watershed. There has already been some significant subdividing of large parcels into small lots. Opportunities to restore the creek and provide a sufficient base flow to the channel will become fewer as the land is further subdivided.

Fisheries and Wildlife Conditions

Historically, Hoodoo Creek was a good fishery with multiple species in abundance. Native westslope cutthroat trout (WCT) pre-dominated the fishery. The fishery was supported by the springs that provide cool continuous water, well-developed riparian, and stable channel conditions. The current fishery does not appear to be as in good of a condition. The stream banks are in poor condition, summer base flow is low, there is little riparian vegetation to shade the stream and provide habitat, and the sediment and nutrient load is high resulting in excess algae.

Restoring Hoodoo Creek will provide an amenity to the area and should restore the fishery. Restoring the fishery will require coordination with IDF&G. Key elements of this coordination include grazing management, physical channel management, and creation of reach-specific riparian stream protection zone (SPZ) setback guidelines as well as fishery issues such as fish stocking policies, public fishing access, and coordination to minimize disturbance to local landowners. Historically, the creek is said to have been stocked with fish. Kokanee were reported in Hoodoo Creek in 1982 and 1983 (BPA, 1985). Surveys in Hoodoo Creek documented WCT presence, but in low densities compared to nonnative rainbow, brook, and brown trout. In a 1991 survey, 35 trout were collected 4 of which were WCT, 13 were rainbow trout, 17 were brown trout, and 1 was a brook trout. In a 1983 survey, 175 trout were collected of which only eight were WCT, 59 were rainbow trout, 39 were brook trout, six were brown trout, and 63 were rainbow/WCT hybrids (USFWS, 1999). The Partners for Fish and Wildlife Program is the US Fish and Wildlife Service's primary mechanism for delivering voluntary, on-the-ground, fish, wildlife and plant habitat conservation projects on private lands. IDF&G will have to commit to maintaining access points and having crews monitor and clean these sites. Much of the creek is surrounded by private land. IDF&G will need to purchase land to provide some access points and seek possible landowners willing to have a conservation access easement. If improvements to Hoodoo Creek include improvements to the fishery, possible sources of funding include Trout Unlimited as well as BPA and Avista mitigation funds.

Hoodoo Lake is fairly isolated with no roads along its banks although the railroads tracks do encroach on the southeastern edge. The area is generally forested and within the Kaniksu National Forest. The lake is shallow, about 8 to 12 feet deep, and fed by springs and upper Hoodoo Creek. The area is good wildlife habitat. The lake and wetlands area could be enhanced along with the creek with one possible source of funding being Ducks Unlimited. The area below Hoodoo Lake may have once been a part of the lake and since has been modified to a channel. Restoration activities within this reach should address the interconnectivity of the lake, wetlands, the channel, and groundwater. Modifications to the channel alone may be inimical to base flow restoration in the stream. The natural wetlands around the stream leaving the lake once was a major asset to downstream baseflow, reduced flooding, and controlled of nutrients and sediments. A complete restoration may be an opportunity to improve water supply and quality in downstream areas of Hoodoo Creek.

Forest Conditions

Many of the tributaries to Hoodoo Creek are not direct tributaries but instead flow to the subsurface and provide groundwater to the springs that feed Hoodoo Creek, especially in upstream areas. Since subsurface materials provide some filtering of sediment and nutrients, some contend that the higher lands in the watershed contribute little to Hoodoo Creek's water quality impairment. However, the benefits of best land management and wetlands maintenance/enhancements to downstream water quantity and quality will still result. Activities in the uplands can still contribute via overland flow during extreme precipitation events, atmospheric suspension and subsequent deposition in the channel, and sediment disturbance by vehicles. The upland forested areas need to commit to adhering to the IFPA. Forest roads need to be maintained to abate dust.

Agricultural Conditions

Below Hoodoo Lake, most of the stream is adjacent to agricultural land uses. Agricultural activities in the valley are multiple uses and include dairies, beef cattle, horses, hay, and other crops. Agriculture activities that impact the creek include fertilizer and other applications, tilling the riparian and bank areas, and grazing to the creek. The NRCS and Idaho Department of Agriculture have programs targeting BMPs to reduce these impacts to the creek. Complete suites of BMPs including off stream stock watering or limited access points, stream fencing exclusion, riparian buffer zones, and on-farm best management practices are needed for complete implementation.

The Idaho Department of Agriculture and IDEQ should enforce confined animal feeding operations (CAFOs) requirements in the watershed. There are some animal operations in the watershed that may be impacting water quality. Maintenance of animals away from live waterways, protection of stream banks from trampling, and control of animal wastes by exclusion from drainage channels is critical to stream water quality.

Transportation and Stream Crossing Conditions

A source of sediment to Hoodoo Creek is the road crossings and overcasting of materials. Maintenance and possibly replacement of culverts and installation of road crossing BMPs could reduce sediment loads. Reconstruction of these crossings may be more successful than an education process alone. Reconstruction would consist of placing appropriately-sized culverts aligned with the water flow, paving a stretch of road either side of the culvert (possibly 1000 ft either side), and placement of concrete curbing or barriers for a stretch of road either side of the culvert, possibly up to 250 ft either side of the crossing. This would prevent the side casting of materials into the channel. Apparently the replacement of culverts has been agreed to by the appropriate agencies and should not be a hurdle. Culvert replacement should also include wing walls, riprap, and retaining walls on upstream and downstream ends of the culverts. Some of the current culverts are not aligned with (parallel to) the flow and are causing erosion of the stream banks. These expenses will need to come from the roadway district and other support from other transportation agencies.

The Union Pacific Railroad (UPRR) operates a rail line through Hoodoo Valley. The UPRR is responsible for its crossings of Hoodoo Creek. The crossings need to be reviewed for flow blockages and erosion. Maintenance of these crossings appears to be needed. The UPRR also needs to target clean up spills of materials in the watershed. In the past, this did not always occur and agricultural products were spilled and left in the channel.

Dust abatement programs need to be in place for the many gravel roads in the watershed. Apparently, treatment has been applied to some of the roads but grading may be defeating some of the treatments. A program to selectively pave, apply treatment, or restrict/close roads needs to be developed to reduce sediment loading.

