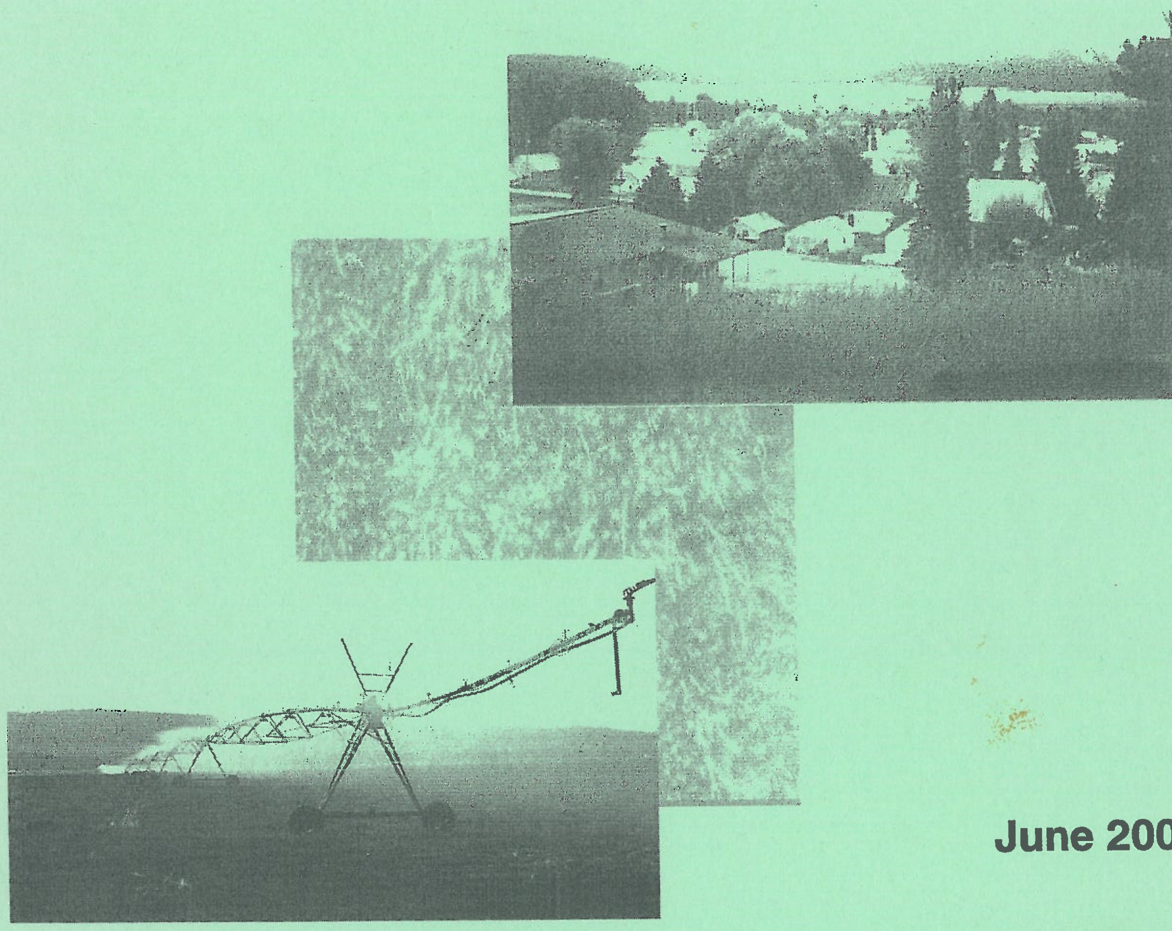
Implementation Plan for the Cascade Reservoir Phase II Watershed Management Plan



June 2000

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June 30, 2000

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Implementation Plan
Draft
June 16, 2000

Introduction

This document represents the Implementation Plan for the Cascade Reservoir Phase I and Phase II Watershed Management Plans. It builds on those previous documents and utilizes the specific loading and reduction values identified in the Cascade Reservoir Phase II Watershed Management Plan which functions as the TMDL for Cascade Reservoir. This document outlines the basis for implementation of the phosphorus loading reductions called for in the Cascade Reservoir Phase II Watershed Management Plan 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 Cascade Reservoir and its tributaries. 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.

This Implementation Plan is not static. It is intended to be a dynamic, living document with implementation changes and modifications occurring as data and documentation become available, and implementation occurs throughout the life of the management plan.

Background

Cascade Reservoir is located in the Payette River Basin of southwestern Idaho in Valley County, one of the fastest growing counties in the state of Idaho. The Cascade Reservoir watershed encompasses approximately 357,000 acres in a moderately high elevation valley between West Mountain and the Salmon River Mountains. Major tributaries to the reservoir include the North Fork Payette River (NFPR), Mud Creek, Lake Fork Creek, Boulder Creek, Gold Fork River and Willow Creek, all of which discharge into the northern end of the reservoir. The overall watershed is divided into seven separate subwatersheds on the basis of drainage areas to these tributaries: North Fork Payette River, Mud Creek, Lake Fork, Boulder/Willow Creek, Gold Fork River, Cascade and West Mountain. A major portion of the watershed is steeply-sloped forested land, while the area immediately adjacent to the reservoir and major tributaries is predominantly gently-sloped agricultural land.

Surface Hydrology

The reservoir was created in the spring of 1949 with the completion of Cascade Dam, which was constructed across the North Fork Payette River, north-northwest of the present day location of the City of Cascade. The reservoir is 21 miles long, 4.5 miles wide at the widest point and is relatively shallow, measuring 26.5 feet in average depth. Cascade Reservoir, operated by the U.S. Bureau of Reclamation (USBR), provides irrigation, hydropower, flood control, recreation, and fish and wildlife habitat needs. Maximum storage capacity at completion was 703,200 acre-feet. Current storage capacity has decreased to an estimated 693,123 acre-feet due to sedimentation at the upper (northern) end of the reservoir.

Three major events, snow-melt, rain-on-snow and seasonal thunderstorms generate stream flow within the watershed. Snow-melt runoff is the predominant source used to fill the reservoir. Natural stream and irrigation channels convey snow-melt runoff to the reservoir and other water bodies in two major events, valley snow-melt (usually occurring in March and April) and mountain snow-melt (usually occurring in June and July) (USFS, 1998). During the irrigation season (May through October), a significant portion of the total tributary flow is diverted for irrigation of pastureland and fields. Sub-flood irrigation, in which large parallel ditches within a pasture are filled for an extended time period and the water allowed to saturate the soil separating the ditches, is the predominant irrigation practice within the watershed.

Water Quality Overview and Phase II TMDL Background

Cascade Reservoir has been identified as water quality limited under section 303(d) of the Clean Water Act (CWA). Water quality studies have shown that phosphorus is the pollutant of concern within the watershed. Monitored water quality data reveal that a significant phosphorus load is carried in the increased flows present during spring runoff. Summer irrigation practices also contribute to phosphorus loading in the reservoir. Nuisance algae growth resulting from nutrient loading has impaired the designated beneficial uses of the reservoir, specifically, fishing, swimming, boating and agricultural water supply. Internal recycling of sediment-bound phosphorus within the reservoir is also a concern.

Cascade Reservoir Water quality Concerns

Segment Identifier:	PNRS# 884, HUC 17050123
Pollutants of Concern:	Nutrients (Phosphorus), Dissolved Oxygen, pH
Uses Affected:	Fishing, Swimming, Boating, Agricultural Water Supply
Known Sources:	Point Sources – Municipal Wastewater Treatment Plant and Fish Hatchery Nonpoint Sources - Forestry, Agriculture, Urban/Suburban, Septic Systems, Internal Reservoir Recycling

In accordance with the section 303(d) requirements, a TMDL (total maximum daily load) was established for the Cascade Reservoir. The Phase I TMDL (or, Watershed Management Plan), which included an initial water quality assessment and nutrient reduction goal, was approved by EPA on May 13, 1996. Further evaluation of phosphorus reduction goals and alternatives was documented in the Phase II Watershed Management Plan, the second phase of the TMDL. The Phase II TMDL stated that a 37 percent overall load reduction in total phosphorus would bring the reservoir into compliance with water quality standards for phosphorus (0.025 mg/L in-lake total phosphorus concentration), chlorophyll a (10 μg/L in-reservoir chlorophyll a concentration), dissolved oxygen (concentrations exceeding 6 mg/L at all times, except for the bottom 20% of water depth where depths are 35 meters or less, and hypolimnion waters in stratified lakes and reservoirs), and pH (6.5 to 9.5 standard units). These targets were based on water quality models for Cascade Reservoir. Because of the direct relationship between algal growth, depleted dissolved oxygen and high total phosphorus concentrations within the water column, the reduction of total phosphorus input to the reservoir is being specifically targeted as a mechanism for overall water quality improvement. Estimated nonpoint source runoff accounts for a majority of the phosphorus input to Cascade Reservoir, averaging ~84 percent in an assessment of current and historical monitoring data. Estimated point source loading averages ~10 percent. Septic tank effluent accounts for the remaining ~6 percent of the total phosphorus load.

Table 1 shows estimated phosphorus loading and reduction goals for the Cascade Reservoir watershed from the Cascade Reservoir Phase II Watershed Management Plan (Phase II TMDL) which functions as the TMDL for Cascade Reservoir. As established in the Phase II TMDL document, estimated loads are broken down by major sources and by subwatershed. Loading for the Phase II TMDL document and this Implementation Plan is based on measured total phosphorus loads for water years 1993 to 1996.

Summary of Cascade Phase II TMDL Objectives

Water Quality Objective:	In-reservoir total phosphorus concentration of 0.025 mg/L In-reservoir chlorophyll a of 10 µg/L
Implementation Plan Objectives:	Sustained annual 37 percent reduction in total external phosphorus loadings
Component reductions:	
Point Sources:	7 percent reduction in the total phosphorus load (100% removal of municipal wastewater treatment plant effluent and reduced fish hatchery discharge)
Nonpoint Sources:	30 percent reduction in the total phosphorus load (Forestry, Agriculture, Urban/Suburban land use)
Operational Objectives:	Maintenance of a minimum Cascade Reservoir pool of 300,000 acre-feet.

Table 2 shows the yield coefficients, expressed as kg/acre/yr, established from monitoring and modeling data, as described in the Phase II TMDL and supporting source plans. These yield coefficients represent the basis of the implementation strategy for the Cascade Reservoir watershed as outlined in this document. These coefficients were used to establish a priority ranking for implementation on both a subwatershed and a land-use basis. The prioritization process is discussed in greater detail in following sections of the document.

Table 1. Annual Total Phosphorus Load (kg/yr) to Cascade Reservoir Averaged from 1993-1996 Instream Monitoring Data

Nonpoint Sources		Annual Phosphorus Load Allocated from Measured Load, kg/yr					Reduction Goal, kg/yr
		Natural Load and Background	Forestry	Agriculture	Urban	Total	
Subwsh	Cascade[1]	209	2	222	229	662	199
	Gold Fork	4,704	3,164	742	63	8,673	2,602
	Lake Fork	600	126	2,401	792	3,919	1,176
	Mud Creek	167	8	612	245	1,032	310
	North Fork[1]	3,445	739	6,994	1,342	12,520	3,756
	West Mtn.	984	924	391	83	2,382	715
	Boulder/ Willow	922	866	2,232	303	4,323	1,297
Septic[2]						2,205	840
Nonpoint Source Totals		11,031	5,829	13,594	3,057	35,716	10,895
Point Sources		**Annual Phosphorus Load Allocated from Measured Load, kg/yr**					**Reduction Goal, kg/yr**
						Total	
McCall Wastewater Treatment Plant						3,947	3,947
McCall IDFG Fish Hatchery						218	0
Point Source Totals						4,165	3,947
Grand Totals		11,031	5,829	13,594	3,057	39,881	14,842

[1] See *Identified Data Gaps* discussion in Section 2.3.3 of the Phase II TMDL, the discussion under the Implementation Priorities for Nonpoint Source Loads on page 12, and the discussion under the heading Agricultural Source Implementation Plan on page 26 of this document for more information.
[2] Septic system loads and load reductions were calculated separately from the 30% nonpoint source load reductions and are not allocated specifically to any subwatershed.

Table 2. Estimated Total Phosphorus Management Load per Acre (kg/acre/yr) for Major Nonpoint Sources by Subwatershed

Subwatershed	Total Phosphorus Yield Coefficient, kg/acre/yr					
	Forestry	Agriculture	Urban[2]	Management Load	Natural Load	Management plus Natural Load
Cascade	0.001	0.019	0.035	0.030	0.014	0.044
Gold Fork	0.012	0.036	0.029	0.031	0.054	0.085
Lake Fork	0.003	0.192	0.237	0.063	0.013	0.076
Mud Creek	0.036	0.045	0.094	0.063	0.016	0.079
North Fork (Total load)[1]	0.046	0.436	0.114	0.284	0.116	0.400
North Fork (Known source load)[1]	0.046	0.117	0.114	0.124	0.112	0.236
West Mtn.	0.028	0.035	0.013	0.047	0.034	0.0.81
Boulder/Willow	0.036	0.146	0.059	0.097	0.031	0.128
Watershed Average						0.031

[1] See *Identified Data Gaps* discussion in Section 2.3.3 of the Phase II TMDL, the discussion under the Implementation Priorities for Nonpoint Source Loads on page 12, and the discussion under the heading Agricultural Source Implementation Plan on page 26 of this document for more information.
[2] Does not include septic-based phosphorus loading.

Phosphorus Reduction Goals

In the Phase II TMDL, load capacity was divided among point source wasteload allocations (7 percent), nonpoint source load allocations (30 percent), and a margin of safety. In the North Fork Payette River (NFPR), the subwatershed load allocation reflects full (100 percent) removal of the City of McCall's Wastewater Treatment Plant discharge, changes in feeding management practices already in place for the Idaho Department of Fish and Game (IDFG) Fish Hatchery, and a 30 percent reduction of all nonpoint sources. A loading analysis for the Phase II TMDL demonstrated that for nonpoint sources, a 30 percent reduction of the total load (management load plus natural and/or background load) is possible from management sources alone. Management load is defined as that portion of the total load directly attributable to the impacts of human activities within the watershed.

Initially, the Phase II TMDL set a goal of reducing nonpoint source loads by 30 percent in each subwatershed. However, the Phase II TMDL acknowledged that "attainment of the 30 percent overall nonpoint-source reduction may be difficult in those subwatersheds (i.e. Gold Fork) where natural phosphorus loads represent the majority of the total load. It should be understood that a watershed-wide reduction of 30 percent of the nonpoint-source total phosphorus load (management load plus natural and/or background load) is required to reach water quality standards. It is recognized that efficient use of management efforts and available implementation monies should be of primary concern. Therefore, it is reasonable to expect that the 30 percent nonpoint source reduction goal may be reached by implementation measures resulting in greater than 30 percent in some subwatersheds to offset less than 30 percent reductions in others" (Phase II TMDL, page 12).

To achieve an overall reduction (management load plus natural and/or background load) of 30 percent for nonpoint sources within the watershed, a reduction of between 40 and 45 percent from management sources alone would be required. This 40 to 45 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 natural load in each subwatershed. It is not expected that the reduction in management load will be achievable at the same level of cost-effectiveness from all areas or sources within all subwatersheds. Therefore, (as above) it is reasonable to expect that the nonpoint source reduction goal will be reached by implementation measures resulting in greater than 40 to 45 percent reduction of management load in some subwatersheds to offset reductions of less than 40 to 45 percent of management load in others. The identification of specific implementation projects will be made with this consideration in mind.

Implementation Plan Overview

The purpose of this Implementation Plan is to outline the point and nonpoint source reduction measures that are needed to effect required water quality improvements and achieve Phase II TMDL goals within Cascade Reservoir. It is a living document and is expected to change as implementation occurs and more data becomes available.

This document was developed from source-specific implementation plans that were prepared by citizen-led source groups representing forestry, agriculture and urban/suburban interests. For each of the nonpoint sources, the following information is included in this Implementation Plan and the source-based implementation plans that were used as the basis for this document: the approach used to determine measures needed; best management practices (BMPs) needed to achieve phosphorus reductions; BMP efficiencies; and source-specific plans for assessing project effectiveness. The source-specific implementation plans also include monitoring programs and general schedules for implementation and monitoring actions. The Implementation Plan describes an approach for tracking implementation plan progress, including a computer-based tracking system that has been designed to track projects and progress toward the 37 percent phosphorus reduction goal established for the Cascade Reservoir, 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 individual source implementation plans and this integrated Implementation Plan was overseen by the Cascade Reservoir Coordinating Council (CRCC), which serves as the watershed advisory group for this TMDL process, and the Cascade Reservoir technical advisory committee (TAC). The CRCC includes nine local representatives appointed by the Idaho Department of Environmental Quality (DEQ) from all major sectors of the local community. CRCC members work directly with their respective interest groups to provide direction to DEQ in developing and implementing a watershed management plan, and help identify funding needs and sources of support for specific projects that may be implemented. The TAC is responsible for reviewing proposed projects to ensure they are consistent with phosphorus reduction goals, that they are scientifically sound and that monitoring follows scientifically accepted procedures. Source-specific work groups formed by the TAC were responsible for preparing the individual source implementation plans. The membership of the TAC includes scientific and engineering representatives from local, state and federal agencies, industry and municipalities.

Point Source Implementation Plan

There are two point sources of phosphorus loading to Cascade Reservoir, the McCall Wastewater Treatment Plant (WWTP) and the IDFG Fish Hatchery in McCall. Both sources discharge nutrients directly to the North Fork Payette River (NFPR) upstream of Cascade Reservoir operating under National Pollutant Discharge Elimination System (NPDES) permits.

The implementation of *point source* reduction measures has been identified as a primary priority within the Cascade Reservoir watershed as outlined by the Phase II TMDL process. Phosphorus reduction projects for each of the two existing point sources are currently underway. Because these reduction projects are already under construction (McCall WWTP / J-Ditch) or completed (IDFG Hatchery) at this time, these sources were not included in the overall prioritization effort for the watershed outlined below. Implementation priority for these projects has previously been identified as high, and recommended actions are being followed to completion.

McCall Wastewater Treatment Plant

The McCall WWTP (NPDES ID0020231) processes approximately 1.8 million gallons per day (MGD) at full capacity. The average load is roughly 0.7 MGD. Peak flows of 2.3 MGD have been reported however, due to infiltration of ground water and snow-melt. Infiltration is estimated to contribute as much as 1.6 MGD to the base flow. Peak inflow occurs during spring runoff and snow-melt periods and declines during the remainder of the year. Effluent phosphorus concentrations vary seasonally and typically exceed ambient concentrations in the NFPR. In treated wastewater effluent, the majority of the entrained phosphorus is present as dissolved ortho-phosphate, a readily bioavailable form of phosphorus. Proportionately, more than 85 percent of the total phosphorus in sewage effluent is in the form of dissolved ortho-phosphate, as compared to less than 1 percent in sediment associated phosphorus. Dissolved ortho-phosphate concentrations in treated effluent commonly range from 1.0 to 6.0 mg/l depending upon the level of wastewater treatment (Randall, Barnard and Stensel, 1992). Annual total phosphorus loading attributed to the treated effluent rose markedly from the early 1970's to 1988 due to increased population and recreational use. Since 1988, annual total phosphorus loading has remained relatively constant, ranging from 3,815 kg to 4,751 kg annually (An average load of 3,947 kg/yr is used in the Phase II TMDL document).

To address the required 100% reduction in discharge, a unique combination of agricultural and urban/suburban efforts has been undertaken by ranchers and farmers in the Mud Creek subwatershed and the City of McCall. This project, named after the J-Ditch irrigation canal it replaces, has allowed treated effluent from the City of McCall to be mixed with irrigation water and applied at agronomic rates to pasture and crop land in the Mud Creek drainage during the summer irrigation season. The current phosphorous loading from the Mud Creek Subwatershed has been identified as predominantly the result of streambank destabilization, poor grazing practices and agricultural recharge from sub-flood irrigation practices (see Table 1). Detailed soil retention capacity and hydrological studies in this subwatershed have shown that with the conversion from sub-flood irrigation to sprinkle irrigation, and the subsequent reduction in ditching and sub-surface flow, the treated effluent applied at rates appropriate to the crop types grown will not result in breakthrough phosphorus loading to the reservoir or tributaries for (at minimum) 20 years (the current lifetime of the project). Additionally, the improvements made in water management, grazing management and streambank stabilization as a result of this project and associated others, will yield a substantial decrease in the existing phosphorus loading to the reservoir from this subwatershed. This project therefore, is projected to result in not only the removal of the WWTP effluent from the NFPR, but also a substantial reduction in nonpoint source loading to the reservoir from the Mud Creek subwatershed. Ground water wells are in place throughout the project area and will be monitored as necessary to determine ground water response to the sub-flood to sprinkler conversion and any trends in phosphorus content of the sub-surface waters.

The J-Ditch project represents a major step in the eventual, 100 percent removal of the Wastewater Treatment Plant effluent from the NFPR identified by the Phase II TMDL document. Additional effluent generated during non-irrigation months will be retained in storage lagoons currently under construction by the City of McCall. Effluent stored over the winter months will be land applied the following irrigation season. Farmers and ranchers participating in this project were originally using sub-flood irrigation practices. To date, all participants have installed on-farm sprinkler systems to be able to utilize the mixed effluent. Currently, the system is able to remove all the treated effluent from the NFPR during the irrigation season. Work on the winter storage lagoons is on-going. Total (100 percent) removal of the treated effluent from the NFPR will be possible with the completion of winter storage lagoons by the City of McCall (scheduled for November 2000). According to the Phase II TMDL document, the McCall Wastewater Treatment Plant is required to have a reduction goal of 3,947 kg/yr or 100 percent reduction of the phosphorus load to the Cascade Reservoir. Completion of this project will fulfill that reduction goal.

Idaho Fish and Game Fish Hatchery

The IDFG Fish Hatchery (NPDES ID-G-1300-52) requires flowing water for maintenance and growth of Chinook Salmon stock and discharges 12.9 MGD to the NFPR. In 1994, the fish food being used (1.7 percent phosphorus by weight) was replaced by a food type with lower phosphorus content (0.7 percent phosphorus by weight). This substitution was further augmented by changes in feeding practices. The combination of these changes has resulted in a substantially reduced phosphorus load since 1994. Pre-1994 total phosphorus loads were evaluated at 726 kg/yr (average). Post-1994 loads have been evaluated at 218 kg/yr (average). Current contributions represent an overall 70% reduction in the pre-1994 hatchery-related load. The reduced load accounts for less than 1 percent of the total phosphorus load to the Cascade Reservoir. The Phase II TMDL document provided the Fish Hatchery with a wasteload allocation of 218 kg/yr, and did not seek any further reductions.

Routine monitoring of hatchery effluent is ongoing as a requirement of the permit process. The data generated will be used to identify trends in the overall phosphorus loading and to further refine operations and management to greater efficiency in phosphorus reduction.

Implementation Priorities for Nonpoint Source Loads

As stated in the preceding section, the implementation priority of *point source* reduction measures has previously been identified as high, and phosphorus reduction projects identified for each of the two existing point sources are already under construction (McCall WWTP / J-Ditch) or completed (IDFG Hatchery) at this time. Therefore, these sources were not included in the overall nonpoint source prioritization effort for the watershed outlined below.

Implementation of reduction measures for *nonpoint source* inputs within the watershed has been prioritized on a subwatershed basis in an effort to increase the efficiency of implementation efforts in both a cost and a water-quality benefit fashion. It is expected that this ranking will be re-assessed periodically as new data becomes available, and as implementation proceeds. In this manner, priority status can be consistently assigned to those areas representing the greatest concern and the greatest cost-efficiency for total phosphorus reduction.