Riparian Buffers

A comprehensive approach of stream and riparian restoration would provide high benefit to the creek and the people of the valley. Multiple programs could be combined to develop an attractive stream channel. A complete stewardship plan would be needed that addresses the land, soils, vegetation, wildlife, fishery, and water quality. The riparian buffer distances could vary along the reach depending on the program, landowner, and land use. Based on past programs the typical buffer would be approximately 75 ft but could vary from 50 to 300 ft. The IDL stewardship program could be used to plant trees while NRCS programs could be used to plant grasses and shrubs.

Physical Characterization of Riparian Area

The following is based on a physical characterization conducted by the Idaho Soil Conservation Commission in June 2001 on Hoodoo Creek. The summary conditions included the following (Ferguson, 2001). “The adjacent land ownership is private with some forest service land. The primary adjacent land use is pastureland. Headwaters area is primarily a wet meadow and springs area. There exists a very little woody vegetative species through most of the riparian area. Riparian grazing is occurring mostly throughout the riparian and adjacent areas. Grazing impacts are likely greatest on vegetative regeneration and limiting the succession of woody species. Channel stability is primarily provided by the roots of any live woody vegetation and by some herbaceous vegetation (where it’s stable). The stream seems to have been channelized as evident by adjacent spoil banks, channel shape, and low sinuosity. Ground water seems to be very available to support vegetation throughout area.”

Watershed Issues and Floodplains

A common watershed issue is the riparian corridor and the floodplain. The interaction of overland flow and the streams is one of the key delivery points for sediment and nutrients. Much of the length of Cocolalla Creek and Hoodoo Creek include a wide floodplain that is estimated to be flooded with a 100-yr flow event (Figure 9). Programs that reduce the potential flooding to property and improve the riparian corridor could also improve the interaction dynamics between stream and floodplain, and improve water quality.

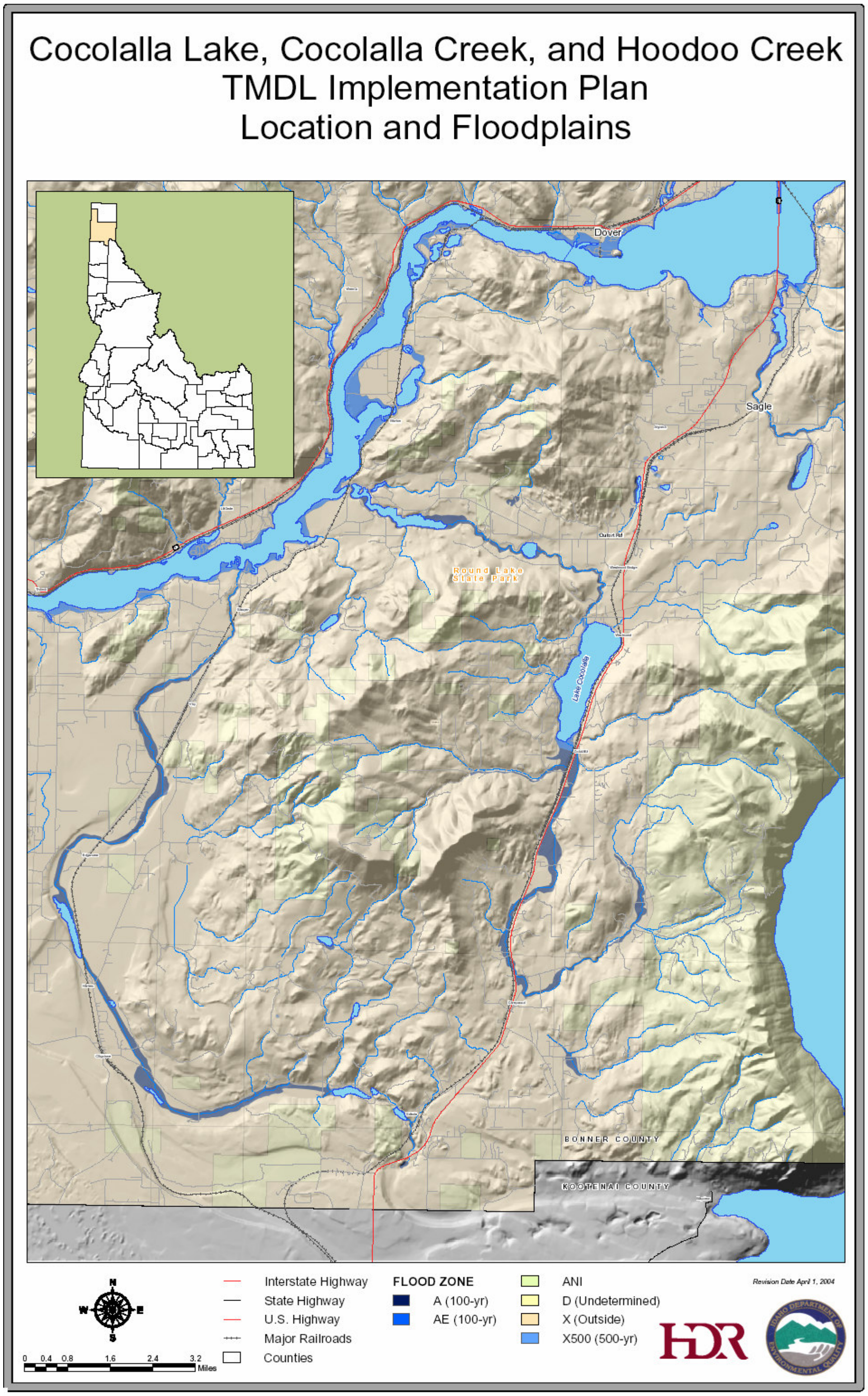

Figure 9. Cocolalla and Hoodoo Watershed Floodplains

PROPOSED CONTROL ACTIONS

The purpose of this Implementation Plan is to outline the point and nonpoint source reduction measures that are needed to improve water quality and achieve TMDL goals for Cocolalla Lake, Cocolalla Creek, and Hoodoo Creek. For each of the nonpoint sources, the following information is included in this Implementation Plan: the approach used to determine the water quality improvement measures needed; BMPs needed to achieve reductions; BMP efficiencies; and source-specific plans for assessing project effectiveness. Also included are monitoring program recommendations and general schedules for implementation and monitoring actions. The Implementation Plan describes an approach for tracking implementation plan progress, outlines reasonable assurances associated with the different management measures, and discusses other options that may be considered if the preferred BMPs are insufficient. Preparation of the Implementation Plan was overseen by the IDEQ.