Current subwatershed priority rank designations have been assigned through the evaluation of several criteria including: total phosphorus yield coefficients (as outlined in Table 2), proximity and delivery efficiency on a source-specific basis, and data available within a subwatershed 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 of the subwatershed were also considered, as was the amount of phosphorus reduction implementation already accomplished within each subwatershed. These factors represent the primary mechanism for priority rank assignment of subwatersheds.

The North Fork Payette River (NFPR) subwatershed was not ranked initially due to the lack of information identifying specific phosphorus sources within this subwatershed. Instream monitoring data has quantified the total phosphorus loading to the reservoir from this subwatershed, however, the nonpoint source-specific assessment of delivered loading does not account for the total monitored phosphorus load. Specific details on the mechanism for assessment of NFPR loading are included in the *Agricultural Source Implementation Plan* section of this document. To fill this data gap, additional monitoring is being conducted to allow better quantification of sources and assignment of the monitored load. Aerial assessment has also been undertaken to identify specific areas within the subwatershed and river channel that need more in-depth evaluation. All data and information collected will be used to determine loading sources, priority ranking and necessary phosphorus reduction locations/sources within the subwatershed by or before 2003 when the Phase II TMDL results and accomplishments are reviewed. At this time, all subwatershed priority rankings will be re-evaluated for applicability and appropriateness in reaching the reduction goals. NFPR will be included in the subwatershed priority ranking following this assessment.

Starting with the total phosphorus yield coefficient data for management-based loading (as shown in Table 2), an initial priority ranking was performed. Using this ranking, further consideration was then given to the primary form of phosphorus in the delivered load and the transport or delivery efficiency. Higher priority was given to subwatersheds that showed a greater proportion of bioavailable phosphorus load and to those that had high transport efficiencies. Because the input of bioavailable phosphorus to the reservoir results in rapid and excessive algae growth, it was reasoned that targeting subwatersheds where a substantial proportion of the phosphorus being delivered was bioavailable would result in a more marked improvement in water quality over a shorter time span than simply targeting phosphorus loads on a total mass basis alone. The potential for rapid, highly efficient delivery of these loads represented an additional priority.

As stated above, the relative proportion of management load to the total load delivered by a subwatershed was evaluated as a priority ranking mechanism for nonpoint sources. This information was also utilized as a cost-efficiency assessment mechanism to ensure that the projects funded and implemented were the most cost-effective for the reductions achieved. For some subwatersheds, reductions may be much more expensive due to the higher proportion of natural loading from these areas.

Since it is recognized that new development often results in a land-use change and represents the potential to introduce additional loading from construction impacts, subwatersheds exhibiting substantial new growth were given some 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 will 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 addressing existing development sources.

Based on total phosphorus yield coefficients alone, the West Mountain subwatershed received a priority ranking of number four. This ranking was increased to number two due to consideration of the fact that failing septic systems within this subwatershed represent a significant threat to water quality because of their substantial bioavailable phosphorus load (>85% of the total phosphorus load) and their near-shoreline locations. A majority of these aged systems are located in direct proximity to the southwestern shoreline of Cascade Reservoir. This area of the reservoir is very susceptible to water quality impacts from bioavailable phosphorus loading due to shallow depth and slow to stagnant water movement in the late summer season. Algae growth in this section of the reservoir is often moved to other areas along the eastern shoreline through wind and wave action, thus creating further degradation of water quality over a larger area.

Based on total phosphorus yield coefficients alone, the Mud Creek subwatershed received a priority ranking of number three. However, the priority status was reduced to number five due to the fact that the yield coefficients used were calculated from data collected during the 1993 to 1996 water years. Since these data were collected, a significant amount of the sub-flood irrigation (known to be a significant phosphorus transport source) in this subwatershed has been replaced with sprinkler irrigation through implementation of the J-Ditch project (outlined on p. 9). Impacts of this project on the total phosphorus yield coefficient for this subwatershed are not yet known, but are expected to result in significant phosphorus reductions due to decreased subsurface recharge, decreased incidence of anoxic soils and decreased erosion and sediment transport potential. In similar system conversion projects in other areas, two to four years have been necessary for the hydrology of the system to stabilize sufficiently to collect accurate trend data for evaluation. Data will continue to be collected from this subwatershed. When a stable trend is identified, the priority ranking will be re-assessed based on the new information.

Given the above considerations, the subwatersheds were ranked in order of priority (highest to lowest) as follows:

1. Boulder/Willow
2. West Mountain
3. Lake Fork
4. Gold Fork
5. Mud Creek
6. Cascade

North Fork Payette River - Not currently ranked

It should be noted that as more information is collected and program efficiencies are identified in a more accurate fashion, the preliminary ranking of subwatersheds above may be re-evaluated prior to the established assessment scheduled for 2003 as part of the TMDL process.

Project-specific priority ranking within a designated subwatershed has been identified according to the existing procedures identified for forestry, agricultural and urban/suburban sources as outlined in general fashion in the following sections. More detailed discussions of project-specific priority rankings are available in the later sections of this document and the source-specific implementation plans.

The Forestry Source Implementation Plan assigned highest priority status to road-based sediment/phosphorus reduction projects and improved grazing management. The

Forestry Source Implementation Plan determines priority road segments based on the mass of delivered load and most immediate delivery pathways. Thus logging roads contributing substantial erosion-based sediment loads that show rapid delivery pathways to a water body have been designated highest priority for implementation of best management practices (BMPs). Grazing management plans (overseen by Idaho Department of Lands (IDL), Boise Cascade Corporation (BCC) and the US Forest Service (USFS)) will also be upgraded in a high priority fashion to improve grazing management practices as current grazing agreements expire and new permits are established. In correlation with the subwatershed rankings above, logging roads identified as contributing substantial erosion-based sediment loads with rapid delivery pathways to a water body within the Boulder/Willow subwatershed will be given the highest priority consideration, followed by similar roadways in the West Mountain and Lake Fork subwatersheds respectively. Specific roadway and grazing management BMPs to be implemented are identified and discussed in greater detail in the *Forestry Source Implementation Plan* section of this document and the Forestry Source Implementation Plan (Appendix A).

The Agriculture Source Implementation Plan determines the priority of project implementation based on distance from a water body and condition of assessed riparian areas. The designated tier system (riparian, irrigated lands, and non-irrigated uplands) assigns highest priority to implementation in degraded riparian areas and improved functioning capacity. It is recognized that improvements in riparian areas will also serve to reduce inputs from upland management. In correlation with the subwatershed rankings above, Tier 1 lands within the Boulder/Willow subwatershed will be given the highest priority consideration, followed by Tier 1 lands in the West Mountain and Lake Fork subwatersheds respectively. Specific BMPs to be implemented are identified and discussed in greater detail in the *Agricultural Source Implementation Plan* section of this document and the Agricultural Source Implementation Plan (Appendix B).

The Urban/Suburban Source Implementation Plan has assigned highest priority status to roadway upgrades and stormwater improvements. The Urban/Suburban Source Implementation Plan prioritizes road upgrades based on proximity to water systems where delivery to the reservoir is most efficient. Prioritization for stormwater and septic inputs initially targets those systems in the most degraded condition, with secondary priority given to upgrading those systems currently functioning at a higher level. In correlation with the subwatershed rankings above, stormwater improvements within the Boulder/Willow subwatershed (City of Donnelly and rural subdivisions) will be given the highest priority consideration, followed by stormwater improvements in the West Mountain (rural subdivisions) and Lake Fork (community of Lake Fork and rural subdivisions) subwatersheds respectively. Specific BMPs to be implemented are identified and discussed in greater detail in the *Urban/Suburban Source Implementation Plan* section of this document and in the Urban/Suburban Source Implementation Plan (Appendix C).

The prioritization of septic-based load reductions within the watershed is well established. Septic to sewer conversions within Boulder/Willow subwatershed have been given the highest priority consideration and an approved facility is now in place. Homeowners not currently hooked up to the sewer system are being actively encouraged to do so. Efforts for septic to sewer conversion within the West Mountain subwatershed are now of highest priority. When an approved sewer system is established for residents of this subwatershed, priority will be given to those systems within the Lake Fork subwatershed that represent a direct transport potential. These projects are discussed in greater detail in the *Urban/Suburban Source Implementation Plan* section of this document and the Urban/Suburban Source Implementation Plan (Appendix C).

With the subwatershed priority ranking discussed above, identification of projects and funding has been initiated in an aggressive fashion for Boulder/Willow, West Mountain and Lake Fork subwatersheds. Starting in March of 1999, federal 319 Grant monies have been pursued and approved for both the Boulder/Willow and West Mountain subwatersheds. An Environmental Quality Incentive Program (EQIP) priority area has been established for the Lake Fork subwatershed. Further funding and project identification is currently in process.

It is recognized that funding for the total implementation of a watershed scale project is not a strong probability at this time. Funding identification will therefore proceed on a priority basis at the most expansive level possible. Data generated by modeling efforts specific to Cascade Reservoir have indicated that attainment of water quality standards within the reservoir will require full achievement of the 37 percent reduction target. Delays in funding to attain this total reduction will result in delays in the attainment of full beneficial use support within the reservoir. Such delays will be minimized to the extent possible by an aggressive approach to funding identification and procurement as outlined below.

To date, 319 Grant funds have been the primary source of support for the implementation effort. While this program will continue to be utilized to the extent possible, it is recognized that it cannot act as the sole sponsor for implementation efforts. Therefore, to the degree possible, a comprehensive list of applicable Federal, State, Local and Private funding sources has been compiled that includes funding status, applicable projects, and funding/distribution schedules. This listing functions as the basis for grant and cost-share funding for the implementation effort. In addition, special legislative disbursements are being discussed with the appropriate political entities, and an ongoing discussion has been initiated with appropriate agency representatives to allow future programs to be designed with implementation funding in mind. Joint efforts are currently underway to pool several smaller monetary sources to create a total budget sufficient to fund proposed site-specific implementation measures.

Examples of such cooperative efforts are: an urban/suburban stormwater proposal to use a refurbished irrigation ditch to funnel and collect stormwater so it can be effectively treated prior to discharge into surface water, and the joint application for federal transportation and 319 Grant dollars to improve roadways on forest, agricultural and subdivision lands to reduce erosion and improve drainage capabilities. Both of these projects are in the initial phases of development and are expected to act as models for future efforts. This funding identification program is dynamic in nature and will change and expand as additional sources become available.

Funding sources for the top three subwatersheds Boulder/Willow, West Mountain and Lake Fork will continue to be actively sought and requested through all available channels. Program and funding identification for the remaining subwatersheds will proceed following the acquisition of funding for the priority subwatersheds as outlined above. Re-assessment of the current priority ranking, followed by program and funding identification for the North Fork Payette River subwatershed, will proceed as soon as adequate data is available to determine appropriate targets for management practices. Monitoring will continue in the Mud Creek subwatershed to determine trend stabilization from the implementation of the J-Ditch project.

It should be noted that while the preceding subwatershed list represents a general priority schedule for the watershed, certain projects within subwatersheds designated as lower priority *will* be implemented if funding becomes available and a positive impact is recognized for the proposed projects. Priority will be given to projects identified within high priority subwatersheds, but no project that demonstrates a positive impact and has identified funding will be denied for the *sole* reason that it targets areas in a lower priority subwatershed.

Nonpoint Source Implementation Plans

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

Forestry Source Implementation Plan

Forestry land use totals 184,092 acres within the Cascade Reservoir watershed, representing roughly 70 percent of the total land area. Evaluations and analyses conducted previously as part of the Cascade Reservoir Phase II TMDL development indicate that road erosion and grazing management are the primary sources of phosphorus delivered to Cascade Reservoir from forest management lands. Instream monitoring data from 1993-1996 indicate that approximately 15 percent of the total phosphorus (5,829 kg/yr) delivered to Cascade watershed streams was derived from forest lands. Of this, 1.15% is estimated to be bioavailable. A majority of the management-related phosphorus load is bound to sediment delivered from forest roads. The Gold Fork River subwatershed, where the majority of the forest lands lie, delivers an estimated 77 percent of this sediment.

The Forestry Source Group considers that 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 forestry stakeholders will: apply a BMP, monitor, evaluate, adapt and determine if the practices are effectively reducing sediment delivery to streams.

A 40 to 45 percent overall reduction in man-induced forestry load (2,652 kg total phosphorus per year) is needed to achieve the 30 percent reduction in total phosphorus load across the Cascade Reservoir watershed. This 40 to 45 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 natural load in each subwatershed. In addition, the natural range of variability across watersheds and over time is high in the Cascade Reservoir watershed. Because of the steep slopes associated with forested lands in the majority of the watershed, natural sediment and phosphorus loading account for a significant fraction of the total phosphorus load delivered from forested land. This is especially evident in the Gold Fork subwatershed where phosphorus loading from natural processes represents 54 percent of the total phosphorus load, the greatest relative percentage of any subwatershed within the scope of this plan. This load it attributed to naturally high sediment load from granitic soils and landslides. The *Forestry Implementation Plan: Cascade Reservoir Watershed*

Phase II Management Plan, provides a more detailed description of the proposed approach for achieving phosphorus reductions from forestry nonpoint sources.

Approach to Determining Implementation Measures

Total phosphorus yield coefficients expressed as kg/acre/yr (Table 2) were used to calculate nonpoint source loads in each subwatershed. These yield coefficients were estimated from monitoring data, as described in the Phase II TMDL and supporting source plans, and were used as a basis for establishing a subwatershed-based priority ranking for implementation (as described in the preceding sections). These coefficients, on a management or practice-specific basis, have been used to establish a priority ranking within the nonpoint source-based loading for each subwatershed. Through this prioritization process, the total phosphorus load from forest roads and forest grazing allotments have been identified as the highest priorities for implementation of reduction measures within the Forestry Source Implementation Plan.

Phosphorus reductions for forestry management practices have been calculated using the formulas and BMP efficiencies described in the Phase II TMDL and associated reference documents. The majority of forest BMPs address sediment production and are intended to either keep sediment from being produced, or divert sediment onto the forest floor and away from streams. The effectiveness of the approved BMPs in relation to phosphorus as a nonpoint source has not been well established through monitoring. The effects of forest management on sediment delivery and the effectiveness of BMPs to reduce sediment from forestry operations, however, have been well studied. (Please see the *Forestry Source Implementation Plan: Cascade Reservoir Watershed Phase II Management Plan* for further discussion.)

The natural variability of forest and range lands, and the limited time and funds available to measure actual concentrations of phosphorus for each watershed, lead to the alternative of using a properly verified and calibrated model for estimating pollutant reductions. SEDMODEL was selected as the modeling tool to estimate sediment load from roads as a surrogate for phosphorus load. The components of SEDMODL have been individually validated through research efforts to determine erosion rates or the effectiveness of BMPs. However, the precision and reliability of the combination of these components has not been tested. The SEDMODEL results have been used, along with other data and information, to help make decisions by comparing relative percent phosphorus reduction from treatments. The Forestry Source Group will continue to use the model results to make treatment decisions, taking the precision and accuracy of estimated values into consideration.

Regulations Governing the Application of Forestry BMPs

BMPs for forest management activities are mandated for all private, state, and federal forest practices in Idaho. The following sections summarize the mandated practices affecting sediment and phosphorus inputs into water bodies.

All Land Ownerships

Forest management activities on all forested lands within the State of Idaho are required to follow the Rules and Regulations pertaining to the Idaho Forest Practices Act (IFPA), Title 38, Chapter 13, Idaho Code (IDAPA 20.15). Within these rules, practices shall also be in compliance with the Stream Protection Act, Idaho Water Quality Standards and Waste Water Treatment Requirements, the Idaho Pesticide Law, and the Hazardous Waste Management Act of 1983. Forest Practices Rules apply to private and state forested lands. Federal lands follow Forest Practices Act as described in forest plans.

Federal Lands

The Inland Native Fish Strategy (INFISH 1995) is intended to provide interim direction on ***Federal lands*** to protect habitat and populations of resident native fish outside of anadromous fish habitats in Idaho and other Pacific Northwest states. This direction is in the form of riparian management objectives, standards and guidelines, and monitoring requirements.

Road Sediment Runoff

The construction and use of roadways represent the major source of sediment from timber harvest activities, with erosion and landslides caused by management activities representing more minor sources. The current estimate of total phosphorus loads to Cascade Reservoir from roads on forested lands is 2,366 kg/yr. This estimate comes from a combination of in-depth, site-specific watershed analysis conducted in the Gold Fork subwatershed in 1996, as well as the application of a road sediment delivery model, SEDMODL Version 1.0, developed by Boise Cascade to determine the magnitude of road sediment runoff in all other subwatersheds. The model uses the same calculations that were used in the Gold Fork subwatershed analysis. Information on precipitation rates, underlying geology and basic erosion rates is also used. Sediment runoff is converted to phosphorus quantities based on the soil monitoring study values conducted in support of this effort. (See the *Cascade Reservoir Watershed Management Plan Phase II TMDL* and the *Forestry Source Plan for Cascade Reservoir Watershed Management Plan Phase II TMDL*, Supporting Information, for information on the soil monitoring study.)

In recent years, the SEDMODL model has been updated. This document and Table 3 reflect the most current and accurate estimates of phosphorus loading for forest roads. It should be kept in mind that there are other important sources of phosphorus in forested areas. Landslides, sheet erosion off previously harvested forest areas and the off-road recreational uses of forested lands also contribute to phosphorus loading in Cascade Reservoir. These sources are not addressed in Table 3, below, but are considered in the overall analysis.

Table 3. Estimated Total Phosphorus Loading from Forest Roads

Subwatershed	Sediment, tons/year	Total Phosphorus, kg/year	Bioavailable Phosphorus, kg/year
West Mountain	1,693	266	3.1
NF Payette	571	90	1.0
Cascade	138	22	0.3
Lake Fork	69	11	.13
Boulder-Willow	1,010	159	1.8
Gold Fork	11,563	1,818	21.0
Total	15,044	2,366	26.5

Proposed Implementation Measures: Road Improvements

The Forestry Implementation Plan Source Group used the data from Gold Fork drainage and the sediment model to identify priority roads for treatment to stabilize and reduce sediment erosion. Roads with high estimated sediment inputs (>50 tons/year) have highest priority for management. Treatments target at least an 80 percent reduction in sediment coming from each treated segment. Where 80 percent cannot be achieved, the actual reduction attained is estimated. Roads will NOT be treated on an "entire road length basis". Roadways will be evaluated for sediment delivery and erosion potential as separate road segments. These segments will then be prioritized for improvement implementation. Priority segments will be treated, as funding becomes available, until the phosphorus reduction goals are met.

Activities to be conducted with the purpose of reducing phosphorus loads to Cascade Reservoir include extensive road upgrades (including graveling and paving, adding culverts), slash management practices, closing and/or relocating roads, and making other improvements.

These practices will be applied to roads within the Cascade Reservoir watershed until load reduction goals have been met at which point the forestry landowners will continue to treat and maintain roads using the standard procedures for identifying and funding projects. Road maintenance is scheduled on an annual basis and includes blading, shaping, spot graveling, and installation and cleaning of drainage structures (waterbars, culverts, driveable dips, etc).

Table 4 describes some of the highest priority road improvement projects for the Cascade Reservoir watershed. Other areas for future road improvement projects include: South Fork Gold Fork; Mud Creek; Big Sage and Van Wyck Campground; French Creek (in Gold Fork); Louie Creek; Willow Creek; Powelson Creek; Jug Creek; Poor Man Creek; Kennally Creek; and Hartzell Creek.

Table 4. Summary of Some High Priority Forest Road Projects

Subwatershed	Location	Miles of Roads to Be Treated	Recommended Treatment	Estimated P Reduction (kg/yr)
Gold Fork	T17NR4ES16	2.8	Outslope and drainage upgrade	0.2
Boulder/Willow	T17NR4ES9	4.3	Outslope, drainage fixes, short gravel segment	5.3
Boulder/Willow	T18NR4ES29	4.9	Gravel and drainage	12.7
Boulder/Willow	T18NR4ES31	0.9	Drainage upgrade	2.7
Boulder/Willow	T17NR3ES36	0.2	Gravel	0.6
Gold Fork	T16NR4ES30	8.4	Gravel	151.8
Gold Fork	T16NR5ES28	13.9	Gravel (drainage)	71.3
Gold Fork	T15NR4ES16	2.2	Move road, decommission road, gravel	44.2
West Mountain	T16NR3ES29	2.1	Gravel, drainage	10.3
NF Payette	T18NR2ES29	1.1	Gravel	13.0
NF Payette	T18NR2ES34	0.7	Gravel	4.3
NF Payette/West MT	T17NR2ES23	1.4	Gravel	3.9
Gold Fork	T16NR5ES31	1.9	Gravel	29.2
West Mountain	T14NR3ES19	5.5	Gravel	149.7
Gold Fork	T15NR5ES6	0.0	Stream bank stabilization	230.4
Gold Fork	T15NR4ES29	0.4	Gravel	4.6
Total Estimated Reductions				734.0

Given the proposed projects outlined in Table 4 above, and the road segments identified for improvement, the total phosphorus reduction projected from road-based projects is 1,454 kg/yr.

Forest Service. The Boise and Payette National Forest will treat roads primarily on a project-by-project basis. For each project, the model will be validated and appropriate treatment measures implemented. These activities will be initiated as funds from an annual budget allocation are made available.

Idaho Department of Lands. IDL has recently completed a road inventory on their lands within the Cascade Reservoir drainage to help identify problems needing attention and to create an accurate inventory of roads. IDL will continue to conduct routine road inspections and provide road maintenance and improvements to reduce erosion and sediment delivery to streams. Periodic maintenance and improvements will be accomplished as the need is identified or in conjunction with scheduled timber sales.

Boise Cascade Corporation. Boise Cascade annually budgets funds for road maintenance and improvements. Improvements in Cascade Reservoir drainage area will be given high priority until the reduction goals are met. Maintenance and improvement of other Boise Cascade roads will, however, be necessary and can affect the improvement schedule in the Cascade Reservoir watershed.

Grazing on Forest Lands

The Phase II TMDL estimates that grazing occurs on a total of 42,984 acres of forested lands in the Cascade Reservoir watershed. Impacts from grazing practices on forested lands include increased sediment and nutrient loading due to waste deposition and erosion of stream bank areas destabilized by animal impacts and waste deposition. Phosphorus inputs from grazing were estimated using the methods described in the Agricultural Source Plan (Phase II TMDL) and the Agricultural Implementation Plan. Of the forested lands grazed, 6 percent (2,601 acres) are in Tier 1 (the area along streams with a 150 foot buffer on both sides) and 94 percent (40,383 acres) are in Tier 3 (which includes grazed pastureland or upland that is not irrigated). The total phosphorus load estimated for forest lands from grazing is 2,565 kg/yr.

A phosphorus loading reduction of 1,189 kg/yr is sought to achieve the needed reduction for grazed forest lands. To meet phosphorus reduction goal, the priority will be to manage grazing on forested lands to have a Tier 1 effectiveness of 90 percent and a Tier 3 effectiveness of 40 percent.

Proposed Implementation Measures: Grazing Management

Most of the state and private forest lands and a small portion of the federal forest lands are grazed by cattle. Sheep are also grazed on the West Mountain, North Fork, Lake Fork Creek, Boulder Creek, Cascade and Gold Fork River subwatersheds. Grazing on forested lands is generally managed through leases, through which the landowner allows access to the lands by livestock operators and their animals. It has become common practice to develop grazing management plans with the lessees to minimize the environmental damage caused by grazing. There are several approaches that can be used to minimize the effects of grazing on the inputs of sediment and phosphorus into streams. Primary among these are:

- Off-site water development that draws livestock from perennial streams, thereby reducing impact on riparian areas
- Moving salt blocks away from water and heavily used meadows to improve distribution and forage utilization
- Fencing of riparian areas
- Pasture rotation
- Changes in the number of animals on an allotment
- Changes in the gender (steers vs. cow/calves), species, or age class on the allotment
- Forest management for percent of forage harvested or stubble height and forage species.