IMPLEMENTATION PLAN DEVELOPMENT APPROACH

The approach to developing the Implementation Plan was to create suites of water quality improvement actions (BMPs), select areas where the actions could be put into practice, and calculate the projected pollutant load reduction. This approach is suited to the specific circumstances of the Cocolalla and Hoodoo watersheds, where relatively few site-specific water quality improvement projects have been identified but the phosphorus and sediment load reductions called for the in the TMDLs are substantial and will require actions be taken throughout the watershed. This approach allows for flexibility in developing and implementing the plan, addresses a wide range of actions, and provides a range of actions from broad to specific. The result is an Implementation Plan that both meets the TMDL requirements and provides projects that can be implemented by stakeholders in the watershed.

Suites of actions (BMPs) where identified that are appropriate and sensible for application to the Cocolalla and Hoodoo watersheds are based on the analysis of existing conditions and loadings. These suites of actions include BMPs that address the specific problems in the watershed, including the priority and largest problems such as internal recycling, stream bank erosion, road and culvert conditions, and forestry and agricultural practices. These actions are intended as a starting point to be considered as an overlay upon land use activities to reduce pollutant loadings. General approaches are discussed for each suite. Specific actions may be undertaken or customized by the sponsor to meet the overall objective of the water quality action suite. Additional BMPs may be inserted or appended to the Implementation Plan as deemed appropriate with the benefit of experience in the watershed and the established of local effectives of various management actions. Suites of water quality improvement actions were developed for each of three major land use categories and characterized in three types, as follows:

1. Individual BMPs or projects (Site specific water quality projects or BMPs that can be identified and targeted for a specific geographic location)

2. Feature-based BMPs, e.g., roads, culverts, stream banks, riparian restoration (One-dimensional linear projects, such as the restoration or treatment of a length of road or length of stream, etc.)
3. Land Use-based BMPs (Two-dimensional projects or management practices generally associated with a land area, such as application of a suite of agricultural BMPs to farm land)

Individual BMPs or projects are likely to be undertaken by a sponsor or landowner. Individual projects are generally undertaken at a specific geographic location, at a single point or zero-dimensional. These projects may include repairing a stream crossing used for dragging logs or moving cattle, removing/replacing a septic tank/drainfield, installing/repairing a storm water facility, or repairing/replacing a culvert.

Feature-based BMPs or projects are generally undertaken as one-dimensional linear project reaches and are one-dimensional. These projects may include restoration of a length of stream bank or treating a length of road to reduce erosion.

Land use-based BMPs or projects are likely to be undertaken by a landowner or agency and targeted on specific type of land use practice. Land use projects are generally undertaken over an area of land and are two-dimensional. For example on agricultural lands such projects may include changing grazing and cropping practices, field management, and stock water management.

General suites of actions developed for the Cocolalla and Hoodoo watersheds as off-the-shelf BMPs are given under each of three major land use categories. These suites of actions were then applied to the watersheds in order to calculate potential pollutant load reductions. The initial application was a general approach, with further refinement after discussion with stakeholders. The selection process and BMPs for each land use are discussed for each land use Implementation Plan. The potential load reduction with the application of the selected BMPs was calculated and compared to the TMDL pollutant reduction target.

Forestry Best Management Practices

Forestry BMPs are meant to address sediment and/or phosphorus reduction in forested land use areas. Forestry BMPs are meant to address all areas that are predominantly forested. This includes lands under various jurisdictions, e.g., US Forest Service or IDL, and under various laws including IFPA.

Primarily forest lands and the standards that apply to them are dictated by the IFPA. The IFPA gives the IDL authority on forest practices including harvest of commercial tree species, road construction, reconstruction or maintenance in association with harvest, reforestation of harvested areas, chemicals for the purpose of managing forest trees or land, management of slash resulting from harvest, management or improvement of forest trees or prescribed fire on forest land. It does not matter if the forest practice is occurring on residential property or industrial timber lands.

The IFPA is site-specific in its application, governing forest operations as defined above. It does not apply to county roads, driveways, farmlands, or residential use if no commercial timber is removed. These areas do exist within forested areas and need to have BMPs applied to meet the reduction targets. While the IFPA addresses BMPs for IFPA governed lands, BMPs for the other areas must be addressed.

IFPA-Forestry Suite

Example BMPs are:

- IFPA rules for erosion control currently give us wide latitude for mulching cuts and fills, armoring runoff channels, rocking roads, and repairing obvious erosion channels.
- For each landing, skid trail, or fire trail, a drainage system shall be provided and maintained that will control the dispersal of surface water to minimize erosion.
- Select for each harvesting operation the logging method and type of equipment adapted to the given slope, landscape, and soil properties in order to minimize soil erosion.
- During and after forest practice operations, stream beds and streamside vegetation shall be protected to leave them in the most natural condition as possible to maintain water quality and aquatic habitat.

Three suites of BMPs were developed for non-IFPA governed forestry areas. These suites were intended to address forested areas near roads and streams, intermediate areas, and distant or isolated areas. The three suites and general BMP components are shown below.

Non IFPA-Forestry Suite A – Roads and Streams

- Replace or upgrade culverts
- Install sedimentation BMPs including roadside retention areas and armoring of runoff channels
- Windrow, mulch, and replant cuts and fills
- Minimize road dust
- Restore degraded streambanks
- Windrow buffer areas near riparian zones
- Revegetate clear cuts and recent harvests and minimize erosion
- Revegetate disturbed or poor condition riparian zones with grasses, shrubs, and trees

Non IFPA-Forestry Suite B – Intermediate Lands

- Modify or enhance culverts
- Mulch cuts and fills
- Minimize road dust
- Implement road closures
- Fix water bars
- Plant tree seedlings
- Windrow buffer areas near riparian zones and revegetate those that are disturbed or in poor condition
- Install sedimentation BMPs including roadside retention areas and armoring of runoff channels

Non IFPA-Forestry Suite C – Isolated Lands

- Implement road closures
- Repair obvious erosion channels
- Plant tree seedlings
- Windrow buffer areas near riparian zones and revegetate those that are disturbed or in poor condition

Agricultural Best Management Practices

Agricultural BMPs are meant to address sediment and/or phosphorus reduction in agricultural land use areas. The NRCS has a list of BMPs and can provide assistance for design and implementation. Three suites of BMPs were developed for agriculture. These suites were intended to address agricultural areas near streams, general areas, and distant or isolated areas. The three suites and general BMP components are shown below.

Agriculture Suite A – Agriculture and Streams

- Fence streams from stock
- Restore degraded streambanks
- Replace or upgrade culverts
- Install sedimentation BMPs
- Apply road dust abatement (oil, MgCl2, Lignin, other)
- Institute land management actions including, water, sediment, and nutrient management plans
    - Provide troughs or tanks for water
    - Deferred grazing
    - Conservation cropping sequences
- Eliminate stormwater runoff of agricultural wastes
- Include end of field retention areas
- Upgrade irrigation systems

Agriculture Suite B – General Agriculture

- Modify or enhance culverts
- Apply road dust abatement (oil, MgCl2, Lig, other)
- Implement road closures
- Institute grazing management plans
- Exclude stock from water courses
- Maintain filter strip zone around watercourses
- Eliminate stormwater runoff of agricultural wastes
- Include end of field retention areas
- Upgrade irrigation systems

Agriculture Suite C – Isolated Agriculture

- Minimize agricultural impacts to the soil
- Repair obvious erosion channels
- Use appropriate land management techniques
- Minimize stormwater runoff of agricultural wastes

Urban/Suburban Best Management Practices

Urban/suburban BMPs are meant to address sediment and/or phosphorus reduction in urban/suburban land use areas. Control of storm water is a large component of urban/suburban BMPs. Three suites of BMPs were developed for urban/suburban areas. These suites were intended to address urban/suburban areas near streams, intermediate areas, and distant or isolated areas. The three suites and general BMP components are shown below.

Urban/Suburban Suite A – Streams and Developing Areas

- Implement and enforce stormwater management policies
- Replace, enhance, or install stormwater BMPs such as swales, filters, or ponds
- Restore degraded streams and riparian corridors
- Apply road dust abatement (oil, MgCl2, Lignin, other)
- Pave selected roadway and parking areas

Urban/Suburban Suite B – Intermediate Development

- Modify or enhance culverts
- Apply road dust abatement (oil, MgCl2, Lignin, other)
- Implement road closures
- Minimize stormwater connectivity and sediment contribution to watercourses
- Grade road areas to slow and disperse runoff or install stormwater BMP

Urban/Suburban Suite C – Isolated Development

- Repair obvious erosion channels
- Minimize stormwater impacts
- Grade road areas to slow and disperse runoff or install stormwater BMP

POINT SOURCE IMPLEMENTATION PLANS

There are no known point sources within the Cocolalla or Hoodoo watersheds. There are currently no point sources with National Pollutant Discharge Elimination System (NPDES) permits. Point sources are summarized under the pollutant source inventory, point source discharges in the TMDL (IDEQ, 2001).

For Cocolalla Lake, the TMDL states that previous to 1999, there were periodic unauthorized discharges to Johnson Creek and Cocolalla Lake of untreated sewage from the Sandy Beach Resort sewage lagoon. The lagoon has been in use since the early 1970's. In May of 1999, the lagoon was drained and the new community drainfield was fully operational (IDEQ, 2001).

For Upper and Lower Cocolalla Creek, the TMDL states that there are no known point source discharges to the creek or its tributaries (IDEQ, 2001).

For Hoodoo Creek, the TMDL states that there are no permitted point source discharges in the Hoodoo watershed.

NONPOINT SOURCE IMPLEMENTATION PLANS

Nonpoint sources of loading are grouped into three major categories based on land use: forestry, agriculture, and urban/suburban. The following sections address the implementation for each land use and phosphorus/sediment reduction measures for these nonpoint sources.

Forestry Source Implementation Plans

Forested land use totals approximately 75,800 acres within the Cocolalla and Hoodoo watersheds, representing roughly 80 percent of the total land area. Evaluations and analyses indicate that bank erosion, road erosion, and forest practices are the primary sources of sediment and phosphorus delivered from forest management lands. A majority of the management-related phosphorus load is bound to sediment delivered from forest streams and roads.

The most effective means for controlling the generation of nonpoint source pollution is by applying preventative and restorative watershed management practices. Nonpoint source pollution control is accomplished through the application of technology based BMPs. Using an iterative approach to management and the control of nonpoint sources of pollution, the forest stakeholders will: apply a BMP, monitor, evaluate, adapt and determine if the practices are effectively reducing sediment and phosphorus delivery to streams.

An approximately 80 percent overall load reduction from forested lands is needed to achieve the targeted load across the Cocolalla and Hoodoo watersheds. This 80 percent reduction is an average for the entire watershed. The actual percentage varies from subwatershed to subwatershed, and is dependant on the relative proportion of loads in each subwatershed. In addition, the range of variability across watersheds and over time is high. Because of the steep slopes associated with forested lands in the majority of the watershed, a significant fraction of the sediment and phosphorus load is delivered from forested land.

Forest land owners include the Kaniksu National Forest (Forest Service), IDL, and private landowners. State and private forest lands are governed under the IFPA. The purpose and goals of the IFPA include protecting, maintaining, and improving the functions and values of streams, lakes, wetlands, and riparian management areas. BMPs include riparian zone protection measures are the mechanism for meeting water quality standards. The IDL provides information and assistance for BMPs including the Forest Stewardship Guidelines for Water Quality (Best Management Practices), which provides simplified guidance to the IFPA (IDL, 2000b).

Programs identified for technical assistance and funding to support TMDL implementation and reduction of loads include: Forest Land Enhancement Program (FLEP), Forest Stewardship Program, and Idaho Forest Legacy Program. The FLEP is the cost share component to the Forest Stewardship Program. It provides up to 75 percent funding for activities such as tree planting, thinning, management plans or hazard abatement. The Idaho Forest Legacy Program provides funding for conservation easements to qualified landowners to maintain a forest land base. Appendix B is intentionally left open for future additional plans that may be submitted by forestry groups.

Agricultural Source Implementation Plans

Agricultural land use totals approximately 12,200 acres within the Cocolalla and Hoodoo watersheds, representing roughly 15 percent of the total land area. Evaluations and analyses indicate that bank erosion, road erosion, and agricultural practices are the primary sources of sediment and phosphorus delivered from agricultural lands. A majority of the management-related phosphorus load is bound to sediment delivered from streams and roads crossing through agricultural areas.