Forest Service. Grazing allotments in each forest are managed under an annual operating plan and a grazing permit. Several of the grazing allotments have been recently revised (PNF-sheep, BNF-Cascade Res.). The remainder of the allotments may be revised following the Forest Plan direction and activity schedules.

Idaho Department of Lands. Grazing practices in riparian areas are stipulated by management plans formed in conjunction with lessees. Streams are assessed for proper functioning condition and plans revised as needed. Since cattle can move freely across property lines, grazing leases and grazing management plans are coordinated with Boise Cascade Corporation.

Boise Cascade Corporation. Grazing leases require compliance with grazing management plans. Over the years, Boise Cascade has been working to identify ways to improve grazing management and incorporates those improvements into the management plans. Planned actions to reduce phosphorus entering Cascade Reservoir and its tributaries include the development of off-site watering areas, revisions of salting practices, development and implementation of a pasture rotation system, stubble height requirements, and other practices that will move cattle out of bottom lands and ensure adequate vegetation is present to capture sediment and phosphorus.

Measuring the Effectiveness of Different Management Measures

Two processes are currently in place to evaluate forestry BMP implementation and effectiveness. These are: (1) annual audits of the Forest Practices Act by Idaho Department of Lands to determine if BMPs are being implemented on federal, state, and private lands; and (2) BMP effectiveness evaluations completed by DEQ every 4 years.

The Forest Service also has performed monitoring of timber sale activities, including road construction. These include project level monitoring for BMP implementation and effectiveness of the IFPA. Monitoring has also been conducted on grazing allotments.

Forest Implementation Plan Monitoring

Forest landowners will monitor implementation and effectiveness of activities conducted to reduce sediment/phosphorus loading. Potential indicators may be quantitative (e.g., laboratory analysis of phosphorus concentrations in water exiting a created wetland) or qualitative (e.g. visual determination that there is less sediment in the water passing through a fenced riparian area) depending on the BMP implemented and the overall scope of the project. Road and slope stabilization construction activities will be inspected for completeness and adequacy of work. Construction dates and inspections will be documented in a written form at the completion of each task. Selected construction sites will be photographically monitored. Photographic documentation will also be done for a representative range of treatments. Photographs will be taken prior to and after road and slope construction activities from established photo locations. Implementation of the grazing plans will also be photographically documented.

The effectiveness of various road improvements in reducing sediment runoff to streams will be regularly monitored using sediment traps. Sites will be checked during the course of the year to ensure that the traps are not full. Traps will be pulled and the quantity of sediment measured either at the end of one year or when the trap fills. Traps that fill before the end of the year will be reset after they are emptied. Sediment traps will also be reset following the completion of road projects and will then be allowed to collect sediment for an additional year. The effectiveness of slope stabilization projects will be assessed through photographic monitoring. Photographs will be taken at least annually and after major storm events, conditions permitting. Monitoring of riparian vegetation and stream conditions will also be conducted to document changes in streamside habitat resulting from changes in grazing management. Established streambank/riparian vegetation acts as an effective buffer to the transport of animal wastes into the stream channel, and drastically reduces sediment delivery from bank erosion. Thus the condition of the streambank/riparian vegetation can be used as a qualitative indicator of grazing impacts on a surface water body.

In addition, the comprehensive, watershed-wide inflow and inlake monitoring used by DEQ to establish current loadings will continue as a mechanism to document improvements, identify initial loading trends, assess load reductions achieved and determine when the overall 37% reduction goal is attained. This monitoring is conducted on a monthly basis and can be used in a quantitative sense to determine the collective effectiveness of BMPs installed or implemented on tributary systems.

Agricultural Source Implementation Plan

Agricultural land encompasses 66,344 acres of the Cascade Reservoir watershed, accounting for 24 percent of the total land area. The Phase II TMDL indicates that agriculture contributes a total of 13,594 kg/yr of phosphorus. The estimated management load from agriculture was decreased by 5,118 kg/yr in the Agriculture Source Plan because the stakeholders agreed that the estimated agricultural load in the Phase II TMDL for the NFPR was probably overstated. Sources of load in the NFPR are not well quantified and the load assigned to agriculture in this subwatershed was four to ten times higher, in terms of the phosphorus yield coefficient (kg/ac/yr), than agricultural loading in other similar subwatersheds (see Table 2). The TAC decided to address this data gap in three steps:

1. Recalculate the agricultural load for the NFPR for the implementation plan using yield coefficients (kg/ac/yr) calculated by the Agriculture Source Group consistent with agriculture loads from similar, adjacent subwatersheds;
2. Conduct monitoring to better quantify sources contributing phosphorus load to the NFPR; and
3. Reassess source contributions and necessary phosphorus reductions by or before 2003 when the Phase II TMDL results and accomplishments are reviewed.

As a result of the recalculation, the estimated agriculture management load for the NFPR subwatershed is 1,876 kg/yr. The Agriculture Source Plan identifies 9,093 kg/yr of total phosphorus load (management and natural) from agricultural lands. A reduction of 3,485 kg/yr, or about 38% of agriculture management load, is needed to achieve the 30 percent reduction goal.

It should be clearly understood that the 5,118 kg/yr removed from the agriculture-based loading assessment above remains part of the monitored inflowing load to the reservoir, and an appropriate reduction from this amount will be required in order to meet the overall 37% reduction goal. With the collection of additional information and data as outlined previously, a reduction allocation will be assigned to this amount following the determination of the source(s) and the identification of appropriate reduction measures.

Approach to Determining Implementation Measures

Total phosphorus yield coefficients expressed as kg/acre/yr (Table 2) were used to calculate nonpoint source loads in each subwatershed. These yield coefficients were estimated from monitoring data, as described in the Phase II TMDL and supporting source plans, and were used as a basis for establishing a subwatershed-based priority ranking for implementation (as described in the preceding sections). These coefficients, on a management or practice specific basis, have been used to establish a priority ranking within the nonpoint source-based loading for each subwatershed. Through this prioritization process, the total phosphorus loading from Tier 1 acreages (land within 150 feet of either side of a stream) has been identified as the highest priority for implementation of reduction measures within the Agricultural Source Implementation Plan.

The Agriculture Source Implementation Group identified the measures needed to meet the goal of a 30 percent reduction of total phosphorus load. The overall approach is to seek voluntary implementation of best management practices (BMPs) on agricultural lands. The *Cascade Reservoir Agricultural Source Implementation Plan,* provides a more detailed description of the proposed approach for achieving phosphorus reductions from agricultural non-point sources.

The approach for determining the measures needed to meet the agriculture load reduction goal is based on a three-tier classification of lands. Tiers were defined and lands classified considering agronomic, geomorphologic and hydrologic characteristics of agricultural land in the watershed. The land-use tiers are:

Tier 1 - All lands within 150 feet of either side of a stream - 7,598 acres.
Tier 2 - Lowlands, mostly irrigated crops and pasture - 37,256 acres.
Tier 3 - Uplands, mostly non-irrigated pasture - 21,490 acres.

An initial goal of treating 100 percent of Tier 1 lands was used to determine reduction measures. Tier 1 lands are particularly important for reducing phosphorus loads to the reservoir. Tier 1 lands are both potentially significant sources of phosphorus and important buffers for the stream. Virtually all the potential phosphorus load from these lands is delivered to streams because of their immediate proximity. Healthy riparian areas on Tier 1 lands are able to capture and assimilate orthophosphate into plant biomass, slow overland flow of runoff and contain sediment. Tier 2 lands are also considered to be significant contributors of phosphorus. Tier 3 lands are the furthest from riparian areas and are not considered to be significant contributors of phosphorus in most cases. The goal for Tier 3 lands is to limit the movement of sediment from these to lowlands and riparian areas.

Appropriate and effective component BMPs were identified for each land-use tier. These practices may be applied individually or as a total system with multiple component practices, depending on the specific characteristics of a land unit. Best management practices were selected considering land use, typical farming practices and effectiveness at reducing phosphorus. The seasonal nature of phosphorus loading was also considered in selecting BMPs. Seventy to eighty percent of nutrient loading to subwatershed streams occurs during snow melt and storm event run-off, and BMPs are selected to reduce this spring load as much as possible.

Total acres for each tier needing treatment were calculated by subwatershed using: (1) yield coefficients from the Phase II TMDL to calculate pre-treatment load; and (2) average reduction efficiencies for BMPs selected for each tier. The calculation was based on the general goals of 100 percent treatment of Tier 1 lands and 75 percent treatment of Tier 2 lands. BMPs and assumed efficiencies for each tier are specified in the Agricultural Source Implementation Plan.

Proposed Implementation Measures

Voluntary application of BMPs on 6,342 acres of Tier 1 lands, 26,636 acres of Tier 2 lands and 4,218 acres of Tier 3 lands in the watershed can meet the reduction goal for agricultural management load. The number of acres to be treated by subwatershed is shown in Table 5.

On a watershed-wide average, treatment of 83 percent of Tier 1 lands and 71 percent of Tier 2 lands will achieve the 30 percent reduction goal. When considered on a subwatershed-specific basis, the treatment of 83 percent of Tier 1 and 71 percent of Tier 2 lands will result in the attainment of the 30 percent nonpoint source reduction goal except in the Gold Fork and West Mountain subwatersheds where the proportion of Tier 1 and Tier 2 land is very low. Treatment of Tier 3 lands however, demonstrates a very low cost-efficiency associated with phosphorus reductions from BMPs implemented on these lands. Therefore, if the opportunity exists to achieve higher than the target reductions on Tier 1 and 2 lands in other subwatersheds, this will be pursued over reductions on Tier 3 lands in West Mountain and Gold Fork. The initial effort of this plan is to treat all Tier 1 acres first, followed by those Tier 2 acres necessary to achieve the required reductions. Specific tiered acreages requiring treatment are summarized in Table 5.

Due to the voluntary nature of agricultural BMP implementation, practices will be installed as landowners agree to participate. However, high priorities for BMP implementation can be generally identified as follows:

- Tier 1 lands - 100 percent of land treated
- Tier 2 lands – 75 percent of lands treated
- Lands in subwatersheds with higher yield coefficients (Boulder/Willow, Lake Fork, North Fork)
- Lands prone to sediment and phosphorus runoff during spring
- Practices that hold sediment and phosphorus on site (source control)

The actual design and installation of BMPs is a site-specific process. A conservationist from Valley Soil and Water Conservation District, the Soil Conservation Commission or the Natural Resources Conservation Service evaluates current practices, land characteristics and the potential for sediment and phosphorus runoff from a particular land unit and recommends specific practices for a farm in the form a conservation or nutrient management plan. Typically, a land owner enters into an agreement that specifies design, installation and maintenance requirements, indicates the number of years the land owner agrees to maintain the BMPs, and provides cost share funds to support implementation.

The following types of BMPs may be installed.

Tier 1 BMPs

- Fencing
- Prescribed grazing systems
- Heavy use area protection
- Offsite watering
- Stream channel stabilization
- Filter strips

Tier 2 BMPs

- Irrigation water management
- Stock water development
- Irrigated systems
- Wetland development
- Ponds
- Prescribed grazing systems

Tier 3 BMPs

- Prescribed grazing systems
- Fencing
- Ponds
- Spring/stockwater development
- Critical area planting
- Range seeding

Table 5. Agricultural Load Allocation and Reductions Required by Tier to Meet Phase II TMDL Goals (Listed by Subwatershed)

Subwatershed	Tier1 Acres	Tier 1 Load (kg)	Tier 1 Load Reduction (kg)	Tier 1 Acres Requiring Treatment[1]	Tier 2 Acres	Tier 2 Load (kg)	Tier 2 Load Reduction (kg)	Tier 2 Acres Requiring Treatment[2]	Tier 3 Acres	Tier 3 Load (kg)	Tier 3 Load Reduction* (kg)	Tier 3 Acres Requiring Treatment[3]
Boulder/ Willow	1,079	376	170	638	8,304	1,910	732	5,306	2,213	67	0	0
Cascade	727	26	18	717	4,132	145	92	3,796	3,259	117	0	0
Gold Fork	890	98	71	874	3,143	314	199	3,133	3,437	399	40	861
Lake Fork	1,228	424	261	1,015	6,504	1,821	697	4,151	2,668	256	0	0
Mud Creek	1,062	126	51	549	9,290	576	221	5,930	491	8	0	0
NF Payette	1,374	272	194	1,320	5,762	1,268	567	4,209	4,256	446	0	0
West Mtn	1,238	113	82	1,229	121	6	3	111	5,166	325	84	3,357
Total	7,598	1,435	847	6,342	37,256	6,040	2,511	26,636	21,490	1,618	124	4,218

* Because of the declining cost-efficiency of treating Tier 3 acres, all acres required for reduction except in the case of West Mountain have been reallocated to the Tier 1 and 2 reduction requirements. This allows for the implementation of BMPs in tiers where the most beneficial use may be obtained with the money spent.

[1] Tier 1 acres requiring treatment based upon calculations made in the Phase II TMDL Agricultural Source Plan using an efficiency rating of 70 percent for BMPs implemented in tier I acres.
[2] Tier 2 acres requiring treatment based upon calculations made in the Phase II TMDL Agricultural Source Plan using an efficiency rating of 60 percent for BMPs implemented in tier II acres.
[3] Tier 3 acres requiring treatment based upon calculations made in the Phase II TMDL Agricultural Source Plan using an efficiency rating of 40 percent for BMPs implemented in tier III acre

Agriculture Implementation Plan Monitoring

The objectives of an agriculture-monitoring plan are to verify that BMPs are properly installed, are properly maintained and are operating as designed. Monitoring for agricultural phosphorus reductions will consist of spot checks, annual reviews and evaluation of advancement toward reduction goals. Monitoring may be qualitative or quantitative, depending on the project. Evaluation of advancement toward reduction goals will be accomplished using a project tracking system currently being developed and annual reports discussed later in this Implementation Plan.

For state-funded projects, spot checks of BMPs will be part of the annual review now required for projects implemented under the State Agriculture Water Quality Program (SAWQP). Landowners will be contacted and visited to review contracts and discuss the need for any changes to the BMPs. The BMPs will be evaluated using the performance criteria outlined on the form included in the Agriculture Implementation Plan. Federal cost-share programs provide for both evaluations of resources during planning and spot checks during annual reviews.

In addition, the comprehensive, watershed-wide inflow and inlake monitoring used by DEQ to establish current loadings will continue as a mechanism to document improvements, identify initial loading trends, assess load reductions achieved and determine when the overall 37% reduction goal is attained. This monitoring is conducted on a monthly basis and can be used in a quantitative sense to determine the collective effectiveness of BMPs installed or implemented on tributary systems.

Urban/Suburban Source Implementation Plan

Urban/Suburban land use totals 25,945 acres within the watershed, representing 9.4 percent of the total land area. The major urban/suburban centers in the Cascade Reservoir watershed are the incorporated cities and city impact areas of Cascade (population ~1,120), Donnelly (population ~200) and McCall (population ~2,600). A significant increase in total watershed population occurs during summer months when part-time residents and tourists frequent the area.

Phosphorus load reduction attributable to the transient population will be addressed to the extent possible through structural improvements, such as stormwater runoff and roadway improvements; and through behavioral improvements such as runoff/drainage and fertilizer management. Rural ranchettes with hobby livestock and other domestic livestock, including their respective drives/driveways are included in the agricultural sections of the implementation plan. The public and private roads/highways included in this section of the implementation plan are exclusive of those covered in the forestry sections of the implementation plan.

Approach to Urban/Suburban Implementation Measures

Total phosphorus yield coefficients expressed as kg/acre/yr (Table 2) were used to calculate nonpoint source loads in each subwatershed. These yield coefficients were estimated from monitoring data and associated modeling efforts, as described in the Phase II TMDL and supporting source plans, and were used as a basis for establishing a subwatershed-based priority ranking for implementation (as described in the preceding sections). These coefficients, on a management or practice specific basis have been used to establish a priority ranking within the nonpoint source-based loading for each subwatershed. Through this prioritization process, the total phosphorus loads from urban stormwater, roadways (private and public), and failing/out-of-compliance septic systems have been identified as the highest priorities for implementation of reduction measures within the Urban/Suburban Source Implementation Plan.

Within this document, septic-related phosphorus loading is discussed separately because of differences in phosphorus load delivery and treatment mechanisms related to this source.

As initial goals and objectives to meet the reductions outlined above and in the Phase II TMDL and the *Cascade Reservoir Watershed Urban/Suburban Source Plan: Phase II TMDL*, the Urban/Suburban Source Group has established the following watershed-wide actions:

- Universal adoption of the *Handbook of Valley County Stormwater Best Management Practices* as an ordinance by local governments will be encouraged.

- Municipalities throughout Valley County will be encouraged to implement development design strategies that are source-control oriented (i.e., on-site detention programs, minimizing directly connected impervious areas, site finger-printing, local urban forestry, etc.). Through design, the natural and landscaped site drainage system can work effectively to soak, filter and temporarily pond runoff. These local programs protect water quality through advocating and enforcing when necessary, the assurance that rates of post-development runoff from a given site do not exceed the rate of pre-development runoff.

- Suspended solids cause many problems for water quality in addition to increasing concentrations of total phosphorus in the water column. Therefore, a county-wide erosion and sediment control ordinance that includes provisions for performance standards that allow for a combination removal of both total phosphorus and total suspended solids will be encouraged.

- Municipalities will be encouraged to set aside and/or donate sensitive lands that posses intact riparian vegetation, "classified" wetlands, steep slopes, and areas of highly erodible soil types. When intact riparian vegetation and wetlands are radically altered, they lose their function as natural collection, filtering and storage systems. However, if they are kept intact, the natural landscape provides for the above mentioned beneficial functions.

Under the comprehensive scope of the items outlined above, specific projects will be designed to meet the overall reduction goals.

Specific BMP selections, and site emplacement locations will be determined by the municipalities; county policy; local governments, associations or agencies; and funding appropriation requirements. It is understood that BMPs will be selected from the approved BMP lists contained in *The Handbook of Valley County Stormwater Best Management Practices (1997),* the *Catalog of Stormwater Best Management Practices for Idaho Cities and Counties,* and the *Stormwater BMP Selection Suitability Decision Tree (DEQ, 1999,* a copy of which is available in the Urban/Suburban Source Implementation Plan, Appendix C*).* Site specific BMP emplacement will be the responsibility of local government authorities and will be documented within a facilities plan or other appropriate document. For load reduction accounting purposes, copies of this documentation and all subsequent site evaluations will be submitted to the Cascade Reservoir TAC for subsequent input to the Cascade Reservoir Implementation Database established for all nonpoint sources within the Cascade Reservoir watershed.

Approach to Determining Stormwater-Related Implementation Measures

The Urban/Suburban Source Implementation Plan approach to phosphorus load reduction in stormwater addressed the stormwater drainage system as a whole. With this approach, all urban/suburban lands contributing runoff were under consideration for control measures. The magnitude of stormwater runoff from each area was calculated using land use acreage, annual precipitation averages and percent impervious surface for urban/suburban lands within the watershed. Land use data and acreage breakdowns were obtained for each municipality from Valley County Tax Assessor records. Precipitation data were available from two climatological stations within the watershed in the cities of Cascade and McCall. Estimates of impervious surface areas and runoff coefficients were extracted from both the "Big Payette Lake Technical Report" (DEQ, 1997) and the EPA stormwater guidance manual (EPA, 1992). The above information and the average pollutant concentrations for the designated land uses were used to calculate the total loading contribution from urban land within the watershed, as discussed in the *Cascade Reservoir Watershed Urban/Suburban Source Plan: Phase II TMDL (DEQ, 1998a).* The estimated stormwater-related phosphorus load originating from the three cities within the Cascade Reservoir watershed is 1,270 kg/yr. The estimated stormwater-related phosphorus load originating from rural subdivisions is 638 kg/yr.

Prioritization of stormwater implementation within the municipalities and rural subdivisions will focus on: (1) Source control measures to minimize or eliminate pollutant impacts to stormwater runoff. (2) Improvement of existing transport 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 discharge into surface waters; and (4) Emplacement of stormwater treatment trains in those locations for which diversion/sedimentation is not possible prior to discharge to surface waters.

An initial goal of treating municipal stormwater loading to achieve a 35 percent total phosphorus reduction (445 kg/yr) was established. A concurrent goal of treating rural residential stormwater loading to achieve a 25 percent (160 kg/yr) total phosphorus reduction was also established. The load reduction goal for rural residential subdivisions was more conservative than that for municipal stormwater because of the lack of centralized stormwater systems in rural subdivisions and the increased difficulty of treating individual runoff locations in these areas.

The cities of Cascade and Donnelly, and City of McCall drainage basins 9, 11, and 13 (*Stormwater Retrofit Options for Valley County*) were determined to represent the greatest potential contributors of total phosphorus and suspended solids based on the current land uses. The projects with the greatest cost-benefit ratio were determined to be those located in the Boulder/Willow Creek, Mud Creek, Cascade, and North Fork Payette River subwatersheds.

Proposed Stormwater-Related Implementation Measures

As noted above, the cities of Cascade and Donnelly, and City of McCall drainage basins 9, 11, and 13 represent the greatest potential contributors of total phosphorus and suspended solids based on the current land uses. The projects with the greatest cost-benefit ratio were determined to be those located in the Boulder/Willow Creek, Mud Creek, Cascade, and North Fork Payette River subwatersheds. A significant amount of progress in the improvement of stormwater runoff treatment has been accomplished recently in the City of McCall and those areas of the City of Cascade that drain into the Cascade Reservoir watershed. These reduction efficiency of efforts will be fully assessed and reported in an annual reporting sequence established for the implementation process (starting Fall 2000).

With the current level of progress in mind, and the subwatershed priority ranking discussed previously, the highest priority ranking for additional treatment of municipal stormwater within the watershed was assigned to the City of Donnelly, located predominantly in the Boulder/Willow subwatershed, as this location experiences significant stormwater flows during snowmelt and spring runoff. Donnelly has the potential to contribute significantly to water quality impacts to Cascade Reservoir due to its close proximity and existing rudimentary stormwater control/treatment system. Improvements and/or upgrades to both stormwater and wastewater collection and treatment systems, are necessary to prevent continuation of snowmelt/runoff transported loadings.

Two initial projects have been identified for management of stormwater flows in association with the City of Donnelly. The first project identified for improving stormwater management targets the ponding of spring runoff water in and around the City of Donnelly. The proposed projects focuses on the manipulation of existing flow channels (located immediately west of the City of Donnelly) through removal of seven small, abandoned irrigation dam structures to allow better flow characteristics in the area of Boulder Creek, followed by the augmentation of several existing sediment ponds lower in the drainage, and removal of identified debris that obstructs flow and creates the opportunity for significant bank erosion in some areas.

Preliminary engineering and site assessments have shown that the overall slope for the existing channel system is less than 0.5%. With this shallow slope, water from snow-melt ponds behind the upper, existing seven structures and creates standing pools (often 7 to 9 inches in depth) over large areas of the land within and immediately surrounding the City of Donnelly. This standing water leads to anaerobic conditions in the soil, followed by the subsequent release and transport of phosphorus to surface waters and, eventually, the reservoir. Improvements in the flow channel to encourage slow-flow movement of the runoff water, combined with augmentation of sediment ponds on the downstream segments, will reduce ponding/anaerobic potential on the upstream segments, and enhance sediment removal before entering the reservoir. Thus, while ponding will occur, it will be limited to smaller, deeper areas in the form of sediment ponds which result in the removal of both sediment particles and the associated bound phosphorus, not large shallow areas that lead to higher bioavailable phosphorus concentrations in the water discharging to the reservoir. Areas with substantial debris accumulation due to previous high velocity flows will be cleared to allow unrestricted, low velocity movement of water within the re-engineered drainage system and reduce the potential for culvert and bank destabilization from debris accumulation during high flow periods.

The second project involves the installation of stormwater treatment mechanisms in channels that discharge directly to Boulder Creek and are not possible to treat in the above manner. There are three primary drainage paths in the City of Donnelly that discharge directly to Boulder Creek. The stormwater treatment trains installed in these drainages will consist of a physical filtration mechanism to remove large debris, followed by a vortex-based separation mechanism designed to remove sediment, bacteria and non-dissolved organic material, followed in turn by an iron-rich sand filter to remove dissolved phosphorus and fine suspended materials.

Similar systems have been proposed for the treatment of stormwater from the designated drainage basins for the City of McCall. Outside funding support in the form of 319 Grant proposals for the City of Donnelly and the McCall drainage basins has been secured. Federal 319 Grant monies were used to complete stormwater upgrades in 1999 and work is ongoing for the 2000 construction season in both Donnelly and the McCall drainage basins. Additional funding for both Donnelly and McCall has been requested for the 2001 through 2003 construction seasons. If attained, work will be initiated in the spring/summer of 2000.

These projects represent an initial but ongoing effort to improve stormwater runoff to the reservoir. Similar projects will be implemented throughout the watershed. Data and operational information from passive and active treatment systems currently proposed or in place will be used to identify treatment practices and mechanisms that will work effectively for other discharge areas. Both passive (i.e. gravel and vegetated filter strips) and active (i.e. sand filter installation) treatment mechanisms will be implemented.

Future recommended BMPs and changes in management practices will seek to control phosphorus loading through the reduction or treatment of runoff volumes and sediment transport in an efficient and cost-effective fashion. The majority of the recommended BMPs pertain to controlling pollution at the source and include both residential and commercial development source treatment measures. Source control measures will be implemented to focus on minimizing or eliminating the source of pollution so that pollutants are prevented from contacting runoff or entering the drainage system. Permanent BMPs and treatment control measures will be designed to remove pollutants after being taken up by runoff. Additionally, the cost-benefit ratio of potential retrofit options will be calculated to optimize potential projects within the watershed.

The following documents list acceptable BMPs for the Cascade Reservoir Phase II TMDL:

The *Handbook of Valley County Stormwater Best Management Practices, 1997*, and the *Catalog of Stormwater Best Management Practices for Idaho Cities and Counties.* These references are recognized as the primary technical references for developers, contractors, design professionals, local agency officials and staff responsible for design, construction, maintenance or the review and approval of stormwater treatment facilities/devices. To prevent future impacts, the *Handbook of Valley County Stormwater Best Management Practices* will serve as a means of implementing consistent county-wide site design treatment considerations. The cities will be proactive and encourage more comprehensive strategies for stormwater planning and management.

Stormwater Retrofit Options for Valley County, 1996. This document provides a list of applicable BMPs, prioritized retrofit projects, and other recommendations for improving water quality on a subwatershed basis.

Procedures and Recommendations for Subwatershed Prioritization of Stormwater BMPs, 1997. This document describes a process for prioritizing stormwater BMPs by subwatershed based on the prevailing and site suitable physical conditions.

The Urban/Suburban Source Implementation Plan references the *Handbook of Valley County Stormwater Best Management Practices, 1997*, and the *Catalog of Stormwater Best Management Practices for Idaho Cities and Counties* as these contain a complete list of site-specific BMP projects, phosphorus load reduction efficiencies, comparative costs and applicability for each of the recommended BMPs.

A selection matrix for identifying potential BMPs in the *Handbook of Valley County Stormwater Best Management Practices, 1997* will be utilized for BMP selection in correlation with the *Stormwater BMP Selection Suitability Decision Tree* included in the Urban/Suburban Source Implementation Plan. Both of these documents will be available to the general public at the Valley County Planning and Zoning Office and the Cascade Satellite Office of DEQ.

Treatment options for urban/suburban stormwater are many and varied. It should be kept in mind that actual BMPs implemented may vary due to site requirements, land availability options, funding availability, and the needs of each separate municipality or subdivision.

Approach to Determining Roadway-Related Implementation Measures

Road erosion is the primary sediment source within urban/suburban land use. Minimization of sediment-bound phosphorus transport through the control of road-related erosional processes is of high priority. Many roads within the watershed are steeply sloped, improperly designed, inadequately maintained, and include cuts and culverts that are in poor repair. Proximity to surface water is of primary concern, as direct transport of sediment is possible in many areas of the watershed. Sediment transport and erosional processes on these road systems is estimated to generate 15,721 tons of sediment per year, yielding approximately 2,515 kg of phosphorus annually, as shown in Table 4 of the Urban/Suburban Source Implementation Plan (Appendix C).

Initial transportation-based load reduction goals are to address 80 percent of the unimproved roads, 65 percent of graveled roads, and 35 percent of paved roads. Roads and highways within the Cascade Reservoir watershed will be expected to accomplish a load reduction of 754 kg/yr. Although it is not directly accounted for in the load calculations, the Idaho Transportation Department will be upgrading specific sections of State Highway 55 within the Cascade Reservoir watershed, which is also expected to result in water quality improvements.

Proposed Roadway-Related Implementation Measures

The Valley County engineer has completed a comprehensive inventory of private roads and highways. Many locations with erosion, predominantly those associated with unimproved roads, were observed during the inventory.

The prioritization of roadway implementation measures targets those roadways located in close proximity to a surface water system, in rolling or steep terrain that are especially at risk for rutting, rilling, and gullying. For the most part, this class of unimproved public and private roadway is best described as narrow, low volume traffic and poorly maintained. Approximately half of this class of unimproved public roads have been identified as high priority sites fitting the above description and are therefore proposed to be improved to a level of upgraded service that would stabilize the road surface and improve drainage to reduce erosion.

Roadways that fit the above description located in the Boulder/Willow, West Mountain and Lake Fork subwatersheds will be addressed first. Appropriate BMPs for roads and highways include graveling on native material roads, ditching and cross-drains with gravel interfaces and vegetated swales (on native and graveled roads), and culvert and ditch upgrade/repair for paved roadways.

A 319 Grant proposal targeting those roadways located in the West Mountain subwatershed identified as being in poor condition and having the greatest chance for direct transport to the reservoir has been approved. The majority of the work for 1999 has been completed and the remainder scheduled for the 2000 construction season. An additional 319 Grant proposal targeted roadways in the immediate vicinity of the reservoir that experience heavy recreational usage has been submitted and approved. Work is scheduled for the years 1999 to 2000. A 319 Grant proposal to address failing road crossings in the Boulder/Willow subwatershed and additional private roadways at risk in the West Mountain subwatershed is in preparation and expected to be submitted for the 2002 funding schedule.

Stormwater and Road Monitoring

The objectives of an urban/suburban monitoring plan are to verify that BMPs are properly installed, that they are being maintained, and are working as designed. Monitoring for phosphorus reductions will consist of spot checks, annual reviews and evaluation of advancement toward reduction goals. Monitoring will be either qualitative or quantitative, depending on the project. Proposed projects may need to incorporate project monitoring into new grant proposals. Evaluation of advancement toward reduction goals will be accomplished using the project tracking system and annual reports.

In addition, the comprehensive, watershed-wide inflow and inlake monitoring used by DEQ to establish current loadings will continue as a mechanism to document improvements, identify initial loading trends, assess load reductions achieved and determine when the overall 37% reduction goal is attained. This monitoring is conducted on a monthly basis and can be used in a quantitative sense to determine the collective effectiveness of BMPs installed or implemented on tributary systems.

Septic Systems

Septic systems provide for sewage treatment and disposal in areas lacking municipal wastewater collection and treatment systems. Septic tank/soil adsorption systems may be a significant source of nutrients and other pollutant loadings to shallow groundwater, particularly in saturated soil conditions.

Approach to Determining Septic-Related Implementation Measures

Two areas adjacent to the reservoir (within 600 feet) with developed subdivision parcels were identified as potential nutrient source locations due to inadequate retention time and treatment of septic tank effluent caused by high ground water and poor soil retention characteristics. One area includes subdivisions aggregated around the north end of the reservoir, in the vicinity of the tributary arms of Boulder/Willow Creek and Lake Fork Creek. The other location includes the subdivisions in the southwest reach of the reservoir. It was recognized in the Phase II TMDL that both locations were dominated by high groundwater tables, evidence of groundwater contamination, high septic system density, and poor soil types.

The Phase II TMDL estimated the load contributed to the reservoir from septic systems at 2,205 kg/yr based on 1,795 septic systems and a range of effluent quality assumptions. As documented in the Urban/Suburban Source Implementation Plan, approximately 650 residences have connected to a sewer system, although to date, not all have properly decommissioned their septic systems.

Proposed Septic-Related Implementation Measures

To address high phosphorus and bacteria loadings identified in the Phase 1 TMDL in the northern arms of the reservoir, the North Lake Recreational Sewer and Water District (NLRSWD) was formed. The NLRSWD is currently providing sewer service to approximately 650 subdivision residences aggregated around the north end of the reservoir, with additional residences expected to be connected to sewer and discontinue use of their septic systems in the near future. Approximately 60 septic systems in this area were unaccounted for as of December 1999. This sewer facility does not discharge to surface water. It is part of a partnership project with the approved City of Donnelly Wastewater Treatment Plant and relies on land application of the treated effluent. Treated effluent is applied at agronomic rates to an area of agricultural land in the eastern portion of the watershed. All application activities are conducted in areas where groundwater is deep below the surface and does not represent a transport potential for phosphorus or other pollutants of concern. The construction of the NLRSWD system has resulted in the removal of septic wastes that previously entered the reservoir in a nearly direct and immediate fashion from failing systems located in very close proximity to the reservoir. With proper decommissioning, the NLSWD connections are estimated to have reduced the total phosphorus loading to Cascade Reservoir by 838 kg/yr.

A second sewer district, the South Lake Recreational Water and Sewer District (SLRWSD) has been formed for the southwest shore and is currently seeking sources of funding to establish service. The southwest location (in the area of the West Mountain subwatershed) has a high groundwater table, evidence of groundwater contamination, a high density of septic systems and poor soil types. Many of the developed parcels in the West Mountain subwatershed have septic systems that predate 1985 (average age is 23+ years) and are not in conformance with contemporary standards. Two different wastewater treatment plant designs are being considered at this time: (1) Augmentation of the approved City of Cascade Wastewater Treatment Plant to increase the existing capacity to handle additional wastes piped from the SLRWSD area. This plant currently discharges treated effluent to the NFPR downstream of Cascade Reservoir, below the Cascade Reservoir watershed boundaries. (2) Construction of a separate, approved treatment facility in the SLRWSD area that will utilize land application in an area with appropriate soil and ground-water characteristics. All land being investigated as potential land application sites is located south of Cascade Reservoir. The current opinion is that the initial design (partnership with the City of Cascade) will be selected as an interim mechanism for wastewater treatment, followed by the construction of a land application-based treatment facility specific to the SLRWSD as over time, restrictions to surface water discharges are expected to become more stringent. To this end, significant progress has been made toward the eventual sewering of the West Mountain area. Current plans include a joint effort with the City of Cascade to install a holding facility for wastewater at the current Cascade WWTP site. Holding tanks will be installed initially in those lots where septic systems are known or suspected to be failing or out of compliance due to age, high ground water conditions, poor soil characteristics or small lot sizes. These holding tank systems will then be upgraded to accommodate a pressurized sewer system at project completion. A 319 Grant proposal for construction of the holding facility has been approved and funded. The work is scheduled for the 2000 to 2002 construction seasons. A second 319 Grant proposal to assist in the emplacement of holding tanks in the SLRWSD area has also been approved and funded. The work is scheduled for the 2001 to 2002 construction seasons. At completion, the SLRWSD facility is expected to serve approximately 350 residences, with subsequent expansion over time. It is estimated that with proper decommissioning the initial 350 hookups will reduce Cascade Reservoir total phosphorus loadings by 706 kg/yr.

It is recognized that septic systems must be decommissioned properly to result in a 100 percent removal of the potential pollutant load they represent. Current Central District Health Department (CDHD) policy requires that abandoned septic tanks must be pumped, filled with sand or collapsed.

With the completion of the winter storage ponds for the McCall WWTP, no treatment systems authorized to accept septic wastes will discharge to surface water within the watershed. Therefore, 100 percent removal of the septic-related pollutant loading from properly decommissioned systems is possible, and does not represent only a relocation of load within the watershed.

Of the total estimated septic system phosphorus load of 2,205 kg/yr, the NLRSWD reduction of 838 kg/yr and SLRWSD reduction of 706 kg/yr combine for a total load reduction of 1,544 kg/yr. The cost of NLRSWD sewer connections was approximately $6,000 each, plus $350 to $450 per connection for septic system decommissioning. The total cost for 650 NLRSWD systems is approximately $4,193,000. The estimated cost of SLRWSD sewer connections range from $8,000 to $11,000 each (which includes decommissioning). The total cost for 350 SLRWSD systems is approximately $3,850,000 (this cost reflects per-site hookup and decommissioning charges only, the current total system construction/operation cost estimates are higher based on additional system requirements). Using these conservative figures, the total estimated capital cost for the septic system load reduction of 1,544 kg/yr is $8,043,000.

Septic System Load Reduction Monitoring

Monitoring of the septic tank phosphorus load reduction consists of tracking the number of residences that connect to a sewer system and decommission their septic systems. Monitoring includes inspection and reporting of decommissioned septic tanks. This inspection and reporting is the responsibility of the CDHD, the State Plumbing Inspector, and the decommissioning contractor.

In addition, the comprehensive, watershed-wide inflow and inlake monitoring used by DEQ to establish current loadings will continue as a mechanism to document improvements, identify initial loading trends, assess load reductions achieved and determine when the overall 37% reduction goal is attained. This monitoring is conducted on a monthly basis and, as several monitoring sites are located in close proximity to both the NLRSWD and the SLRWSD boundaries, can be used in a quantitative sense to determine the collective effectiveness of septic to sewer conversions, septic decommissioning and other associated measures completed.

Urban/Suburban – Load Reduction Summary

Urban/Suburban phosphorus load reductions for municipal stormwater, rural residential stormwater, roadways, and septic systems are summarized in Table 6.

Table 6. Average Total Phosphorus Load and Reduction Goals for Urban/Suburban Sources

Nonpoint Sources	Total Phosphorous,[a] kg/yr	Land Use Treated,[b] Percent	Reduction Goal, kg/yr	Percent Reduction, percent
Urban/Suburban				
Municipalities Stormwater[b]				
City of Cascade	222	100	78	35 percent
City of Donnelly	151	100	53	35 percent
City of McCall	897	100	314	35 percent
Total Municipal Stormwater[b]	1,270	100	445	35 percent
Rural Residential Subdivisions Stormwater[b]	638	100	160	25 percent
Roads and Highways				
Unimproved	434	80	295	85 percent
Gravel	1,247	65	365	45 percent
Paved	601	35	95	45 percent
State Hwy 55	234	0	0	0 percent
Total Transportation	2,515		754	30 percent
Subtotal Stormwater and Roads and Highways	4,423		1,359	
Septic Systems	2,205		1,544	70 percent [c]
Total Urban/Suburban	6,628		2,903	44 percent

[a] These figures include both the management load shown in Table 1 and the natural and background loads specific to these sources.
[b] The 100 percent treatment designation indicates the intent to pursue a system-wide approach to stormwater management.
[c] The septic system load reduction results from both water quality and public health driven priorities. Provision of wastewater collection and treatment facilities is accomplished on service area basis as opposed to an individual, site specific basis.

Created Wetlands

In addition to the land-use specific BMPs outlined in the preceding discussion and the accompanying source-based implementation plans, created wetlands were constructed in 11 areas of the reservoir shoreline between 1995 and 1999. Collectively, these wetland areas occupy roughly 60 acres of land, and receive and treat approximately 1,100 acre-feet of water annually from an estimated 17,000 acres of agricultural and forestry land. These wetlands were constructed through joint efforts by the USBR, DEQ, the Cascade Reservoir Association, CRCC, IDFG and volunteers from the Boy Scouts of America and the local community. They are administered by the USBR.

Wetland monitoring is conducted jointly by USBR and DEQ. Monitored parameters consist of nutrient and heavy metal loading evaluation, temperature, dissolved oxygen and flow assessments, and bacterial concentration in the inflowing and outflowing waters.

Because wetlands in other areas have been shown to be effective in the reduction or removal of dissolved phosphorus from inflowing waters, these projects are expected to result in significant phosphorus load reduction to Cascade Reservoir. In addition, they are projected to provide sediment reduction, erosion protection and improved wildlife habitat. Commonly, created wetlands require 3 to 5 years to mature as efficient phosphorus reduction treatment systems. These wetlands are monitored monthly during the ice-free season and preliminary data trends in the most mature wetlands show that the projected reductions are occurring. Monitoring will continue, and as collected data show consistent reduction trends, the operational efficiencies of these projects will be determined and the reductions achieved will be distributed according to the proportional land-use acreage within the drainage areas of each created wetland.

Several other created wetlands are currently proposed for areas of tributary drainage and stormwater treatment in urban/suburban land use. The design, siting and construction of these proposed wetlands will draw heavily on the techniques learned and information gained while developing and monitoring the existing created wetlands.

Summary of Proposed Point and Nonpoint Source Reductions

Table 7 and 8 summarize all point and nonpoint source estimated phosphorus reductions achieved by reduction measures outlined in this implementation plan. Estimated reductions are shown by subwatershed where source plans provide that information, otherwise, estimated reductions are shown as a total for the watershed.

The estimated reductions from implementation measures identified in this plan are not enough to meet the total nonpoint source load reduction goal of 10,895 kg/yr, in part because they do not include reductions for 5,118 kg/yr of load from the North Fork Payette River (NFPR) subwatershed. As described in the Agricultural Source Implementation Plan section, the sources of this load have not been well defined. DEQ has undertaken a monitoring program to better determine the sources of this load. Specific reduction measures will be identified and implemented when the source identification monitoring is complete, to achieve a 30 percent reduction of total load.

The plan also does not identify implementation measures to reduce the background load entering the NFPR and Lake Fork Creek, from Big Payette Lake (estimated at 1,717 kg/yr) and Little Payette Lake (estimated at 281 kg/yr), respectively. Background loads from Big Payette Lake are currently being addressed under the Big Payette Lake Management Plan and Plan Implementation Program. Actions taken to improve water quality conditions in Big Payette Lake will reduce phosphorus loads flowing into the NFPR. Background loads from Little Payette Lake will be addressed by an agreement between Water District #65K, the Lake Irrigation District, and Water District #65 for management of irrigation water from Little Payette Lake. The management scenarios identified in this agreement are expected to result in improved water quality and fish habitat in Lake Fork Creek and, as an end receiver, Cascade Reservoir. The management agreement is expected to continue indefinitely, with the exception of extreme dry (drought) years, or in the event of substantial revision to the current flow augmentation scenarios for salmon flush waters.

If the NFPR total load is reduced by 30 percent once the unknown sources are identified, and the Big Payette Lake and Little Payette Lake efforts reduce the background loads by 30 percent, the total load reduction goal for the Phase II TMDL will be achieved.

A formal evaluation of all reduction measures within the Cascade Reservoir watershed will be completed in 2003 and trends toward water quality goals will be identified. The re-assessment of proposed implementation measures will be carried out at this time for all sources within the watershed. If trends indicate that reduction goals will not be achieved under the existing management plan, more stringent reduction measures will be outlined within the progress report generated and further implementation measures will be put in place.

Monitoring of the specific sources listed above will continue under the DEQ monitoring plan through at least 2003. Periodic reviews of the data will be undertaken to identify potential trends in phosphorus loading. These issues will also be re-evaluated in depth in 2003, and an assessment will be performed of the reduction status for both the measured load from North Fork Payette River subwatershed and the background loads Big Payette Lake and Little Payette Lake. If trends indicate that reductions are proceeding and that designated reduction goals will be met in an appropriate time frame, implementation will proceed as outlined. If trends indicate that reduction goals will not be achieved under the existing management plans for Big Payette Lake and Little Payette Lake, more stringent reduction measures will be outlined for these contributing systems within the progress report generated and further implementation measures will be put in place.

As stated earlier, additional monitoring and review of the North Fork Payette River subwatershed is necessary to target phosphorus reduction BMPs in the most efficient and cost effective manner possible. Monitoring is continuing and funding sources for acquisition of additional data for this subwatershed are being actively sought. Additional monitoring will be undertaken in the timeliest manner available. At current funding levels, additional data acquisition is expected to occur within the next four years, at which time the subwatershed priority ranking will be re-evaluated and the North Fork Payette River subwatershed listed at the appropriate level based on the factors outlined previously. An assessment of data collected and evaluation of progress toward this goal will be undertaken in 2003. If possible, a priority ranking of this subwatershed will be undertaken at that time. If additional data is necessary, a listing of data gaps remaining will be prepared and funding sources identified to complete the source evaluation.

Table 7. Summary of Estimated Phosphorus Loads and Reductions for Point and Nonpoint Sources Within the Cascade Reservoir Watershed

	Total Load[1] (kg/yr)	Projected Total Reduction (kg/yr)	Projected % Reduction of Total Load
Point Sources			
McCall WWTP	3,947	3,947	100%
IDFG Hatchery[2]	218	0	0%
Point Source Totals	**4,165**	**3,947**	**95%**
Nonpoint Sources			
Forestry	8,840		
Roadways		1,454	16%
Grazing		1,198	14%
Total		*2,652*	*30%*
Agriculture	11,740		
Tier 1		849	7%
Tier 2		2,512	22%
Tier 3		124	1%
Total		*3,485*	*30%*
Urban/Suburban	4,423		
Roadways		754	17%
Urban stormwater		445	10%
Subdivision stormwater		160	4%
Total		*1,359*	*31%*
Other Nonpoint Sources			
Septic Systems[3]	2,205	1,544	70%
NFPR - Unidentified Sources	5,118	1,535	30%
Background - Big Payette Lake	1,717	515	30%
Background - Little Payette Lake	281	84	30%
Other Natural/Background Sources	1,392		0%
Nonpoint Source Totals	**35,716**	**11,174**	**31%**
Grand Totals	**39,881**	**15,121**	**38%**

1 Contains management, natural and background loading.
2 A 70% reduction (from 726 kg/yr to 218 kg/yr) has already been achieved.
3 Reductions are driven by both water quality and public health concerns and will be accomplished on a service area basis as opposed to an individual basis.

Table 8. Summary of Estimated Subwatershed Based and Watershed Based Phosphorus Reductions for Point and Nonpoint Sources Within the Cascade Reservoir Watershed

	Subwatershed-based Projected Phosphorus Reductions (kg/yr)							Watershed-based Projected Phosphorus Reductions (kg/yr)	Total Projected Phosphorus Reductions (kg/yr)
	Boulder/Willow	Cascade	Gold Fork	Lake Fork	Mud Creek	North Fork	West Mountain		
Point Sources									
McCall WWTP						3947			3947
IDFG Hatchery[1]									
Point Source Totals						**3947**			**3947**
Nonpoint Sources									
Forestry									
Roadways	98	14	1117	7		55	163		1454
Grazing	144		382			131	541		1198
Agriculture									
Tier 1	170	18	72	261	51	195	82		849
Tier 2	732	92	200	697	221	567	3		2512
Tier 3			40				84		124
Urban/Suburban									
Roadways								754	754
Urban stormwater	53	78				314			445
Subdivision stormwater								160	160
Other Nonpoint Sources									
Septic Systems[2]	***				***		***	1544	1544
NFPR - Unidentified Sources						1535			1535
Background - Big Payette Lake						515			515
Background - Little Payette Lake				84					84
Other Natural/Background Sources									
Nonpoint Source Totals	**1197**	**202**	**1811**	**1049**	**272**	**3312**	**873**	**2458**	**11174**
Grand Totals	**1197**	**202**	**1811**	**1049**	**272**	**7259**	**873**	**2458**	**15121**

1 A 70% reduction (from 726 kg/yr to 218 kg/yr) has already been achieved.
2 Reductions are driven by both water quality and public health concerns and will be accomplished on a service area basis as opposed to an individual basis.