The overall approach is to seek voluntary implementation of BMPs on agricultural lands. Agricultural lands may be prioritized using three tiers considering agronomic, geomorphic, and hydrologic characteristics. These land-use tiers are:

Tier 1 – All lands within 150 feet of either side of a stream
Tier 2 – Lowlands and irrigated crops and pasture
Tier 3 – Uplands and non-irrigated pasture

Tier 1 lands are particularly important for reducing loads as they are potentially significant sources and important buffers to streams. A majority of the load from these lands is delivered to streams because of their immediate proximity. Healthy riparian areas are able to capture and assimilate potential loads and slow overland flow of runoff. The uppermost areas of Hoodoo Creek would make a very effective Wetland Reserve Program site.

The actual design and installation of BMPs is a site-specific process. Conservationists from Bonner County SWCD, the Idaho Soil Conservation Commission, and/or the NRCS can be extremely helpful to the landowner. They can provide an evaluation of current practices, land characteristics, and the potential for decreased loading for particular land units and recommend specific practices for a farm in the form of conservation and/or nutrient management plans. Additional resources including the Idaho Agricultural Pollution Abatement Plan (2003) are available.

Appendix C is intentionally left open for future additional plans that may be submitted by agricultural groups. A typical agricultural component implementation outline is provided in Appendix C.

Urban/Suburban Source Implementation Plans

Urban/suburban land use totals approximately 2,000 acres within the Cocolalla and Hoodoo watersheds, representing roughly less than 5 percent of the total land area. Evaluations and analyses indicate that bank erosion and road erosion are the primary sources of sediment and phosphorus delivered. A majority of the management-related phosphorus load is bound to sediment delivered from streams and roads crossings. Loads from stormwater, roadways, and failing/out-of-compliance septic systems are high priorities for implementation of reduction measures.

Specific BMP selections and site locations will be determined by the municipalities, county policy, local governments, associations, and/or other agencies. New and/or modified erosion and sediment control ordinances and their enforcement are important factors to meeting load reductions. Resources for BMP selection include the Catalog of Stormwater Best Management Practices for Idaho Cities and Counties along with the Stormwater BMP Selection Suitability Decision Tree (IDEQ, 2004).

Prioritization of stormwater implementation within municipalities, rural subdivisions, and other urban/suburban areas should focus on: (1) Source control measures to minimize or eliminate pollutant impacts to stormwater runoff; (2) Improvement of existing transportation corridors to encourage unobstructed, low velocity movement of stormwater and discourage extended shallow ponding; (3) Improvement of sedimentation or other passive treatment mechanisms immediately prior to discharge into surface waters; and (4) Installation of stormwater treatment trains in those locations for which diversion/sedimentation is not possible prior to discharge to surface waters.

Road erosion is a primary source within urban/suburban land use. Minimization of sediment and sediment-bound phosphorus transport through the control of road-related erosion processes is of high priority. Proximity to surface water is of primary concern, as direct transport of sediment is possible in many areas of the watershed. Load reductions are expected for unimproved, graveled, and paved roads. The Idaho Transportation Department (ITD) will be upgrading sections of US 95 through the watershed and is expected to include water quality improvement projects as part of any construction. IDEQ cannot dictate the selection of BMPs but can provide assistance and will expect a high level of cooperation and the installation of quality BMPs before issuing the water quality certification for the highway project. Appendix D is intentionally left open for future additional plans that may be submitted by urban/suburban groups.

LAND USE CHANGES

The TMDL and Implementation Plan address loading issues and implementation strategies primarily on a land-use basis. However, land-use distributions are not static. Forestry land use will likely decline, agricultural is unknown and urban/suburban land-use will likely increase. It is acknowledged that changes in land use will continue to occur throughout the implementation process and into the future. The following discussion is therefore intended to address this potential and ensure that land-use changes will not result in non-attainment of the required pollutant load reductions.

There are three general approaches that may be considered with regard to the management of changing land use. These include selecting BMPs to meet current targets, selecting BMPs to meet a pre-development condition, or selecting BMPs for the site that compensate for increased loads elsewhere from land use change. However, the selection of BMPs is generally site-specific and not viewed on a watershed scale. Meeting the reduction objectives of the TMDL will require a comprehensive watershed-wide implementation of interrelated BMPs. State agencies will need to be primarily responsible for the comprehensive planning of the implementation.

Land use changes that can be expected include the division of large tracts into smaller tracts, changes in zoning, and in-fill development. Large tracts of previously forested or agricultural land may be subdivided and zoned as residential or commercial. Initially, a home may occupy 10 acres but eventually the 10 acres may be developed with other homes or businesses to urban/suburban conditions with roads and buildings. Local authorities with the responsibilities of reviewing and approving new development will need to understand the impacts to water quality, the actions that need to be taken to minimize the water quality impacts, and enact and enforce appropriate local ordinances. On a state level, permit applications submitted to IDEQ for new development within the watershed of an impaired water body will need to be evaluated for potential water quality impacts and with the Implementation Plan in mind.

IMPLEMENTATION PLAN SCHEDULE

A schedule for planned actions to implement the TMDL is a tool to organize and coordinate pollutant reduction efforts, pursue funding support, and track accomplishments. However, a complicating factor in watershed implementation planning is that a firm schedule for completion of the proposed implementation measures cannot be formulated without assurance of funding. Additionally, the diverse group of stakeholders and land use further complicates the picture. A baseline schedule of completing at least one significant reduction project per quarter should be planned to meet the long-term reduction targets.

Funding Programs

Implementation funding may vary with individual sources and projects. There are a myriad of continually changing federal, state, and local sources of funding for water quality improvement projects. Generally a sponsor, or key individual, is needed to pursue and obtain the resources from the various sources. The following websites provide general information on available sources of funding for water quality projects in Idaho:

http://sspa.boisestate.edu/efc/services.htm
http://ssrc.boisestate.edu/
http://sspa.boisestate.edu/efc/Tools&Services/Plan2Fund/plan2fund.htm

Implementation Schedule Considerations

Important elements that may enhance the prospects for implementation of BMPs and projects recommended in this implementation plan include the following:

- Securing outside funding support is key.
- It appears that a multi-stage effort is necessary to plan, fund, and execute projects.
- Both the need to continuously seek outside funding support and the need for multiple project coordination over an extended period of years, emphasize the need for on-going program management.
- Program management will be needed to sustain project development including: tracking progress, funding projects, and coordinating individual project implementation.
- Adequate consideration should be given to funding the on-going program management effort needed for implementation. More aggressive project funding would allow the reduction projects to be implemented earlier. Otherwise, project implementation might lag if project funding is delayed or unavailable.