Land Use Changes

Land Use Change Scenarios

The Cascade Reservoir Phase I and Phase II Watershed Management Plans and this Implementation Plan address loading issues and implementation strategies on a land-use basis. However, land-use distributions are not static. Data collected within the Cascade Reservoir watershed show diminishing agricultural and forestry land use and increasing urban/suburban land-use trends. 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 load reductions. This discussion is not intended as a mechanism to address current loading. Three generalized scenarios have been considered in evaluating the potential impact of land use changes on implementation of the Cascade Reservoir Phase II TMDL. These scenarios have been outlined as follows:

- Move High Load to Low Load Situation
  - Example: Convert Developable Land to Conservation Easement
- Move Low Load to High Load Situation
  - Example: Convert Developable Land to Residential
- Transition/Construction Impacts
  - Example: Construction Erosion and Sedimentation

If pre-development and post-development phosphorus loadings can be quantified, three approaches may be considered with regard to the management of new development impacts. These approaches are outlined as follows:

- Apply BMPs to Achieve Reduction Goal
- Apply BMPs to Maintain Pre-Development Loads (No Net Increase)
- Compensate for Increased Load with Other Reductions

The following section presents a discussion of current development trends in the Cascade Reservoir watershed and the policy considerations associated with development.

New Development Policy

New development represents a unique aspect of loading and reduction considerations within the watershed as it commonly represents a change in land-use from within the existing nonpoint source categories. Currently, there are three types of new development in the Cascade Reservoir watershed that introduce changes in land use:

1. Division of Large Rural Tracts into Smaller Rural Tracts. These divisions result in tracts ranging from one or two acres, to forty acres in size. The most popular sizes are from five to twenty acres. The majority appear to be investment properties that remain undeveloped for many years. Others provide spacious sites for ranchettes where about one acre is developed with buildings, driveways, parking, and utilities. The remaining area is removed from agricultural production to remain idle as grassland or to support hobby livestock. In the near-term, this may result in improved runoff water quality. In the long-term however, many of these lands may move to a more intensive level of development.
2. Land use change by zoning process. Commercial, industrial, multi-family, and subdivisions generally require zoning approval through a public hearing process in most local jurisdictions. A formal land use change is subject to review of agencies, adjoining property owners, and the public. The application includes a site grading plan that demonstrates the use of best management practices to minimize sediment transport during construction and in the final development. This provides a strong link to water quality management by controlling erosion and sedimentation.
3. In-fill Development. The Valley County Building Department issues approximately 350 building permits each year. In 1999, 61 of those were for new residential homes. Excavations for foundations and utilities, and construction of impervious surfaces such as roofs, driveways, and parking areas increase stormwater runoff and the potential for sediment transport. Most parcels undergoing this type of development are located in urban/suburban areas. It is typical for these parcels to have been undeveloped for many years with limited runoff. Development of these parcels is frequently in areas where runoff is transported to surface waters.

The dominant trend in land-use change within the Cascade Reservoir watershed is the conversion of agriculture and forested land to urban/suburban development. The area of the watershed most vulnerable to this type of change is the valley floor and fringe areas along the foothills. Features such as view, topography, recreation potential, and access by public roads drives development decisions. Income from property sales supplements or replaces more limited income derived from agricultural land use.

It is recognized that in order to effectively meet phosphorus reductions throughout the watershed, all contributing sources must participate in the reduction effort. Limiting reductions to existing land uses alone will place an unfair burden for phosphorus reduction on established practices. This burden will increase over time with occurrence of land use changes within the watershed.

Primary responsibility for review and approval of new development rests with local authorities. Zoning within the watershed is administered by the Valley County Planning and Zoning Commission and the cities of McCall (city impact area), Donnelly, and Cascade. The decisions for the three city commissions are subject to the action of their respective city councils. The County decisions are subject to action by the Board of

County Commissioners. Most County actions are only reviewed by the Board upon appeal. Ordinances are adopted by the city councils and the County Board. The majority of the watershed area where land use can change from agriculture is administered by the County.

Efforts have been made to control the impact of construction on water quality. The City of McCall has adopted a stringent site grading ordinance. Valley County has adopted the "Handbook of Valley County Stormwater Best Management Practices" and the County Building Department is encouraging the use of the Handbook with the following stamp on site plans for building permits:

"SITE GRADING NOTE: Excavators are encouraged to use the "Handbook of Valley County Stormwater Best Management Practices" for site grading, foundation excavation, driveway construction, utility trenches, etc. For more information contact the County Engineer's office, 382-4251"

The County's Conditional Use Permit process requires a site grading plan and the applicant, or design engineer, is required to demonstrate that BMPs are utilized to mitigate erosion and sedimentation during construction. The site grading permit is subject to review by the County Engineer and the Valley Soil and Water Conservation District, and can be reviewed by interested agencies and the public during the formal review process. The Planning and Zoning Commission and the Board of Commissioners will use the input received in this process in preparing Conditions for Approval for new development proposals and will officially accept a plan as part of a Conditional Use Permit. This provides a link between water quality management considerations and the review and approval process for new development.

An assessment of projected water quality impacts (both positive and negative) incorporated within the existing process for review of proposed new developments, would allow an equitable and effective distribution of the required phosphorus reduction to all land uses. This incorporation of Phase II TMDL requirements, BMPs, mitigation, and reduction mechanisms as part of this review process will further assure the success of the Phase II TMDL and Implementation Plan at a local level.

On a state level, permit applications submitted to DEQ for new development within the watershed of an impaired water body will be evaluated as to potential water quality impacts, and will be reviewed with Phase II TMDL load and reduction allocations in mind.

Implementation Plan Schedule

A schedule for planned actions to implement the Cascade Reservoir Phase II TMDL is a key tool to organize and coordinate phosphorus reduction efforts, pursue funding support, and track accomplishments. However, a complicating factor in Cascade Reservoir watershed implementation planning is that a firm schedule for completion of the proposed implementation measures cannot be formulated without assurance of funding. Until funding sources are secured, an active program to identify and prioritize projects has been established to allow immediate application of funds as they become available. A nominal schedule has been developed based on a number of assumptions in order to allow the sequence of activities and the potential interface between actions to be considered.

Implementation Schedule

An example schedule for the Cascade Reservoir Phase II TMDL Implementation Plan has been developed for review and discussion. Figure 1 illustrates a sequence of activities extending from the Phase II TMDL, through the preparation of the Implementation Plan, and including the pursuit of outside funding and execution of phosphorus reduction BMPs/projects.

The schedule in Figure 1 illustrates the relationship between the planning activities and potential implementation actions to reduce phosphorus loadings. Project funding is key and a series of five funding cycles are shown to implement the external phosphorus reduction projects. Potential external funding sources of all types are grouped under the funding request for each of the five years to pay for all, or part, of nonpoint source projects from the three major nonpoint sources. Implementation of projects and BMPs is assumed to follow each annual funding cycle.

For the example schedule shown in Figure 1, it is assumed that these five rounds of funding provide adequate resources to construct all of the BMPs/projects needed to accomplish the targeted 37 percent reduction in external phosphorus loadings. This results in the first year of full implementation of planned projects extending beyond the year 2006.

Funding Programs

Implementation funding may vary with individual sources. Potential examples of funding sources include bonds, sewer districts, Local Improvements Districts, Block Grants, SIPs, State Revolving Funds, TEA 21 programs, CWA 319 Grants, EQUIP funding, CRP programs, special legislative grants/funding, and a myriad of other federal, state and local opportunities. The following discussion highlights a few of these funding programs to illustrate the program management activities and scheduling that may be required. It is assumed for the sake of this example that external funding to support Phase II TMDL implementation can be secured from three sources; the Idaho state legislature, CWA Section 319 Grants, and the federal EQIP program. Figure 2 illustrates the main activities involved in pursuing funds for each of these pathways. Funding from the state legislature assumes a budget request formulated in the year 2000 for the January 2001 legislative session. Projects proposed for funding require a sponsor or may be submitted as part of the DEQ budget. It has been assumed that projects funded by the legislature have funds available to the state in July of the same year, with allocation to recipients for projects by September. This results in funds being available to implement BMPs/projects very late in the construction season. The schedule shown in Figure 2 illustrates extension of implementation activities through the following summer in order to allow for more favorable construction conditions.

The Boulder/Willow Creek 319 Grant is used to illustrate the funding cycle for this program in Figure 2. The grant application was prepared in December of 1998 for projects that will be implemented beginning in the summer of 2000. Budget resources are assumed to be available from EPA in March/April of 2000. This is followed by development of conservation plans and land owner contracts, and approval by the Valley Soil and Water Conservation District (VSWCD) Board. The 319 Grant program combines 60 percent cost share funds from EPA with a 40 percent land owner match. At least one project or practice from the conservation plan must be implemented in the first 12 months of the program. The conservation plan must be sustained for a minimum of 5 years and a maximum of 10 years for reimbursement. The VSWCD provides annual status reviews and maintains a tracking system for monitoring the program.

The Lake Fork Creek Priority Area EQIP project is used to illustrate the funding cycle for the federal Environmental Quality Incentive Program in Figure 2. The program application was prepared in June of 1999 with Natural Resources Conservation Service (NRCS) approval in September of 1999. Budget resources became available in January of 2000. This is followed by development of conservation plans and land owner contracts, and approval by the Valley Soil and Water Conservation District (VSWCD) Board. At least one cost share practice must be implemented in the first 12 months of the program. The conservation plan must be sustained for a minimum of 5 years and a maximum of 10 years for reimbursement. The VSWCD provides annual status reviews and maintains a tracking system for monitoring the program.

Implementation Schedule Considerations

While the example schedule in Figure 1 serves only as an illustration of a potential sequence of activities for implementing the Phase II TMDL, important observations can be made that may enhance the prospects for implementation of phosphorus reduction BMPs/projects. First, 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 the administration of the overall Phase II TMDL, track progress, fund projects, and coordinate individual project implementation. Adequate consideration should be given to funding the on-going program management effort needed to implement the Phase II TMDL.

Full implementation of the targeted 37 percent reduction in external phosphorus loadings will not occur for a number of years. As discussed below, the timeline for expected improvements in Cascade Reservoir water quality were estimated to extend over a period of 5 to 20 years in the Phase II TMDL. It appears from the example implementation plan schedule that it will not be possible to gauge the full impact of planned reductions until after the target date set for the Cascade Reservoir Phase III Watershed Management Plan Progress Report in December 2003. More aggressive project funding would allow the planned phosphorus reduction projects to be implemented earlier. Conversely, project implementation will lag if project funding is delayed or unavailable.

Figure 1. Cascade Reservoir Phase II TMDL Implementation Plan Draft Schedule

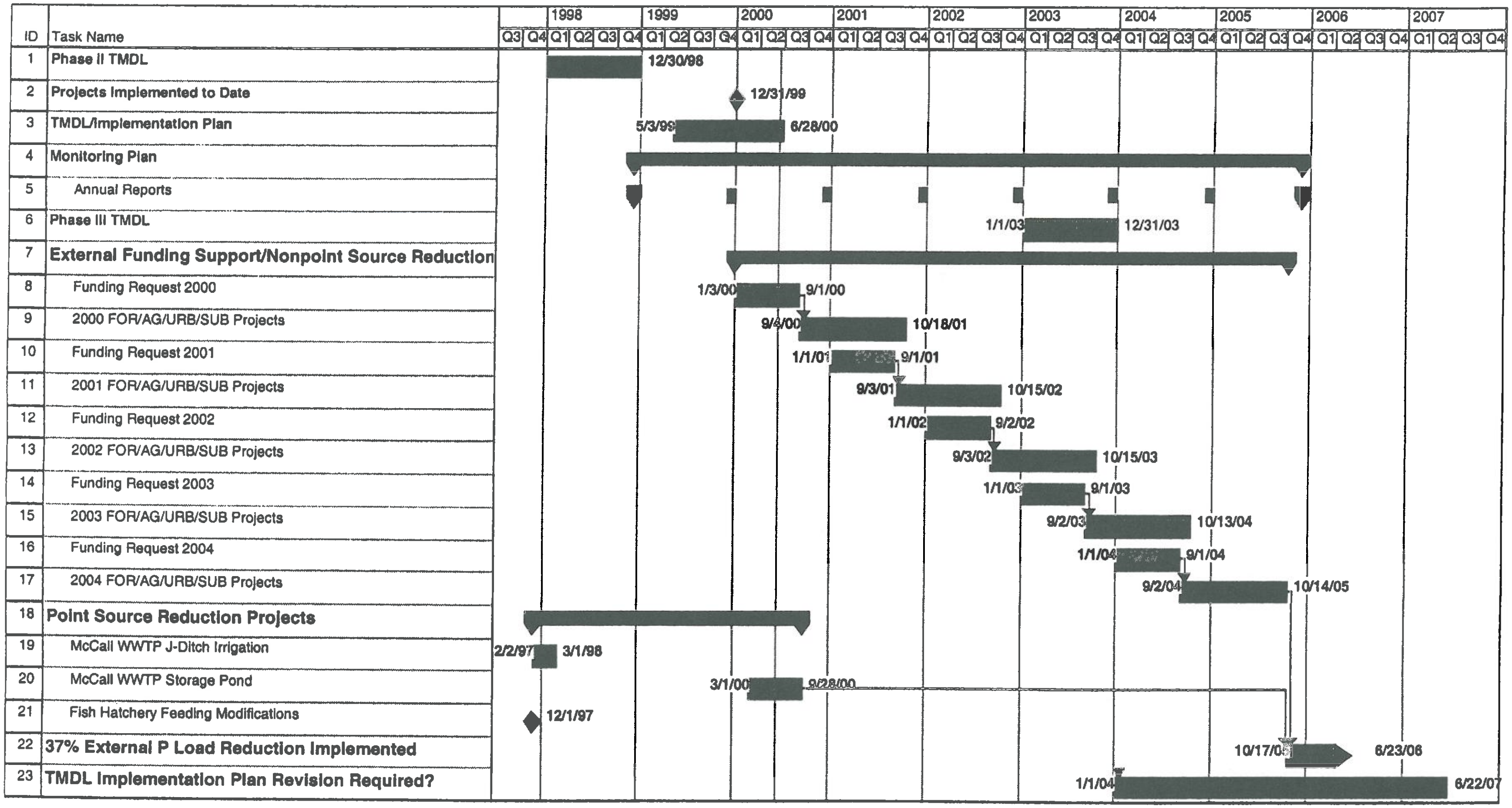

Figure 2. Example External Funding Cycles for State Funds, 319 Grants and the Environmental Quality Incentive Program (EQIP)

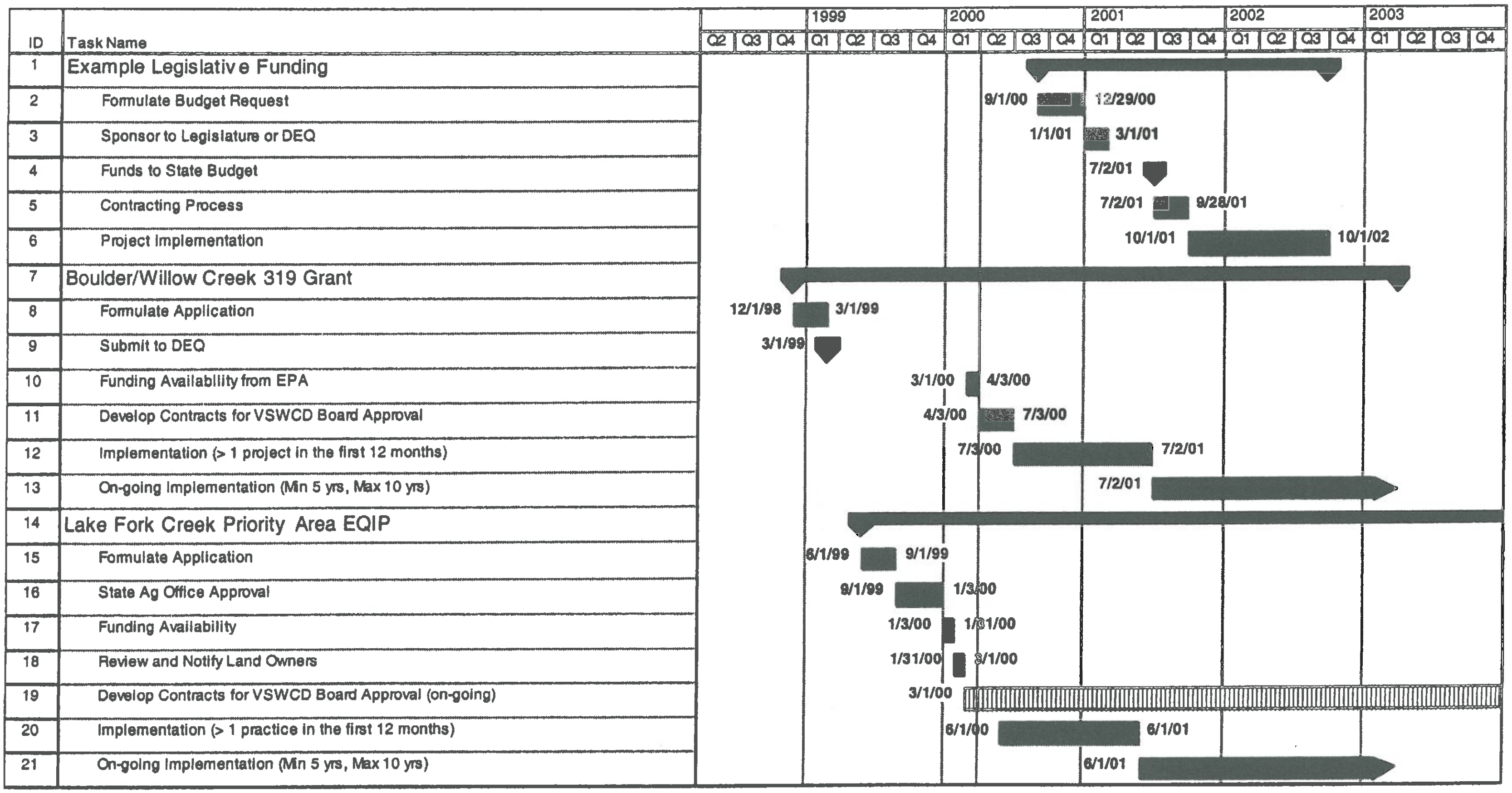

Table 10 combines capital and operations and maintenance costs from Table 9 with the phosphorus reduction values for the point and nonpoint sources from Table 7 and Table 8. Costs are shown by source with estimated reductions in mass units of phosphorus per year (kg/yr). Two approaches to using economic analysis to compare the cost effectiveness of phosphorus reduction measures are presented in Table 10. The first is a simple combination of capital cost divided by phosphorus reduction in kilograms per year. This results in a measure of the initial capital cost per rate of annual phosphorus reduction ($/kg/yr). This approach does not account for annual operations and maintenance costs, nor does it account for the continuing phosphorus reduction benefit that projects/BMPs provide in subsequent years over their useful lives.

The second approach to comparing cost effectiveness utilizes both capital and annual operations and maintenance costs in combination with phosphorus reduction. Inclusion of annual operating costs with assumptions about project life and duration of effectiveness allows the economic analysis to be extended to consider life cycle costs. In Table 10, capital and annual operations and maintenance costs are used to calculate equivalent annual costs using assumptions about useful project lives and the time value of money. An interest rate of 7 percent has been assumed and useful lives vary depending upon the nature of the BMPs and projects. Life cycle costs are divided by annual phosphorus reductions rates (kg/yr) to calculate a unit cost for removal. This results in a measure of the capital and operations and maintenance costs per unit of phosphorus reduction ($/kg).

Table 10 assumes a 20-year life for point source projects and sewer hookups for septic systems. Life cycles for nonpoint source measures have been estimated by the source work groups. Tier 1 agriculture projects are expected to have an average 15 year life. Tier 2 and 3 agriculture projects are expected to have an average 20 year life. Changes to grazing allotments on forested land are considered permanent; a 20 year life is used to calculate cost per kilogram reduced for forestry grazing improvements. Forestry roads are assumed to have a 15 year life. Subdivision road and non-subdivision road improvements are assumed to have a useful life of 20 years. Useful lives of urban and rural residential stormwater BMPs vary from 10 to 50 years. A 50 year useful life has been chosen for cost calculations based on the projected useful life of vegetated swales and filter strips.

Table 10. Economic Analysis and Comparison of Unit Costs for Phosphorus Reduction Measures

Source	Total Capital Cost ($)[a]	Operations and Maintenance ($/yr)[a]	Estimated P Reduction (kg/yr)[b]	Capital Cost per P Reduction Rate ($/kg/yr)[c]	Equivalent Annual Cost ($/yr)[d]	Cost per Kilogram ($/kg)[e]
McCall Wastewater Treatment Plant	9,996,000	38,000	3,947	2,500	982,000	250
Agriculture Tier 1	1,976,000	9,900	849	2,300	227,000	270
Agriculture Tier 2	11,096,000	55,500	2,512	4,400	1,103,000	440
Agriculture Tier 3	933,000	4,700	124	7,500	93,000	750
Forest Grazing	87,000	44,050	1,198	100	52,000	40
Forest Roads	1,800,000	131,454	1,454	1,200	329,000	230
Non-Subdivision Roads	1,420,000	71,000	324	4,400	205,000	630
Subdivision Roads	2,026,000	101,000	430	4,700	293,000	680
Urban Stormwater	393,013	7,900	445	900	36,000	80
Rural Residential Subdivision Stormwater	111,375	2,200	160	700	10,000	60
Septic System Upgrades	8,043,000	14,000	1,544	5,200	773,000	500
Other Nonpoint Sources[f]			2,134			
Total	37,881,000	480,000	15,121	2,900	4,089,000	270

[a] Capital and operations and maintenance costs from Table 9.
[b] Estimated phosphorus reduction values from Table 7.
[c] Calculated as follows: (Initial capital cost, $)/(Annual phosphorus reduction rate, kg/yr) = $/kg/yr.
[d] Calculated as follows: (Initial Capital Cost, $)*(Capital recovery factor [$Int*(1+Int)^n/(1+Int)^n-1$])+(Annual O&M cost, $/yr) = ($/yr). The factor Int is the annual interest rate (assumed to be 7 percent) and the factor n is the years of useful life.
[e] Calculated as follows: (Equivalent annual cost, $/yr)/(Annual phosphorus reduction rate, kg/yr) = $/kg.
[f] Costs for other nonpoint sources including NFPR-unidentified sources, background-Big Payette Lake, background-Little Payette Lake, and other natural/background sources are not yet defined.

Milestones for Attaining Water Quality Standards

Water quality model simulations of Cascade Reservoir conducted in support of the Phase II TMDL indicate that a sustained 37 percent reduction in total external phosphorus loadings results in a continuing trend of water quality improvements over a 20 year period. While actual changes in water quality may vary considerably and individual years will be influenced to a large degree by weather conditions, the water quality model simulations provide a general reference to track expectations for changes in reservoir quality.

Figure 3 illustrates predicted improvements in Cascade Reservoir water quality resulting from a sustained 37 percent reduction in total external phosphorus. An initial period of rapid improvement is predicted for the first five years. A forecast of a more gradual trend of improvement follows for the next 15 years.

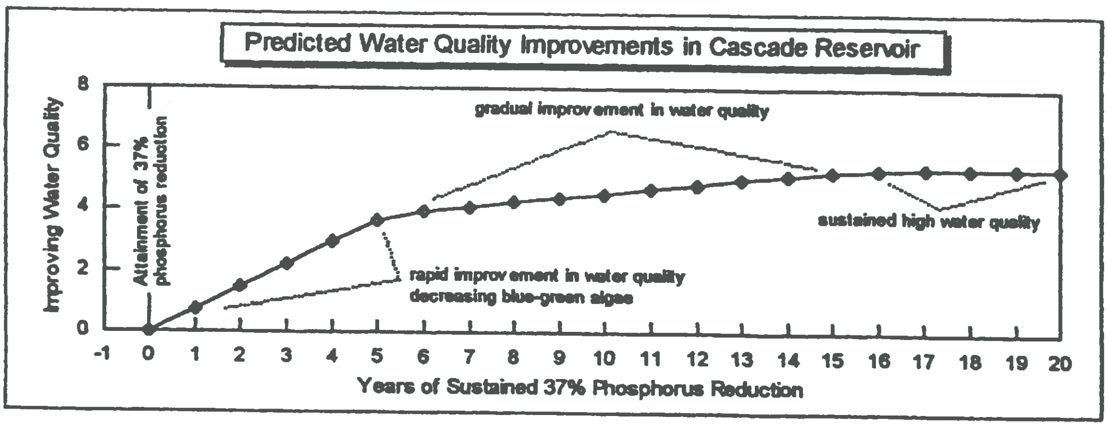

Figure 3. Water Quality Model Predicted Improvements in Cascade Reservoir

(Source: Cascade Reservoir Phase II Watershed Management Plan, Appendix C: Computer Modeling Summary)

This forecast of water quality improvement presumes climatic and weather conditions are near average. Cascade Reservoir water quality benefits from increased snowpack and precipitation. Conversely, adverse drought weather conditions would be expected to delay projected improvements.

Estimated Cost of Reductions

Point Source Costs

Point source reduction costs include the construction of the McCall J-Ditch pipeline project and the planned McCall seasonal effluent storage pond. The McCall J-Ditch effluent pipeline project is completed and costs are a matter of historical records. The McCall seasonal effluent storage pond is in the process of design and implementation. Capital costs are estimated to be on the order of $5 to $7 million. The total public funding devoted to the J-Ditch project is estimated to be between $8 and $10 million upon completion.

Nonpoint Source Costs

Capital and operation and maintenance costs for implementing the nonpoint source reduction measures planned by the source groups, where available, are presented in Table 9. The purpose of identifying these costs is to provide a basis for project budgeting. Cost entries in Table 9 are estimates based upon currently available information which will be updated with more precise information on actions taken in the year 2000 when the first annual report on implementation activities is prepared. These costs include both public and private financial contributions to project funding. In most cases the total estimated costs to achieve the reductions are drawn directly from the source-specific implementation plans.

Cost Estimation Assumptions

A common set of economic analysis assumptions is required for consistent consideration of phosphorus 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.

Table 9. Summary of Estimated Costs for Implementation of Phosphorus Reduction Measures

Source	Capital Cost (Pending Funding) ($)[a]	Capital Cost (Funded) ($)[a]	Total Capital Cost ($)[a]	Operations and Maintenance ($/yr)[b,c,d,e]
McCall Wastewater Treatment Plant	7,000,000	2,996,000	9,996,000	38,000
Agriculture Tier 1	1,560,000	416,000	1,976,000	9,900
Agriculture Tier 2	6,222,000	4,874,382	11,096,000	55,500
Agriculture Tier 3	933,000	0	933,000	4,700
Forest Grazing	40,400	46,600	87,000	44,050
Forest Roads	598,988	1,201,012	1,800,000	131,454
Non-Subdivision Roads	1,336,438	83,160	1,420,000	71,000
Subdivision Roads	2,026,000		2,026,000	101,000
Urban Stormwater	301,296	91,717	393,013	7,900
Rural Residential Subdivision Stormwater	111,375		111,375	2,200
Septic System Upgrades[f]	3,380,000	4,663,000	8,043,000	14,000
Other Nonpoint Sources[g]				
Total	23,509,000	14,372,000	37,881,000	480,000

[a] Some project costs have been funded previously. Pending funding indicates new budget resources are required. Assumes estimated costs are based on a December 1999 Seattle Area Engineering News Record construction cost index (ENR-CCI) of 7,137.
[b] O&M costs for wastewater treatment at McCall and NLRWSD and SLRWSD are assumed to be $0.15 per 1000 gallons treated.
[c] O&M costs for Agricultural Tiers 1, 2, and 3 are based on an assumed 0.5% of capital costs/year.
[d] O&M costs for subdivision and nonsubdivision roads is assumed to be 5% of capital costs/year.
[e] O&M costs for urban and rural stormwater BMPs is assumed to be 2% of capital costs/year.
[f] Assumes 650 NLRWSD sewer connections at $6,450 each and 350 SLRWSD sewer connections at $11,000 each.
[g] Costs for other nonpoint sources including NFPR-unidentified sources, background-Big Payette Lake, background-Little Payette Lake, and other natural/background sources are not defined.

Consideration should be given to unified assumptions for the components of capital cost estimates. As an example, municipal utility 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, such as the Engineering News Record Construction Cost Index (ENR-CCI), are frequently used to establish a date reference and a basis for updates. For example, a December 1999 Seattle Area ENR-CCI value is 7,137. 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 ranges 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, this summary identifies important considerations for cost estimates.

Economic Analysis

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 operations costs to be compared. When combined with phosphorus removal effectiveness, project costs can be compared in terms of their economic benefit per unit of phosphorus 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 BMPs/projects.

Preliminary estimates of operation and maintenance costs were developed for projects and BMPs, as shown in Table 9. The annual costs for wastewater treatment and land application for the City of McCall and the annual cost for treating the wastewater at the North Lake and South Lake Recreational Water and Sewer Districts (NLRWSD and SLRWSD), is assumed to be $0.15 per 1,000 gallons treated per year. The annual operation and maintenance costs for Tiers 1, 2 and 3 agricultural BMP projects are assumed to be 0.5 percent of the capital project cost. The annual operation and maintenance cost for urban/suburban subdivision and non-subdivision roads is assumed to be 5 percent of capital costs. The annual operation and maintenance cost for urban and rural stormwater BMPs is assumed to be 2 percent of capital costs.

Evaluation of Progress/Reporting

Annual reports from each source work group, detailing phosphorus reduction measures implemented, observed emplacement and operation efficiencies, and projected load reductions will be submitted to the appropriate TAC representative for inclusion in the Cascade Reservoir Implementation Plan database and tracking system.

Project Tracking System

The Phase II TMDL Implementation Plan tracking system serves as a master summary of all projects and BMPs constructed for the purpose of reducing the phosphorus load to the Cascade Reservoir. The system will be used as a management tool to assess phosphorus load reduction, to analyze cost effectiveness, and to assess performance of each BMP either individually or as a whole. Components of the tracking system include the following project characteristics:

- Project/BMP identification and description
  - Date scheduled
  - Date completed
  - Date inspected for proper implementation
    Inspector
- Location and mapping
  - Subwatershed
  - Source
- Project priority and substantiation
- Quantify estimated phosphorus control effectiveness
- Identify collateral benefits (in-stream flows, temperature, fisheries, aesthetics, flooding)
- Identify estimated costs (capital, operation and maintenance)
- Funding description
  - Source (private/public/joint, etc.)
  - Type/schedule (one time vs. ongoing, cost-share, etc)

The tracking system will provide a database summary of all projects and BMPs in the Cascade Reservoir watershed. Project information is entered into the database using a standardized form that will automatically tabulate the data. Individual projects, subwatersheds, and the entire Cascade Reservoir watershed will be assessed for phosphorus load reductions and cost effectiveness from the information available in the database. The tracking system will be used to support the preparation of annual reports and to document projects completed. Since the database also tracks projects yet to be completed, it will provide an aid to developing a funding strategy and project construction schedule. Finally, the database will be linked to a geographic information system (GIS) mapping system to locate each project within the Cascade Reservoir watershed.

The tracking system is built using a Microsoft Access interface. This is a readily accessible program with a user-friendly interface. Microsoft Access can also be linked to ArcView to provide GIS functionality to create maps and locate projects within the watershed.

Microsoft Access allows data to be entered into the database using a standardized form creating a quality control/quality assurance feature. Each project will be identified with a unique project number, as well as a project description and location. Phosphorus load reduction data, and sediment data where available, will be entered into the database, along with the cost of the project. This information will be used to locate each project within the watershed, summarize the phosphorus load reduction effort, analyze cost effectiveness of the projects, and aid in determining project schedules. Microsoft Access also allows for preparation of data queries and project summary reports. Project reports can be prepared in a standardized format.

A project summary report lists all of the projects with their associated phosphorus load reduction values. This report provides the project number, project name, a brief description and the estimated phosphorus load reduction. A total phosphorus load reduction is included at the end of the report to track progress in pursuit of the Phase II TMDL goal. The report is intended for use as a summary of all the projects and the load reduction in the watershed.

Projects can be sorted and queried by source group and subwatershed. This allows for analysis of the Phase II TMDL reduction goals of the individual source groups and subwatersheds.

A cost effectiveness report lists the projects with their capital cost and unit cost per mass unit ($/kg) of phosphorus reduction. This report provides the project number, name, capital cost, and cost per unit of phosphorus load reduction. A total cost will be calculated at the end of the report. Two versions of this report are produced. One will utilize estimated project costs from planning. The second version tracks actual project costs following project completion.

The project profile report is designed to provide a one-page summary of the database information available for an individual project. Project name, number, location, description, capital cost, date of implementation, ancillary benefits and a photograph are included in the project profile report. Each project will be viewed individually in order to document and analyze each performance.

The project schedule report is intended to provide timing information for planning implementation of projects and BMPs. Each project will be listed along with the projected and actual date of implementation.

The tracking system will be linked with a simple Cascade Reservoir watershed map to illustrate project locations. Initially, a GIS point coverage was created to locate projects within the watershed with a project number callout. Boise Cascade Corporation's GIS coverages were used to provide a base map of the area, which shows the watershed and a limited number of reference features such as roadways, cities, and waterways. Each project was shown with a dot and identified with the project number. The mapping was linked manually to the tracking system using the project number.

Annual Report

Annual reports detailing phosphorus reduction measures implemented, observed emplacement and operation efficiencies, and projected load reductions will be submitted to the appropriate TAC representative for inclusion in the Cascade Reservoir Implementation Database. The current schedule calls for preparation and submission of annual reports by November 30 of each year. This may change with refinement of the reporting process and scheduling of the other nonpoint source group annual reports.

The tracking system will be used to support the preparation of annual reports and to document projects completed. Since the database also tracks projects yet to be completed, it will provide an aid to developing a funding strategy and project construction schedule.

Monitoring

The DEQ has continuously monitored the water quality in the Cascade Reservoir watershed since 1993. The monitoring plan document outlines a proposed coordinated monitoring plan for the implementation of a Phase II TMDL allocation to improve reservoir water quality and the quality of runoff from contributing watersheds.

Implementation plan monitoring has two major components; watershed monitoring which includes both in-stream subwatershed monitoring and in-reservoir monitoring, and BMP monitoring. DEQ has primary responsibility for the former, while designated management agencies have primary responsibility for the latter. Watershed monitoring measures the success of the implementation measures in achieving Phase II TMDL goals. BMP monitoring measures the success of individual phosphorus reduction projects. Monitoring of Cascade Reservoir has six objectives:

- Evaluation of watershed nutrient sources, baseline conditions and reservoir loading.
- Evaluate trends in water quality data.

- Establish phosphorus storage and recycling capacity in Cascade Reservoir.
- Evaluate the effectiveness of constructed wetlands and detention ponds in reducing phosphorus loading to the reservoir and/or tributaries.
- Increase the flow and pollutant load information during the peak runoff season in order to more accurately determine phosphorus loading to the reservoir.
- Increase temperature information on tributaries.

Currently, an annual report is written to document changes in load and concentration in Cascade Reservoir.

Subwatershed Monitoring

Success in reducing the current annual load of total phosphorus will be measured by comparing individual subwatershed allocations with the measured contributions monitored at or near the mouth of major tributaries. The current monitoring of the nine inflow stations is designed to quantify nutrient contributions from each of the nine subwatersheds that drain into Cascade Reservoir. Each of these stations is monitored monthly. However, during snowmelt periods, which causes high flows and an increase in phosphorus loading to the Cascade Reservoir, the monitoring stations are sampled weekly. Flow, conductivity, pH, temperature, and dissolved oxygen measurements are taken and water samples are collected for analysis.

Reservoir Response Monitoring

Reservoir response monitoring measures the effectiveness of the Phase II TMDL and implementation measures. In-reservoir monitoring is scheduled to occur monthly during the ice-free season and includes physical, chemical and microbiological parameters. The four monitoring stations in the reservoir establish baseline conditions, phosphorus storage, and recycling capacity information for the reservoir. DEQ monitoring is expected to continue throughout the implementation process (through 2003 with extension schedule to be determined at that time), as outlined in the Phase II TMDL, and will provide a comprehensive assessment of changes in phosphorus and suspended sediment loading within the watershed.

BMP/Project Effectiveness Monitoring

Site or BMP-specific monitoring may be included as part of specific treatment projects if determined appropriate and justified, and will be the responsibility of the designated project manager or grant recipient. The objective of an individual project monitoring plan is to verify that BMPs are properly installed, being maintained and working as designed. Monitoring for phosphorus reductions at individual projects will consist of spot checks, annual reviews and evaluation of advancement toward reduction goals. Evaluation of advancement toward reduction goals will be accomplished using the project tracking system and annual reports.

Individual entities and source groups constructing BMP projects should include budget allowances for a monitoring program (qualitative and/or quantitative) for the project site. Those entities will be responsible for collection of data and reporting monitoring results to the Cascade Satellite Office. This data will be used to evaluate the effectiveness of the BMP project. Results will be used to recommend or discourage similar projects in the future and to identify specific subwatershed, or reservoir, monitoring information that indicate the implementation plan is not achieving expected results.

Reasonable Assurance

All identified point sources within the Cascade Reservoir watershed are permitted facilities administered by the EPA. These facilities are located within the City of McCall. Wasteload (WLAs) reductions have been incorporated into point source NPDES permits. However, the load reduction (WLAs and LAs) needed to achieve desired water quality and restore beneficial uses in the reservoir will not be achieved in its entirety by upgrades of the point sources.

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

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 and are described in more detail in the appropriate appendices.

Generally, water quality monitoring will not be carried out on a project-specific basis but rather as a suite of indicator analyses monitored at the outflow of major tributaries within the watershed. For example, a decrease in total phosphorus over time as monitored at the outflow of Mud Creek indicates that BMPs emplaced within this subwatershed were reducing total phosphorus levels within the tributary water column. This data will be used, in conjunction with flow measurements, to evaluate the overall decrease in total phosphorus mass being contributed to the reservoir by the subwatershed. Concurrent monitoring of reservoir water quality will be undertaken to determine the direct effects of the monitored subwatershed concentration trends on reservoir water quality.

If in-stream monitoring indicates an increasing total phosphorus concentration trend (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 (IDAPA Section 16.01.02.350.02.b.ii). 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. With continued instream monitoring, Phase II TMDL implementation will initiate the feedback loop process and will evaluate the success of BMP implementation and its effectiveness in controlling nonpoint source pollution.

State Programs and Authorities

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 (Bauer, 1989) 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. Since the development of the Nonpoint Source Management Program in 1989, revisions of the water quality standards have occurred. Many of these revisions have adopted provisions for public involvement, such as the formation of Basin Advisory Group (BAGs) and Watershed Advisory Groups (WAGs) (IDAPA 16.01.02052). The WAGs are established in high priority watersheds to assist DEQ and other state agencies in developing TMDLs, Watershed Management Plans and Implementation Plans for those segments.

The State of Idaho water quality standards refer to other programs whose mission is to control nonpoint pollution sources. Some of these programs and responsible agencies are listed in Table 11.

The State of Idaho uses a voluntary approach to control agricultural nonpoint sources. However, regulatory authority can be found in the state water quality standards (IDAPA 16.01.02350.01 through 16.01.02350.03). IDAPA 16.01.02054.07 refers to the Idaho Agricultural Pollution Abatement Plan (IAPAP) (IDHW, SCC, EPA; 1993) which provides direction to the agricultural community for approved BMPs. The IAPAP outlines responsible agencies or elected groups (SCDs) that will take the lead if nonpoint pollution problems need addressing. For agricultural activity 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. If a voluntary approach does not succeed in abating the pollutant problem, the state may provide injunctive relief for those situations determined to be an imminent and substantial danger to public health or environment (IDAPA 16.01.02350.02 (a)).

If a nonpoint pollutant(s) is determined to be impacting beneficial uses and the activity already has in-place referenced BMPs, or knowledgeable and reasonable practices, the state may request the BMPs be evaluated and/or modified to determine appropriate actions. If evaluations and/or modifications do not occur, injunctive relief may be requested (IDAPA 16.01.02350.2, ii (1)).

Table 11. State of Idaho Regulatory Authority for Nonpoint Pollution Sources

Citation	IDAPA Citation	Responsible Agency
Rules governing Idaho forest practice	16.01.02350.03(a)	Idaho Department of Lands
Rules governing solid waste management	16.01.02350.03(b)	Idaho Department of Health and Welfare
Rules governing subsurface and individual sewage disposal systems	16.01.02350.03(c)	Idaho Department of Health and Welfare
Rules and standards for stream channel alteration	16.01.02350.03(d)	Idaho Department of Water Resources
Rules governing exploration and surface mining operations in Idaho	16.01.02350.03(e)	Idaho Department of Lands
Rules governing placer and dredge mining in Idaho	16.01.02350.03(f)	Idaho Department of Lands
Rules governing dairy waste	16.01.02350.03(g) or IDAPA 02.04.14	Idaho Department of Agriculture

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

Reasonable Assurance for Forestry BMP Implementation

The major forest landowners and land managers in the watershed have been working together throughout development of the Phase II TMDL and this Implementation Plan. All the major forest land managers have committed to achieving the reduction goals on forested lands. As a reflection of this commitment, the forest landowners have already completed several projects towards attaining this goal and have several more projects in the planning stages. This commitment on the part of the major forest land managers ensures that the reduction goals will be met for forested lands. All forest landowners are committed to continuing to work with DEQ and the Cascade Reservoir committees to ensure success of the program.

In addition to this commitment, various federal and state requirements and regulations will ensure that the forest landowners continue to maintain and improve road systems and riparian management. Forestry is one of the few regulated land uses in the watershed. All owners will continue to abide by the rules and regulations of the State under the Forest Practices Act that require monitoring of BMP effectiveness and update of BMPs when they are found to be inadequate.

Additionally, the Forest Service will continue to follow land and resource management plans to implement activities. There is currently a Forest Plan Revision underway that is expected to be completed in December 2000. Activities include: timber harvest, road management, livestock grazing, prescribed fire, watershed improvements, fish habitat improvements, recreation management, and others. Sources of sediment/phosphorus will be identified and treatments implemented concurrent with activities. Activity plans are finalized and implemented as funds become available. National Environmental Protection Act and Endangered Species Act analyses will be required prior to implementation. Projects are scheduled based on funding and priorities on each forest. Partnership and cooperative efforts will be developed on a project-by-project basis.

For federal lands, funding for projects will rely upon fees taken in on timber sales and/or special federal allocations to address water quality problems. Funding sources include: collection agreements, soil and water improvements, road maintenance, ecosystem management, Capital Investment Project (CIP), 5 percent funds, and Knutsen-Vanderburg (K-V) funds, and other grants (CWA Section 319, National Forest Foundation, etc). Future direction from the Natural Resource Agenda, and Clean Water Action Plan may also provide future sources of funding.

Idaho Department of Lands relies largely on funds received from timber sales. Boise Cascade also has limited funds available to maintain and improve roads.

Reasonable Assurance for Agricultural BMP Implementation

BMP implementation for agriculture is achieved through voluntary incentive-based programs. Historically, cost-share incentives have been available to producers from state and federal conservation programs. The state incentive program was the SAWQP program. This program was established to assist agricultural producers in subwatersheds where critical acres are identified as contributing to a defined problem associated with a decline in water quality. In the Cascade Reservoir watershed, the Boulder/Willow and Mud Creek subwatersheds have a SAWQP plan. Contracts were developed and work has proceeded on these contracts through the Valley Soil and Water Conservation District (VSWCD). The SAWQP program has been historically funded through the Idaho Pollution Control Account. That fund was projected to deplete financial resources in 1999. All funds from this account have been allocated and the ability to write new contracts has been frozen. A SAWQP replacement program administered by the Idaho Soil Conservation Commission is expected to be in place in the near future, and will act as a funding source to projects similar to those funded by the original SAWQP program.

As well, the Lake Fork subwatershed has been designated as a high priority funding area under the EQIP program.

A new statewide cost-share program was approved and funded by the Idaho Legislature for the state fiscal year 2000. Funds for this program will become available in July of 2000. At the time this plan is being written, there were no funds or projects under this program targeted to the Cascade Reservoir watershed.

Federal programs have been available to landowners or producers for the implementation of BMPs or practices that will have a positive impact on the land and water quality. These programs historically include the Conservation Reserve Program (CRP), as well as Habitat Improvement Program (HIP), Wildlife Habitat Incentive Program (WHIP), Wetland Reserve Program (WRP), and the most recent program, EQIP Program. Federal programs are developed outside of the State of Idaho. Availability of funds, longevity, and rules of the programs are not subject to local management. Federal cost-share programs are expected to continue to be available in the future to assist meeting the requirements of the Phase II TMDL.

Reasonable Assurance for Urban/Suburban BMP Implementation

Successful implementation of recommended BMPs and management practices to reduce phosphorus loading within the urban/suburban arena will require the availability of cost share funding, loans, grants, or other sources of funding. Full-scale implementation cannot be expected to occur prior to the identification of such funding sources, and is expected to proceed on an intermittent basis, as funding becomes available. The adoption of a county-wide erosion and sediment control ordinance and implementation of specific programs recommended for the municipalities depends on action by the Valley County Commission and elected city officials.

Implementation Plan Revision

The Phase II TMDL included a plan for tracking progress in attaining water quality standards and if necessary, revising the Implementation Plan. A Cascade Reservoir Cascade Reservoir Phase III Watershed Management Plan Progress Report will be prepared following the adoption of the Implementation Plan and is targeted for completion in December of the year 2003. The Cascade Reservoir Phase III Watershed Management Plan Progress Report will utilize monitoring data to evaluate progress in attaining water quality standards in the reservoir 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 Cascade Reservoir Implementation Plan:

- Monitoring data indicate water quality standards will not be attained by continued execution of the Implementation Plan.
- Actual effectiveness and efficiency of phosphorus 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.
- Cascade Reservoir operational changes alter the minimum storage pool volume, or the timing of water releases, such that the relationship between external phosphorus loadings and in-reservoir phosphorus and chlorophyll a concentrations is changed.
- Monitoring data indicate that natural background loadings of phosphorus differ from historical data and revisions to reduction targets for manageable loadings are required.

A sustained effort in reduction of external phosphorus loadings will be needed to improve water quality in Cascade Reservoir. Natural weather conditions may affect the rate of progress in meeting the Phase II TMDL objectives for water quality improvement. Increased snowpack and precipitation is expected to benefit short-term water quality condition. Extended low water years are expected to delay beneficial improvements in water quality.

Other Options for Restoration of Water Quality

A number of management techniques for improving Cascade Reservoir water quality were considered in the development of the Phase II TMDL. These options included chemical sealing of reservoir sediments, dredging of the trashrack channel to Cascade

Dam, increasing the spillway discharge over the dam, aeration of the reservoir, modified reservoir operations, and external nutrient loading reduction. Each of these options was explored using a computer-based water quality simulation model developed for Cascade Reservoir. A brief summary of the conclusions of these investigations is presented in the following discussion.

Water quality modeling indicated that only two options provided the potential for long-term improvements in Cascade Reservoir water quality. These options were changes in reservoir management and reduction of external phosphorus loadings to the reservoir. Consequently, the focus of the Implementation Plan is on phosphorus loading reduction, with a stated operational objective of maintenance of a minimum pool of 300,000 acre-feet and the current split-release schedule for salmon flow augmentation. Other options for restoration of Cascade Reservoir were determined to have limited potential for water quality improvement for a variety of reasons.