ESTIMATED COST OF REDUCTIONS

A common set of economic analysis assumptions is required for consistent consideration of phosphorus and sediment reduction efforts from each of the source groups. In terms of capital costs, all estimates should be formed under the same assumptions for the base date of the estimates for reference and future updates. The scope of the cost estimates should be consistent and include the same base assumptions for contents. When using historical costs as the basis of new estimates, it is important to consider whether reference information includes all applicable costs. For example, total project costs, as opposed to bare construction costs, include allowances for the following: construction contractor overhead and profit; mobilization/demobilization, engineering, legal, and administrative costs; provision for sales tax/public works utilities tax; and adequate contingencies.

Consideration should be given to unified assumptions for the components of capital cost estimates. As an example, capital improvement programs typically utilize standardized assumptions in estimating costs to provide consistency, a basis for comparisons, and ease in developing future updates. Cost indices are frequently used to establish a date reference and a basis for updates. Providing an allowance for contingencies is a sound practice for project budgeting. Contingencies account for accuracy in estimating unknowns at the time of estimating, and potential changes in the scope of work and actual field conditions. Typically, contingency allowances range from 10 to 20 percent of construction costs, depending upon the level of development of the cost estimates. For projects that require contracting with a constructor, allowances must also be made for mobilization and demobilization of work crews and general contractor overhead and profit. Typically, mobilization, surety bonds, and liability insurance costs range from 3 to 5 percent of the construction costs. General contractor overhead and profit generally range from 15 to 20 percent of construction costs. Project management, administration, design services, and legal services may all be required components of a program to undertake water quality improvements. Typically, these allied costs account for 25 to 35 percent of the total installed cost of capital projects. While all of these costs are not applicable to every project, these are important considerations for cost estimates.

The purpose of conducting economic analysis of project costs is to compare options and their effectiveness. Life cycle cost analysis allows projects of varying capital and operation costs to be compared. When combined with removal effectiveness, project costs can be compared in terms of their economic benefit per unit of pollutant load removed. Additional cost information and assumptions are necessary for complete life cycle analysis. These include annual operations and maintenance cost estimates for projects and estimated effective lives for projects.

The large scope of the effort, the multiple land uses, issues, and stakeholders makes it difficult to impossible to detail cost estimates. As stakeholder commitment increases and projects occur record keeping of individual project pre- and post-implementation costs will become useful for the planning of future projects. A preliminary estimate of the potential range of dollars that may be required to accomplish the water quality improvements called for in the Implementation Plan objectives is presented in Table 32.

The costs shown in Table 32 are meant to provide only an initial estimate of the potential range of costs in 2004 dollars. The estimated range of costs presented here are based upon unit costs for water quality projects and BMPs from reference sources, combined with the land use areas identified in the Cocolalla and Hoodoo watersheds. The land areas used to estimate treatment costs are from Table 26. The unit costs for BMPs have been selected from a variety of literature sources including the USFWS, Forest Service, other state and municipal environmental agencies, and TMDLs from other locations. The unit costs and land use areas were multiplied to compute costs. These costs were then factored for additional costs associated with planning, design, construction, and contingency to calculate the estimated costs shown in Table 32.

Forest lands that are within 500 feet of streams are considered high priority for water quality BMPs and it has been assumed that 30 percent are wetlands areas and 70 percent are riparian. A cost of $300 per acre for wetlands BMPs and a riparian BMP treatment cost of $500 have been assumed, based on USFWS (2001) information. Broader forest lands greater than 500 feet from streams have been assumed to require general forestry BMPs in the range of $27 per acre, based on Forest Service information (Forest Service, 1997). These costs have been combined to estimate the potential range of costs for water quality improvements in the forest land use.

Agricultural lands that are within 500 feet of streams are considered high priority for water quality BMPs and it has been assumed that 30 percent are wetlands areas and 70 percent are riparian. A cost of $400 per acre for wetlands BMPs and a riparian BMP treatment cost of $650 have been assumed, based on USFWS (2001) information. Broader agricultural lands greater than 500 feet from streams have been assumed to require general agricultural BMPs in the range of $38 per acre, based on state information (DDNR&EC, 2004). These costs have been combined to estimate the potential range of costs for water quality improvements in the agricultural land use.

Urban/suburban lands that are within 500 feet of streams are considered high priority for water quality BMPs and it has been assumed that 30 percent are wetlands areas and 70 percent are riparian. A cost of $500 per acre for wetlands BMPs and a riparian BMP treatment cost of $800 have been assumed, based USFWS (2001) information. Broader urban/suburban lands greater than 500 feet from streams have been assumed to require general BMPs in the range of $30 per acre. The Cocolalla Lake water quality improvements have been estimated based upon a unit cost of $5,000 per surface acre of water to represent a preliminary estimate of the effort required to reduce internal recycling of phosphorus, based upon municipal sources (CT, 2004). These costs have been combined to estimate the potential range of costs for water quality improvements in the urban/suburban land use. The urban/suburban costs indirectly include some costs associated with roadway projects and drainage improvements. However, cost estimates for major roadway reconstruction or new roadways were not included as these projects are not identified and would likely have separate and individual sources of funding.