Chemical sealing of the reservoir bottom sediments with alum to prevent the release of phosphorus under anoxic conditions was investigated. This option was viewed as expensive for application to such a large reservoir and would require repeated chemical applications if external phosphorus loadings to the reservoir were not reduced. Additionally, application of this treatment option has never been undertaken on a water body the size of Cascade Reservoir. All successful applications have been accomplished on water bodies of much smaller size. Because of this, the probability of success in the case of Cascade Reservoir is unknown.

Model simulation of a lower reservoir minimum pool indicated a negative effect on both water quality and fish habitat. A higher minimum pool typically increased the volume of water suitable for fish habitat. In 1982, IDFG recommended a 300,000 acre-foot total minimum pool based on a model they developed to predict the risk of winter fish kill at different minimum pools. The 300,000 acre-foot total minimum pool was administratively established by USBR in 1985.

Public Information and Education

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 who may be involved in implementing phosphorus reduction measures. General information and education measures will include a public meeting sponsored by the CRCC to explain the draft plan, an opportunity for public review and comment, and distribution of the final plan to interested parties. HDR Engineering, Inc., under contract to DEQ, will also prepare and distribute a pamphlet describing the plan to interested parties. Ongoing information about implementation progress will be provided at CRCC and TAC meetings, which are open to the public, and on the Cascade Reservoir Implementation Web site (www.crews-cascade.org).

Forestry Information and Education Efforts

Load reduction information, BMP locations, and performance/efficacy values obtained during the course of implementation will be available to the public through a variety of public forums including reports to the CRCC, TAC, Implementation Plan Source Groups and other organizations and agencies. The information will also potentially be available to the public through the Cascade Reservoir Implementation Web site, public tours, implementation efforts brochures published as part of the Cascade Reservoir Implementation Plan, and included in the Cascade Reservoir Watershed Cascade Reservoir Phase III Management Plan Progress Report which will be completed in 2003.

Agriculture Information and Education Efforts

Valley Soil and Water Conservation District has been involved in various efforts to increase the knowledge and awareness of conservation practices for agricultural landowners. This has been advanced with methods such as with newsletters, workshops, articles and conservation planning.

Newsletters are mailed out to producers, landowners and interested residents of the district. These newsletters are produced at the District and provide general information about conservation practices as well as current events occurring at the district. Workshops that are held annually cover agriculture and other natural resource topics of special interest in the District. These workshops have been well attended by the general public. The District has also provided local media with articles about issues of interest to local agricultural land owners. Inserts from the local paper have been funded by and produced by the District. Subjects such as riparian management have been covered by this method. Education also occurs on a personal level when district planners visit landowners and producers to develop conservation plans.

Urban/Suburban Information and Education Efforts

Load reduction information, BMP emplacement mechanisms and performance/efficacy values obtained during the course of implementation will be available to the public through a variety of public forums including reports to the CRCC, TAC, Implementation Plan Source Groups and other organizations and agencies. The information will also potentially be available to the public through the Cascade Reservoir Implementation Web site, public tours, implementation efforts brochures published as part of the Cascade Reservoir Implementation Plan, and included in the Cascade Reservoir Phase III Watershed Management Plan Progress Report which will be completed in 2003.

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APPENDIX A

Cascade Reservoir Watershed Forestry Source Implementation Plan

(This document is bound separately)

APPENDIX B

Cascade Reservoir Watershed Agricultural Source Implementation Plan

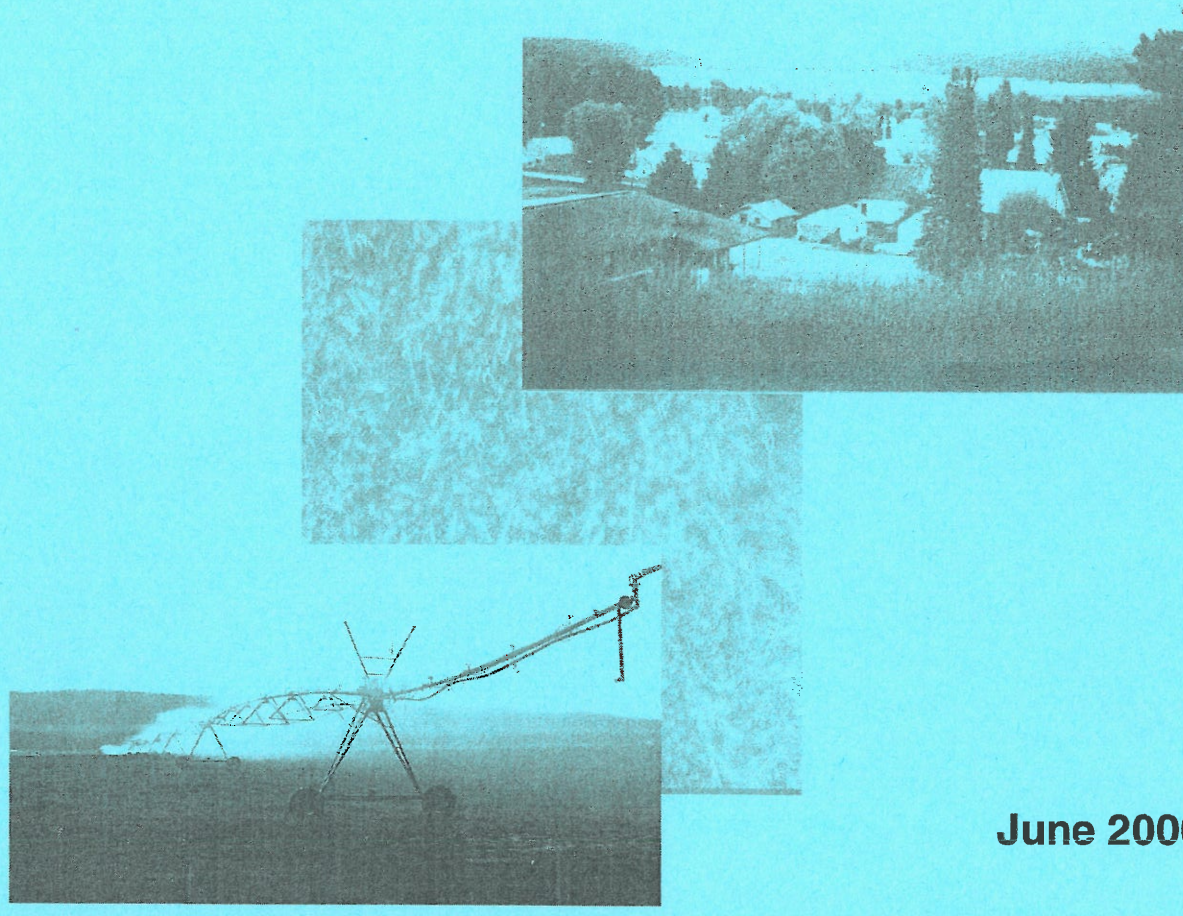
(This document is bound separately)

APPENDIX C

Cascade Reservoir Watershed Urban/Suburban Source Implementation Plan

(This document is bound separately)

Implementation Plan for the Cascade Reservoir Phase II Watershed Management Plan



June 2000

Volume II
Nonpoint Source Implementation Plans

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APPENDIX A
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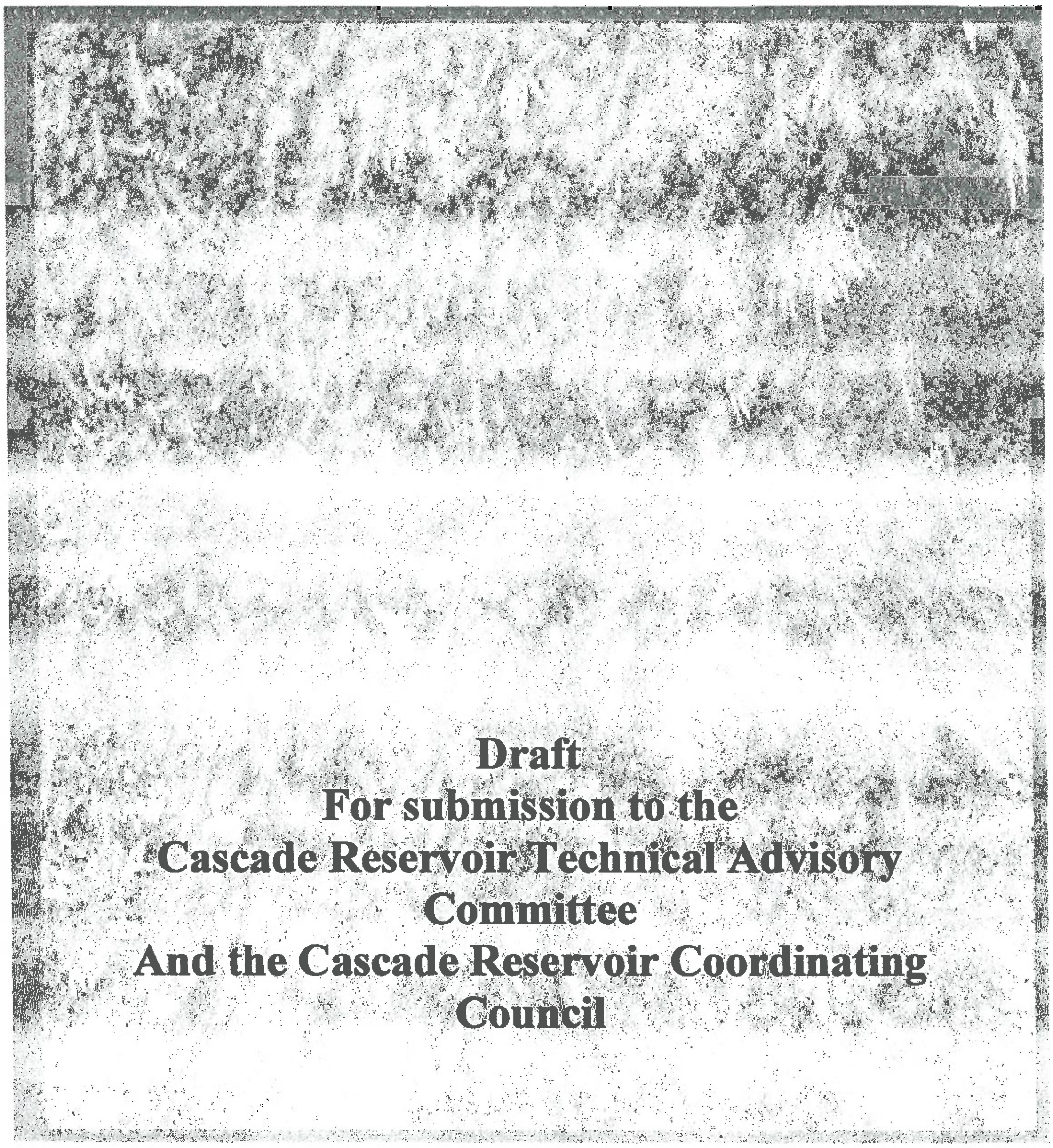
Forestry Implementation Plan

Cascade Reservoir Watershed Phase II Management Plan



Draft
For submission to the
Cascade Reservoir Technical Advisory Committee
And the Cascade Reservoir Coordinating Council

June 15, 2000

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Forestry Implementation Plan

Cascade Reservoir Watershed Phase II Management Plan

1.0 INTRODUCTION

The Forestry Implementation Plan is a consensus-based document based on the efforts of members of the Forestry Source Work group, and the Cascade Reservoir TAC, WAG. This document represents the basis for the forestry portion of the overall Cascade Reservoir Implementation Plan.

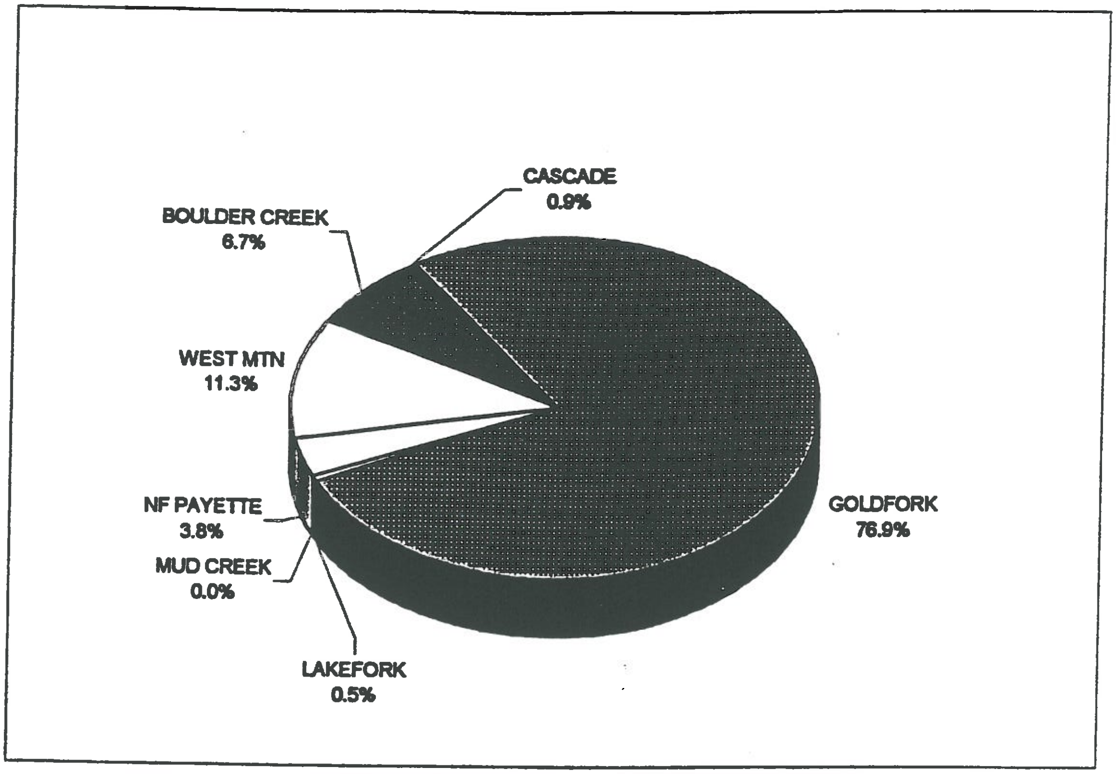
A watershed approach has been used to address water quality issues related to forestry land use activities and pollutant loads associated with discharges to the Cascade Reservoir and its tributaries. Evaluations and analyses conducted previously (see Forestry Plan under the Phase II TMDL) indicated roads and grazing management are the primary sources of phosphorus delivered to Cascade reservoir from forest management practices. This Forestry Implementation Plan addresses those identified inputs.

Forestry land-use totals 184,092 acres (Table 1.0) within the watershed, representing roughly 70% of the total land area in the Cascade basin. As of 1994, approximately 21% of the total phosphorus delivered to Cascade basin streams was delivered as non-point sources from forested land. Of this total forestry related phosphorus load, 1.15% is estimated to be bioavailable. The majority of the management related sediment load is delivered from roads. The Gold Fork River subbasin, where the majority of the forestlands lie, delivers most of this sediment (Figure 1). A 45% overall reduction in phosphorus loading has been assigned to all areas of land use within the watershed.

Table 1.0 Acres of forested lands by ownership for each subwatershed

SUBWATERSHED	BOISE NF	PAYETTE NF	BOISE CASCADE	IDL	TOTAL
Boulder Creek	0	3,476	1,088	7,236	11,800
Cascade	0	0	2,067	1,306	3,373
Gold Fork River	27,691	30,691	26,133	8,232	92,746
Lake Fork Creek	0	33,714	0	4,508	38,222
Mud Creek	0	0	0	0	0
NF Payette River	0	5,137	6,132	885	12,154
West Mountain	16,545	866	1,196	3,377	21,984
Willow Creek	0	0	3,651	162	3,813
TOTAL	**44,236**	**73,883**	**40,267**	**25,706**	**184,092**

Figure 1. Percent Sediment Contributions from Forest Roads by Subwatershed



Based on the measurement of phosphorus concentrations in soils, only 1.15% of the phosphorus delivered from forest roads is bioavailable. Therefore, the effectiveness of reductions in sediment runoff will have a small overall effect on the in-stream phosphorus water quality levels and downstream conditions in the reservoir. However, the TMDL was developed using total rather than bioavailable phosphorus; hence forested lands were identified as a significant source of total phosphorus. The forestry source group has agreed to target a phosphorus reduction because we realize that reductions in sediment will have a positive effect not only on reservoir water quality but also on riverine fish habitat.

Recommended Best Management Practices (BMPs) and changes in management practices seek to control phosphorus loading through the reduction or treatment of runoff volumes and sediment transport in an efficient and cost-effective fashion. The majority of BMPs recommended pertain to controlling pollution at the source.

2.0 OBJECTIVES

The primary goal of this document is to accurately identify existing implementation practices, and to outline additional practices and procedures necessary to successfully reduce existing phosphorus sources by at least the targeted amount and prevent additional future phosphorus loading to the North Fork Payette River and Cascade Reservoir from forestry-related land use activities and practices. The targeted amount identified in the Phase II TMDL was 30% overall reduction from all sources in the basin. One of those sources is the natural inputs from normal basin processes that would occur in the absence of land management. Since these natural inputs cannot be reduced, the management related sediment has to be reduced by more than 30% in order to achieve the 30% overall goal identified in the TMDL. By proportioning out the total reductions needed over man-induced sources only, we have estimated that a 45% reduction in man-induced sources is needed to meet the 30% overall target.

Recommended BMPs and other reduction practices have been selected from approved sources (discussed in more detail below). Phosphorus reductions for forestry management practices have been calculated using the formulas and BMP efficiencies described in the TMDL and associated reference documents.

The Forestry Implementation Plan/process addresses each of the following:

1. Implementation measure to be applied to meet the our objectives,
2. Schedule for completion,
3. Expected costs and funding sources,
4. Reasonable assurance, and
5. Monitoring of selected practices (qualitative or quantitative as appropriate).

3.0 IMPLEMENTATION MEASURES

BMPs are measures or a combination of measures that have been determined to be the most effective and practical means of preventing or reducing contamination to ground water and/or surface water pollution from nonpoint and point sources. The objective in implementing BMPs is to achieve water quality goals and protect the beneficial uses of the water body. The majority of forest BMPs that address sediment production are intended to either keep sediment from being produced or diverting sediment onto the forest floor and away from streams.

3.1 Forest Management Activities

The most effective means for controlling the generation of nonpoint source pollution from forested lands is through the use of preventative and restorative watershed management practices, or Best Management Practices (BMPs). The State of Idaho's Forest Practices Rules, mandates BMPs for forest management activities for all private, state, and federal forest practices in the state. The following summarizes the mandated practices affecting sediment and phosphorus inputs into water bodies:

All Land Ownerships

Forest management activities *(on all forested lands within the State of Idaho, Federal, State and Private)* are currently required to follow the Rules and Regulations pertaining to the Idaho Forest Practices Act (IFPA), Title 38, Chapter 13, Idaho Code (IDAPA 20.15, IDL 1992). Within these rules, practices shall also be in compliance with the Stream Protection Act, Idaho Water Quality Standards and Waste Water Treatment

Requirements, the Idaho Pesticide Law, and the Hazardous Waste Management Act of 1983.

The Idaho Water Quality Standards and Waste Water Treatment Requirements reference the Forest Practice Rules as approved best management practices (BMPs) and describe a procedure of modifying the practices based on monitoring and surveillance. Forest Practices Rules apply to private and State forested lands. Federal lands follow Forest Practices Act as described in Forest Plans.

The BMPs described in the Forest Practice Rules were determined to be the most effective and practicable mean of preventing or reducing the amount of nonpoint pollution generated by forest practices. BMPs shall include but not be limited to those management practices included in the rules. Sections of the Rules include: timber harvest, road construction and maintenance, reforestation, use of chemicals, slashing management, practices regarding stream segments of concern.

There has been a great deal of work with BMPs and the prevention of sediment delivery and stream protection in the past. Two processes are currently in place to evaluate BMP implementation and effectiveness. These are (1) annual audits of the Forest Practices Act by Idaho Department of Lands to determine if BMPs are being implemented on federal, state, and private lands, and (2) IDHW-DEQ completes a BMP effectiveness evaluation every 4 years. The results of these audits have shown that BMPs are being used and are effective in the prevention of sediment delivery to streams. Finally, the 4-year audit of BMP effectiveness provides a forum for adaptive management. Should any BMPs be found to be ineffective during the audits, a modification to the required state BMPs under the Forest Practices Act is automatically triggered and the practice updated.

Federal Lands

The Forest Service considers that 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 Best Management Practices (BMPs). Using an iterative approach to management and the control of nonpoint sources of pollution, the Forest Service will: apply a BMP, monitor, evaluate, adapt and determine if the practices are effectively reducing sediment delivery to streams.

The Inland Native Fish Strategy (INFISH 1995) is intended to provide interim direction on *Federal Lands* to protect habitat and populations of resident native fish outside of anadromous fish habitats in Idaho and other Pacific Northwest states. This direction is in the form of riparian management objectives, standards and guidelines, and monitoring requirements. The Forest Service has implemented this strategy through an amendment to the Forest Plan (Boise and Payette NF). Riparian Management Objectives (RMOs) are developed for a watershed to describe good fish habitat, pool frequency, water temperature, large woody debris, bank stability, lower bank angle and width to depth ratio from stream inventory data. Riparian Habitat Conservation Areas (RHCAs) are portions of the watersheds where riparian-dependent resources receive primary emphasis and management activities are subject to specific standards and guidelines. These areas include traditional riparian corridors, wetlands, intermittent streams, and other areas that help maintain the integrity of aquatic ecosystems. These areas (1) influence the delivery of coarse sediment, organic matter, and woody debris to streams, (2) provide root strength for channel stability, (3) shade the stream, and (4) protect water quality (Naiman et al. 1992).

The Forest Service also has performed monitoring of timber sale activities, including road construction. Theses include project level monitoring for BMP implementation and effectiveness of the IFPA.

Sediment Reduction and Effectiveness of BMPs

The effectiveness of the approved BMPs in relation to phosphorus as a nonpoint source has not been well established through monitoring. The effects of forest management on sediment delivery and the effectiveness of BMPs to reduce sediment from forestry operations, however, have been well studied (Belt et al, 1992; Dissmeyer, 1994; Seyedbagheri, 1996; Beschta, 1978; Bilby et al, 1989; Burroughs and King, 1989; Dryess, 1975; Foltz, 1996; Foltz and Burroughs, 1990; Goldman et al, 1986; Ketcheson and Megahan, 1986; Kochenderferand Helvey, 1987; Luce and Black, in press; Megahan and Ketcheson, 1996; Megahan, etal, 1986; Reid, 1981; Reid and Dunne, 1984; Sullivan and Duncan, 1980; Swift, 1984; Vincent, 1985). The cost and effectiveness of selected and commonly used forest BMPs are summarized in Table 2.0.