Table 32. Preliminary Planning Level Estimated Costs for Implementation of Reduction Measures

Watershed[1]	Forestry[2] ($)	Agricultural[3] ($)	Urban/Suburban and Lakes[4] ($)	Total[5] ($)
Cocolalla Lake Area	190,000 – 290,000	70,000 – 110,000	5,580,000 – 8,380,000	5,840,000 – 8,780,000
Fish Creek	850,000 – 1,280,000	130,000 – 200,000	10,000 – 20,000	990,000 – 1,500,000
Johnson Creek	500,000 – 760,000	10,000 – 20,000	40,000 – 70,000	550,000 – 850,000
Westmond Creek	520,000 – 780,000	290,000 – 440,000	250,000 – 380,000	1,060,000 – 1,600,000
Butler Creek	360,000 – 550,000	50,000 – 80,000	10,000 – 20,000	420,000 – 650,000
Upper Cocolalla Creek	2,300,000 – 3,460,000	730,000 – 1,100,000	80,000 – 130,000	3,110,000 – 4,690,000
Lower Cocolalla Creek	1,160,000 – 1,740,000	370,000 – 560,000	1,830,000 – 2,760,000	3,360,000 – 5,060,000
Hoodoo Creek	2,390,000 – 3,590,000	1,460,000 – 2,190,000	1,050,000 – 1,590,000	4,900,000 – 7,370,000
Subtotal	8,270,000 – 12,450,000	3,110,000 – 4,700,000	8,850,000 – 13,350,000	20,230,000 – 30,500,000

1Riparian restoration costs of $500 to $800 per acre, wetland restoration costs of $300 to $500 per acre (USFWS, 2001)
2Forestry BMPs $26.98 per acre (Forest Service, 1997)
3Agricultural BMPs $37.5 per acre (DDNR&EC, 2004)
4Urban/Suburban BMPs $30 per acre, Lakes estimated at $5,000 per acre (CT, 2004)
5Additional contingency, design, and construction factors included for preliminary planning from 35 to 50 percent

EVALUATION OF PROGRESS/REPORTING

IDEQ will evaluate the progress of the Implementation Plan and periodically report their assessment. Data collected from other monitoring programs in the watershed will be used in addition to IDEQ's monitoring results for the evaluation. Others performing monitoring in the watershed are encouraged to share their data with IDEQ to provide a broad picture of water quality conditions.

Monitoring

Water quality monitoring is an important component of the Implementation Plan and may be used to measure the success of both individual activities and the overall effort. An on-going, long-term monitoring effort will be required. The results of the monitoring will be used to evaluate the changing condition of the watershed and may lead to adjustments in priorities throughout the implementation of the TMDL. Several approaches to obtain water quality characteristics will be used.

Implementation Plan monitoring includes three components: in-stream subwatershed monitoring, lake monitoring, and BMP monitoring. Watershed monitoring measures the success of implementation measures in achieving the TMDL goals. BMP monitoring measures the success of individual projects.

Success in reducing the present loads may be measured by comparing individual subwatersheds with monitoring results. IDEQ should continue to monitor the watersheds and/or adapt a new monitoring program to measure the effectiveness of the Implementation Plan. IDEQ monitoring is expected to continue throughout the implementation process and provide a comprehensive assessment of changes in the watersheds.

Site or BMP-specific monitoring may be included as part of specific treatment projects but will likely be the responsibility of the project manger or grant recipient. Individual entities constructing BMPs are recommended to include budget allowances for monitoring. These entities will be responsible for collection of data and reporting monitoring results to IDEQ. These data will be valuable to evaluating the effectiveness of the BMP project and useful for recommending or discouraging similar projects. This will help meet the objective of verifying that BMPs are properly installed, being maintained and working as designed.

Projects Implemented To-Date

The following projects have been recorded for Cocolalla and Hoodoo Creeks (NPPC, 2001). For the Cocolalla watershed the following has been undertaken. In 2000, the Cocolalla Lake Association, Bonner County SWCD, NRCS, Soil Conservation Commission, IDL, IDEQ, and IDF&G implemented projects including an incentive program for improved management of riparian areas on private lands, restored fish passage, and improved water quality in the lake. These projects targeted improving water quality and trout fishery. For the Hoodoo watershed, NRCS and landowners installed riparian buffers in 1998. These projects targeted improving habitat for fish, songbirds, waterfowl, and furbearers.

REASONABLE ASSURANCE

For watersheds that have a combination of point and nonpoint sources, where pollution reduction goals can only be achieved by including nonpoint source reduction, a reasonable assurance that reductions will be met must be incorporated into the TMDL (EPA, 1991). The load reductions rely on nonpoint source reductions to meet the targets to achieve desired water quality and to restore designated beneficial uses.

Under Section 319 of the CWA, each state is required to develop and submit a nonpoint source management plan. Idaho's Nonpoint Source Management Program (IDEQ, 1999) was submitted and approved by the EPA. The nonpoint source management program describes many of the voluntary and regulatory approaches the state will take to abate nonpoint pollution sources.

The State of Idaho water quality standards refer to other programs whose mission is to control nonpoint pollution sources. The State of Idaho uses a voluntary approach to control nonpoint sources. For many activities it assigns the local soil conservation districts to assist the landowner/operator to develop and implement BMPs to abate nonpoint pollution associated with the land use.

A voluntary approach is expected to be able to achieve the nonpoint source reduction goals. Strong public involvement coupled with the eagerness of the community demonstrates a willingness to implement BMPs and protect water quality. In the past, cost-share projects have provided the community technical assistance, information and education, and the cost share incentives to implement BMPs. The continued funding of these projects will be critical for the load allocations to be achieved.

Monitoring and the 'Feedback Loop'

Monitoring will be conducted to ensure that nonpoint source reduction mechanisms are operating effectively, and to give some quantitative indication of the reduction efficiency for in-place BMPs. The monitoring proposed for this plan includes both implementation monitoring and water quality monitoring. Implementation monitoring consists of a variety of methods such as spot checks, periodic project reviews, and photographic documentation to demonstrate that phosphorus reduction measures have been properly installed, are being properly maintained, and are performing as designed. Implementation monitoring methods have been summarized in the sections describing implementation measures. Generally, water quality monitoring will not be carried out on a project-specific basis but rather as a suite of indicator analyses monitored at selected locations within the watershed.

If in-stream monitoring indicates a trend of increasing phosphorus or sediment concentration (not directly attributable to environmental conditions) or a violation of standards despite use of approved BMPs or knowledgeable and reasonable efforts, then BMPs for the nonpoint source activity must be modified by the appropriate agency to ensure protection of beneficial uses. This process is known as the "feedback loop" in which BMPs or other efforts are periodically monitored and modified if necessary to ensure protection of beneficial uses. In-stream monitoring will provide the data necessary to evaluate the success of BMP implementation and its effectiveness in controlling nonpoint source pollution.

IMPLEMENTATION PLAN REVISION

The monitoring data will be evaluated to assess progress in attaining water quality standards and restoration of beneficial uses. If goals are being reached, or if trend analysis shows that implementation activities are resulting in benefits that indicate that water quality objectives will be met within a reasonable time, the Implementation Plan will not be revised. If analysis or other information indicates that water quality goals will not be met, the Implementation Plan will be revised to include new objectives and a new strategy for implementation actions.

The following conditions could indicate a need to revise the Implementation Plan:

- Monitoring data indicate water quality standards will not be attained by continued execution of the Implementation Plan.
- Actual effectiveness and efficiency of reduction BMPs/projects falls short of, or exceeds, projections used in the Implementation Plan.
- Phosphorus reduction BMPs/projects are not executed according to the Implementation Plan due to lack of funding or other factors.
- Monitoring data indicate that background loadings differ from historical data and revisions to reduction targets for manageable loadings are required.

A sustained effort in implementing reduction actions will be needed to improve water quality. Weather conditions may affect the rate of progress in meeting the objectives for water quality improvement.

SOURCE GROUP INFORMATION AND PUBLIC EDUCATION EFFORTS

Public information and education efforts are an important part of ensuring full and timely implementation of the measures proposed in this plan. Information and education will generally take two forms: general information about the plan directed to all residents and interests in the watershed and source-specific information and education efforts targeted to sources that may be involved in implementing phosphorus and/or sediment reduction measures. General information and education measures include a public meeting sponsored by IDEQ to explain the process, a working meeting sponsored by IDEQ, an opportunity for public review and comment, and distribution of the final plan to interested parties. Ongoing information about implementation progress will be provided by IDEQ and monitored as discussed in this plan.

REFERENCES

BPA. 1985. Kokanee Stock Status and Contribution of Cabinet Gorge Hatchery, Lake Pend Oreille, Idaho. DOE/BP-22493-1. Bonneville Power Administration, Portland, OR.

CT. 2004. Methodology for TMDL Preliminary Cost Analysis. City of Tallahassee, FL. http://www.florida-stormwater.org/pdfs/TallahasseeTMDL.pdf

DDNR&EC. 2004. Agricultural Best Management Practices. Delaware Department of Natural Resources and Environmental Control, Dover, DE. http://www.dnrec.state.de.us/water2000/Sections/Watershed/ws/fact_ib_ag_bmp.pdf

EPA. 2001. Guidance for Water Quality-based Decisions: The TMDL Process, (EPA 440/4-91-001).

Ferguson, D. F. 2001. Hoodoo Creek of Bonner County, Idaho, Physical Characterization of Riparian Area. Idaho Soil Conservation Commission, Boise, ID.

Forest Service. 1997. Annotated Bibliography on Forest Practices Legislation Related to Water Quality. US Department of Agriculture, Forest Service, Northeastern Research Station, General Technical Report NE-258. http://www.fs.fed.us/ne/newtown_square/publications/technical_reports/pdfs/1999/gtrne258.pdf

IDEQ. 1999. Idaho Nonpoint Source Management Plan. State of Idaho, Department of Environmental Quality.

IDEQ. 2000. Implementation Plan for the Cascade Reservoir Phase II Watershed Management Plan, Volume 1 and 2-Nonpoint Source Implementations Plans. June 30, 2000. Submitted by: HDR Engineering, Inc. and Ross & Associates Environmental for Division of Environmental Quality, Boise, ID.

IDEQ. 2001. Clark Fork/Pend Oreille Sub-Basin Assessment and Total Maximum Daily Loads, Hydrologic Unit Codes 17010213 & 17010214. November 18, 1999, revised April 17, 2000, revised November 2000, revised March 2001, Updated August 2001. Division of Environmental Quality, Coeur d'Alene, ID.

IDEQ. 2004. Catalog of Stormwater Best Management Practices for Idaho Cities and Counties and Stormwater BMP Selection Suitability Decision Tree. Boise, ID. http://www.deq.state.id.us/water/stormwater_catalog/index.asp#

IDL. 2000a. Forest Practices, Cumulative Watershed Effects, Process for Idaho, Idaho Forest Practices Act. March 2000. Idaho Department of Lands, Boise, ID.

IDL. 2000b. Forestry BMP's (Best Management Practices) for Idaho, Forest Stewardship Guidelines for Water Quality. Idaho Department of Lands, Coeur d'Alene, ID.

ISCC. 2003. Idaho Agricultural Pollution Abatement Plan, a guidance document addressing nonpoint source water quality pollution, March 2003, sponsored by Idaho Soil Conservation Commission and Idaho Department of Environmental Quality, prepared by Resource Planning Unlimited, Inc.

NPPC. 2001. Draft Pend Oreille Subbasin Summary. http://www.cbfwa.org/files/province/mtncol/subsum/PendOreille/PendOreille.htm

USFWS. 1999. Status Review for Westslope Cuttthroat Trout in the United States. US Department of the Interior, US Fish and Wildlife Service, Regions 1 and 6, Portland, OR and Denver, CO. http://mountain-prairie.fws.gov/endspp/fish/wct/cutthroat1.pdf

USFWS. 2001. Idaho Partners for Fish and Wildlife. US Fish and Wildlife Service, Boise, ID. http://partners.fws.gov/pdfs/ID-needs.pdf

Appendix A

Cumulative Watershed Effects Assessment - Cocolalla Creek, Fish Creek, and Hoodoo Creek

Appendix B

Forestry Source Implementation Plan
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Appendix C

Agricultural Source Implementation Plan

Agricultural Component
TMDL Implementation
Plan Outline

Introduction:

- Purpose
- Goals
- Objectives

Background:

- Project Setting
- Land use
- Ownership
- Accomplishments

Problem:

- Beneficial Use Status
- Pollutants – Load Allocation and Reduction
- Water Quality Monitoring Results
- Critical Areas
  - ✓ Definitions
  - ✓ Quantification
  - ✓ Location
- ESA Issues (Other)
- CAFOs
- Other

Implementation Priority (Rationale)

- Subwatersheds
- Critical Areas
- Implementation Tiers

Treatment – by subwatershed

- Treatment Units
- Alternatives
- Costs

Funding

Outreach

Monitoring and Evaluation

- Field Level
  - Status Reviews
  - BMP Effectiveness
- Watershed Level
  - Pollution Source and Transfer
  - Project/Program Reviews
  - Progress Tracking and Reporting

Appendix D

Urban/Suburban Source Implementation Plan
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