Table 2.0 Effectiveness of Forest Road BMPs

Treatment	Percent Sediment Reduction	Treatment Cost	Cost Effectiveness (tons/$1000)	Reference
Road cut/fill slopes				
Hydro mulch Road cut/fill slope	30%	$850/ac	2.10	Burroughs & King 1989
Slash filter windrow & Hydro mulch Road Cut Slope	84%	$1350/ac	4.00	Burroughs & King 1989
Slash filter windrow & Hydro mulch Road Fill Slopes	97%	$5,176/ac	1.16	Burroughs & King 1989 Cook & King 1983
Timbered Grid Structure	90%	$18,000/ac	0.62	Unpublished Report Cascade/Krassel RD
Road Surface/Prism				

Treatment	Percent Sediment Reduction	Treatment Cost	Cost Effectiveness (tons/$1000)	Reference
Dust Abatement Oil MgCl2 Lig	85%	$.50/linear ft $0.31/sq. yd	n/a	Burroughs & King 1989
Asphalt Paving	97%	$23.50/linear ft	n/a	Burroughs & King 1989
Armor Ditch line	92%	$4.96/linear ft	n/a	Burroughs & King 1989
Graveled Water bar	92%	$8.50/lineal ft		Foltz & Truebe 1994
Additional Culverts near streams	50-100%	~$30/lineal ft plus installation		
Road Closure				
Road Closure	75%	Varies		Harvey & Burton 1991
Road Decommission	n/a	$1.07/linear ft	n/a	Harr & Nichols 1993

3.2 Grazing Management

Most of the State and private forestlands and a small portion of the Federal forestlands are grazed. Left unmanaged, grazing animals tend to collect in the cooler valley bottoms where water is readily available. This concentration of animals can result in high levels of surface erosion, over utilization of available forage material near streams, and deposition of animal wastes in and near the stream. There are several approaches that can be used to minimize the effects of grazing on the inputs of sediment and phosphorus into streams. Primary among these are:

- Off site water development that encourage cows to move up onto the hillsides
- Moving salt blocks to ridge tops
- Fencing of riparian areas
- Pasture rotation
- Changes in the number of animals on an allotment
- Changes in the sex (steers vs. cow/calves) or species on the allotment

More information on grazing BMPs and BMP effectiveness can be found in the Agricultural Source Plan (see Phase II TMDL) and the Agricultural Implementation Plan.

On forested lands, grazing is generally managed through leases, through which the landowner allows access to the lands by cattlemen and their animals. It has become common practices to develop grazing management plans with the lessees to minimize the environmental damage caused by grazing.

4.0 PHOSPHORUS LOADING AND REDUCTION TARGET

As was previously discussed, phosphorus loading from forestry sources is recognized to come primarily from roads and grazing. In the Cascade watershed, landslides are also a source of sediment, although the number of management related slides has been very small on an annual average basis. These sources were evaluated separately to prioritize loading and reduction potential.

The natural variability of forest and rangelands, and the limited time and funds available to measure actual concentrations of phosphorus for each watershed, led to the alternative of using a properly verified and calibrated model for estimating pollutant load allocations. SEDMODL (Wold and Dubé, 1998) was selected as the modeling tool to estimate sediment loads from roads as surrogate for phosphorus load. Local soil phosphorus concentrations were collected and used to estimate the amount of phosphorus in the delivered sediments. Together, these provide an estimated of phosphorus delivery to Cascade Reservoir and its tributaries arising from management activities.

The components of SEDMODL have been individually validated through research efforts, to determine erosion rates or the effectiveness of BMPs (Appendix A). The precision and reliability of the combination of these components has not been tested to date. This is recognized as a data gap at this time. However, the relative percent sediment reduction through the application of BMPs is incorporated into SEDMODL and is expected to be a sufficient tool to determine the phosphorus load allocation and reduction.

SEDMODL results will be used, along with other data and information, to help make decisions by comparing the relative percent phosphorus reduction from treatments. The Forestry Source Group will use modeled results in making decisions consistent with levels of precision and accuracy of estimated values. Modeled results will not be used to make decisions where the error of the estimated is greater than the difference between treatments.

4.1 Road Sediment Runoff

The magnitude of road sediment load delivered to streams is a function of a large number of parameters. These parameters include: road gradient, road width, delivery length (length of road surface draining to a stream), surface type, traffic, hill slope gradient, cutslope height and gradient, fillslope length and gradient, vegetation density on cut and fill slopes, locations of culvert and other drainage control structures, and ditch type and condition. Accurate estimates of sediment delivered to streams require information on all of these parameters for each road segment in the basin. Information on precipitation rates, underlying geology and basic erosion rates is also needed.

In the Gold Fork subbasin, an in-depth watershed analysis was conducted which included a detailed evaluation of road sediment quantities and sources in the subbasin (Boise Cascade, 1996). As part of this analysis, the above data was collected to estimate total road sediment delivered to streams by road segment. Since an in-depth road inventory was not available for forest roads in the rest of the Cascade watershed, road sediment delivered to streams was estimated for all other watersheds using a road sediment delivery model, SEDMODL Version 1.0, developed by Boise Cascade (Wold and Dubé 1998). The model uses the same calculations that were used in the watershed analysis. However, it makes numerous assumptions regarding many of the road parameters. These assumptions are based on averages of hundreds to thousands of measurements taken on Northwest forest roads. Most of these assumptions tend to error on the side of overestimating the amount of sediment generated and delivered to streams. Details of the model calculations are provided in Appendix A. The calculations of road sediment delivered to streams used in the Phase II TMDL have been revised for the purposes of this document using an updated version of the model which we believe provides more accurate estimates of road sediment.

4.2 Grazing

Phosphorus inputs from grazing were estimated using the same methods described in the Agricultural Source Plan (Phase II TMDL) and the Agricultural Implementation Plan. The total load estimated for forested lands from grazing is 1887 tons per year (see Forest Source Plan, Phase II TMDL).

4.3 Reduction Target

The current estimate of the phosphorus loads from roads on forested lands is 2,366 kg total phosphorus per year or 27 kg bioavailable phosphorus per year (Table 3). Grazing is estimated to provide an additional load as of January 1994 of 1887 kg/yr. Assuming a goal of 45% reduction in the total phosphorus levels, forestry land uses are targeting a reduction of 1914 kg total phosphorus per year.

The background component of the sediment/phosphorus load has been determined and disclosed in the Cascade Reservoir Watershed TMDL Phase I and Phase II documents. The reduction target of 45% applies to the management load under the assumptions that natural sources cannot be controlled. The Forestry Source Group recognizes the natural range of variability across watersheds and over time is high in the Cascade Reservoir Watershed. Specifically, the Gold Fork subwatershed has the highest amount of background load. This load is attributed to a naturally high sediment load from granitic soils and landslides. Therefore, it may be difficult to achieve the reduction goal in this subwatershed.

Table 3. Estimated Total Phosphorus Loading, as of January, 1994, for Forest Roads

Subwatershed	Sediment Tons per Year	Total Phosphorus Kg per Year	Bioavailable Phosphorus Kg per Year
West Mountain	1693	266	3.1
NF Payette	571	90	1.0
Cascade	138	22	0.3
Lake Fork	69	11	.13
Boulder-Willow	1010	159	1.8
Gold Fork	11563	1818	21.0
TOTAL	**15044**	**2366**	**27.0**

4.4 Implementation of BMPs

It is recognized that Best Management Practices (BMPs) are the primary mechanism to enable the achievement of water quality standards. Using the estimate of load allocation from the SEDMODL, field inventories, assessments, and monitoring data, BMPs will be planned, designed, applied and refined to reduce sediment delivery to streams. BMPs must be properly applied and maintained by the implementing agency or individual.

Sediment delivered to streams has been significantly reduced since the inception of the State Forest Practices Act. BMPs have been continually updated since the act was adopted; hence, sediment has been on a continuously declining trend on forest lands since the late 1970s. In addition to implementation of normal BMPs required under the Forest Practices Act, local owners of forested lands have committed to increasing the amount of work done to reduce sediment and phosphorus inputs to Cascade Reservoir. Tracking of actions taken that reduce sediment and phosphorus was not initiated until 1984. Hence, quantification of sediment and phosphorus reductions will be calculated against the 1984 baseline. This section outlines the approach to be taken (that has been taken) to implement BMPs in Cascade Reservoir.

Activities to be conducted with the purpose of reducing phosphorus loads to Cascade will include extensive road upgrades, some road closures and relocations, reduction of grazing on forested lands, and improved management of grazing on lands owned and managed by Boise Cascade Corporation and Idaho Department of Lands.

4.4.1 Road Improvements

Forestry Source Group has used and will continue to use the modeled sediment inputs by road segment to prioritize activities that will reduce sediment and phosphorus. Roads with high estimated sediment inputs (>50 tons/year) have highest priority. The first step of treatment includes a site visit to the identified road segment to verify the model assumptions and estimates. If the assumptions and/or calculations are found to be inaccurate, the estimates are corrected to reflect actual conditions. This may result in a change (usually downgrade since the model tends to overestimate sediment) in the total estimated sediment delivered by that road segment and may remove the segment from the list of high priority roads.

If the road segment remains on the list of high priority roads, the appropriate treatment is identified and implemented as funds become available. Treatment targets at least an 80% reduction in sediment coming from the treated segment. Where 80% cannot be achieved, the actual reduction attained is estimated. The sediment and phosphorus reductions attained are estimated and will be reported to DEQ annually (see reporting). Priority segments will be treated, as funding becomes available, until the phosphorus reduction goals are met.

Once reductions goals are met (or very nearly met), the forestry landowners will continue to treat and maintain roads using the standard procedures for identifying and funding projects. Particulars on the approach used to identify and fund projects vary between landowners as is described below.

Forest Service: The Boise and Payette National Forest will treat roads primarily on a project-by project basis. The project type determines the ability to treat a road segment identified in the project area. The general method would include:

1. Validate modeled segments.
2. Decision to treat road segments with a project (NEPA).
3. Implement treatment.
4. Monitoring treatment effectiveness (qualitative assessment of effectiveness).

Road maintenance is scheduled on an annual basis and includes minor reconstruction activities that can treat identified road segments to reduce sediment delivery to streams. Road maintenance activities include: blading, shaping, spot graveling, installation and cleaning of drainage structures (waterbars, culverts, driveable dips, etc).

Each road is assigned a maintenance level by the District. Each District maintains a list of all roads that are on the transportation system and the maintenance level. The maintenance level assigned to each road determines the amount and type of maintenance that the road will receive. Level 1 roads are typically low use roads and require less maintenance and may require a 4-wheel drive. Level 4 roads are high use roads and are used frequently by non 4-wheel drive vehicles. A level 4 road is maintained more frequently and to a higher standard.

Idaho Department of Lands: The Idaho Department of Lands (IDL) has recently completed a road inventory on their lands within the Cascade Reservoir drainage to help identify problems needing attention and to create an accurate inventory of roads. IDL will continue to conduct routine road inspections and provide road maintenance and improvements to reduce erosion and sediment delivery to streams. Periodic maintenance and improvements are accomplished as the need is identified or in conjunction with scheduled timber sales. The Idaho Forest Practices Act stipulates riparian area management, in regard to silvicultural activities.

Boise Cascade Corporation: Boise Cascade annually budgets funds for road maintenance and improvements. Improvements in Cascade Reservoir will be given high priority until the reduction goals are met. Maintenance and improvement of other Boise Cascade roads will, however, be necessary and can affect the improvement schedule in the Cascade Reservoir watershed. For instance, major storm events may necessitate giving maintenance and repair of storm-impacted roads precedence over refinements in the Cascade Reservoir road system. Although such activities may not benefit Cascade Reservoir, the activities will be necessary to provide access and to reduce sediment effects on aquatic resources in other basins.

4.4.2 Grazing

As is the case with roads, the landowners began to change grazing management practices in earnest in 1994, with the intention of reducing phosphorus loads to the reservoir. Therefore, all estimates of improvements will be made relative to the 1994 baseline. Calculations of reductions achieved will follow the procedures described in the Agricultural Implementation Plan.

Forest Service: Grazing allotments on each forest are managed under an annual operating plan and a grazing permit. Several of the grazing allotments have been recently revised (PNF-sheep, BNF-Cascade Res.). The remainder of the allotments may be revised following the Forest Plan direction and activity schedules. A revision may be initiated by a degradation of resource conditions. The timing of these revisions has not been determined. An inventory of resource conditions would be the first step to determine the current conditions and conditions of the Tier I and Tier III areas.

Idaho Department of Lands: Grazing of riparian areas is stipulated by management plans formed in conjunction with lessees. Streams are assessed for proper functioning condition and plans revised as needed. Since cattle can move freely across property lines, grazing leases and grazing management plans are coordinated with Boise Cascade Corporation.

Boise Cascade Corporation: Grazing leases require compliance with grazing management plans. Over the years, Boise Cascade has been working to identify ways to improve grazing management and incorporates those improvements into the management plans. Boise Cascade has committed to reduce the phosphorus introduced into the waters of Cascade Reservoir through further improvements in grazing management. Boise

Cascade's grazing expert has been brought in to help with the development of a revised management plan. The plan will include the development of off-site watering areas, revisions of salting practices, the development and implementation of a pasture rotation system, stubble height requirements, and other practices that will move cattle out of the bottoms and ensure adequate vegetation is present to capture sediment and phosphorus.

4.2.3 Record Keeping

For load-reduction accounting purposes, copies of this documentation and all subsequent sediment/phosphorus reduction activities will be submitted to the Cascade Reservoir TAC for input to the Cascade Reservoir Implementation Database established for all non-point sources within the Cascade Reservoir Watershed.

5.0 SCHEDULE FOR COMPLETION

The forestry landowners have been implementing projects to reduce phosphorus and sediment since 1994 and expect to have met a substantial portion, if not all, of the targeted reduction by the end of 2000. At that time, by far the majority of the high priority roads will have been treated. Beyond the year 2000, the forest landowners will continue to upgrade roads as part of the normal operations. Hence, the quality of forest roads should continuously improve for some time. The Forestry Source Group will prioritize, and schedule the implementation of BMPs as funding becomes available. A firm schedule for completion of the listed goals and objectives cannot be formulated without assurance of funding sources.

6.0 FUNDING/COST

Cost

The cost per kilogram phosphorus reduced will steadily increase as road projects get implemented. The earliest projects will target the road segments that contributed the most phosphorus. Hence these projects reduce the most phosphorus at the lowest cost. Roughly $420,000 in work has been implemented to date. Phosphorus reductions came at the cost of approximately $400 per kilogram phosphorus. This is the expected average cost per kilogram for meeting the first 35% of reduction. Costs of additional reductions are expected to increase exponentially as the benefits of improving roads decrease and costs increase. The next 5% reduction in phosphorus loads will likely cost in the range from $1,000 to $2,000/kg, a further 5% reduction will likely range in cost from $4,000 to $8,000/kg, and so on. These costs are based on estimated reductions of TOTAL phosphorus. Since only 1.15% of the total phosphorus delivered from forest roads is bioavailable, the cost of reducing bioavailable phosphorus is almost 100 times greater. In addition to the costs for road improvements, annual cost for operation and maintenance of the road improvement programs is estimated at approximately $141,500 per year.

Total capital cost for implementing grazing improvements is estimated at approximately $87,000. In addition to these costs, operation and maintenance of the grazing program and facilities is expected to cost approximately $44,000 per year.

Funding

For Federal lands, funding will rely upon fees taken in on timber sales and/or special federal allocations to address water quality problems. Funding for sediment reduction activities would be generated through specific project implementation. Funding sources include: collection agreements, soil and water improvements, road maintenance, ecosystem management, Capital Investment Project (CIP), 5% funds, and Knutsen-Vanderburg (K-V) funds other grants (CWA Section 319, National Forest Foundation, etc). Future direction from the Natural Resource Agenda, and Clean Water Action Plan may also provide future sources of funding.

Idaho Department of Lands relies largely on funds received from timber sales; however, some additional funds are available for annual road programs and through grants. Boise Cascade has an ongoing commitment to maintain and improve roads. However, they, too, have limited funds and must allocate those funds to locations where the most benefit will be received.

7.0 REASONABLE ASSURANCE

The major forest landowners and land managers in the basin have been working together throughout the development of the TMDL and this Implementation Plan. The major landowners have also been working together to implement this plan. All the major forested land managers have committed to achieving the reduction goals on forested lands. The major roads that are contributing the most sediment have been identified and a plan is being developed to address each of them. This commitment on the part of the major forested land managers ensures that the reduction goals will be met for forested lands.

In addition to this commitment, various federal and state requirements and regulations will ensure that the forest landowners continue to maintain and improve road systems and riparian management. Forestry is one of the few regulated land uses in the basin. All owners will have to continue to abide by the rules and regulations of the State. These rules and regulations include the adaptive management imbedded in the Forest Practices Act that requires monitoring of BMP effectiveness and update of BMPs when they are not found to be adequate.

Additionally, the Forest Service will continue to follow Land and Resource Management Plans to implement activities. There is currently a Forest Plan Revision underway, its expected completion date is December, 2000. Activities include: timber harvest, road management, livestock grazing, prescribed fire, watershed improvements, fish habitat improvements, recreation management, and others. The identification of sources of sediment/phosphorus treatments and implementation of treatments will occur concurrently with activities. Activity plans are finalized and implemented as funds become available. Required NEPA and Endangered Species Act analyses will be required prior to implementation. Funding and priority on each Forest will determine scheduling of project implementation. Partnership and cooperative efforts will be developed on a project-by-project basis.

DEQ will rely upon existing authorities and voluntary implementation of additional phosphorus reduction measures to achieve the goals and objectives of this plan. Attainment of water-quality objectives and full support of beneficial uses for Cascade Reservoir, as demonstrated by this plan, will require a significant long-term coordinated effort from all pollutant sources throughout the watershed. All forest landowners are committed to continuing to work with DEQ and the Cascade Reservoir committees to ensure success of the program.

For non-point sources, the feedback loop will be used to achieve water-quality goals. DEQ and other involved agencies will conduct instream and/or qualitative monitoring throughout the watershed to evaluate the overall effectiveness of best management practices (BMPs) and other restoration projects in reducing phosphorous loading. If BMPs and other restoration projects prove ineffective they will be modified to ensure effectiveness of existing and future projects. Any modifications to required BMPs will be subject to state rule-making requirements. DEQ will work closely with the CRCC, applicable resource agencies and affected parties to review the existing regulatory requirements and determine if there is a need for additional requirements for non-point sources activities to achieve the goals of the plan.

DEQ's regulatory and enforcement authorities are generally set forth in the Idaho Environmental Health and Protection Act of 1972, as amended (See Idaho Code Sections 39-101 *et. seq.*).

Following the approval of the Cascade Reservoir Implementation Plan, Phase III of the TMDL document will be prepared (December 2003) using monitoring data to evaluate progress toward attainment of water-quality standards and support of designated beneficial uses. If goals are being reached, or if trend analysis indicates that improvements made are substantial enough to result in attainment of water-quality objectives within a reasonable time frame, the watershed management plan will be a success. If not, the plan will be revised and will outline new goals and a new implementation strategy.

8.0 MONITORING

Success in reducing the current annual load of total phosphorus will be measured by comparing individual subwatershed allocations with the measured contributions monitored at or near the mouth of major tributaries. Potential indicators may be quantitative (e.g laboratory analysis of phosphorus concentrations in water exiting a created wetland) or qualitative (e.g. visual determination that there is less sediment in the water passing through a fenced riparian area) depending on the BMP implemented and the overall scope of the project.

Consistent in-stream, and in-reservoir monitoring by the Idaho DEQ is ongoing within the watershed. In-stream monitoring is scheduled to occur on a monthly basis, year round, and includes physical, chemical and microbiological parameters. In-reservoir monitoring is scheduled to occur monthly during ice-free seasons and includes physical, chemical and microbiological parameters. Idaho DEQ monitoring is expected to continue throughout the implementation process (through 2003), as outlined in the Cascade Reservoir Watershed Phase II Management Plan, and will provide a comprehensive assessment of changes in phosphorus and suspended-sediment loading within the watershed.

Additionally, the forest landowners have been monitoring implementation and effectiveness of activities conducted to reduce sediment/phosphorus loading. Monitoring has included documentation of implementation, sediment traps to test effectiveness of applications, and monitoring of riparian vegetation and stream condition to document changes in streamside habitat resulting from changes in grazing management.

9.0 REPORTING SCHEDULE

Annual reports detailing phosphorus reduction measures implemented, observed emplacement and operation efficiencies, and projected load reductions will be submitted to the appropriate TAC representative for inclusion in the Cascade Reservoir Implementation Database. The forest landowners expect to meet annually at the end of the season to update records and document activities.

10.0 INFORMATION AND EDUCATION EFFORTS

Load reduction information, BMP emplacement mechanisms and performance/efficacy values obtained during the course of implementation will be available to the public through a variety of public forums including reports to the Cascade Reservoir Coordinating Council, Cascade Reservoir Technical Advisory Committee, Cascade Reservoir Implementation Plan Source Groups and other intersected organizations and agencies. The information will also potentially be available to the public through the Cascade Reservoir Implementation Web site, public tours, implementation efforts brochures published as part of the Cascade Reservoir Implementation Plan, and included in the Cascade Reservoir Watershed Phase III Management Plan document which will be completed in 2003.

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APPENDIX A

OVERVIEW OF SEDMODL CALCULATIONS

(Wold and Dubé 1998)

Overview of SEDMODL Calculations

The construction and use of roads can be a significant source of sediment in forested basins. Road construction removes vegetation from the road cutslope, fillslope, ditch, and tread, leaving these areas susceptible to erosion. Over time, the cutslope and fillslope revegetate and erosion from these sources is reduced, however, the road tread and ditch continue to be sediment sources as long as the road is in use. Research has shown that the most important factors determining how much sediment is produced from the road tread are how much the road is used and the amount and type of road surfacing. In addition to these factors, the configuration of the road drainage system, particularly whether or not road drainage reaches the stream network, determines if sediment produced from roads has the potential to affect aquatic resources.

1.0 Road Segment Delivery

One of the goals of the model is to identify which portions of the road network in a basin are delivering sediment to streams. That way, land managers can pinpoint where to direct road improvements to reduce sediment input to streams. The model divides the road network into three categories: segments that deliver directly to streams (i.e. at stream crossings); segments that deliver sediment indirectly to streams (i.e. roads closely parallel streams, within 100 feet and within 200 feet); and segments that do not deliver to streams (i.e. runoff is directed onto the forest floor and infiltrates). Segments in the latter category are dropped from further computation because sediment produced from these portions of the road network do not reach the stream system.

Stream crossings are defined first using a series of intersections of the road and stream layer. These intersections are then input into the elevation grid to be used as a starting points for calculating the delivery length to each crossing. Each grid cell on either side of this point is evaluated to determine if it is higher, lower or the same elevation as the stream crossing. If the new cell is higher in elevation, it becomes the new starting point. This process continues until the next elevation is lower than the previous cells' elevation. The road segments that match with these newly defined areas of direct delivery are extracted from the road layer. The model then buffers the stream layer to 100 and 200 feet and extracts the roads with indirect delivery.

Road segments that deliver directly to streams are assigned a delivery factor of 1, meaning that 100 percent of water and sediment produced from these segments is delivered to the stream network. Road segments that do not deliver to streams are assigned a delivery factor of 0. Road segments that deliver sediment within 200 feet and 100 feet of a stream, but not directly to a stream, are assigned a delivery factor of 10 percent and 35 percent; respectively (WDNR 1995).

2.0 Erosion from Delivering Segments

Erosion from roads in the basin was estimated using formulas based on empirical relationships between road use, parent material, road surfacing, road surface slope, cutslope and fillslope vegetative cover, and delivery of eroded sediment to the stream network (WDNR 1995, Beschta 1978, Bilby et al. 1989, Megahan et al. 1986, Reid and Dunne 1984, Sullivan and Duncan 1980, Swift 1984).

Sediment is produced from four components of a standard forest road prism: the cutslope, ditch, tread, and fillslope. Since the intended use of this model is a screening tool, actual dimensions and conditions of each of these components throughout the road network are not known. The model uses several simplifying assumptions to allow calculation of relative sediment yield based on measurements of road prisms on over 800 road segments in watersheds in Washington, Oregon, and Idaho. These measurements were made on private, state and federal lands as part of road erosion surveys during watershed analyses.

The first simplifying assumption is that roads in the watershed have been in place for several years, and cutslopes and fillslopes have revegetated and stabilized. While there are likely several miles of new roads (less than 2 years old) in a watershed at any given time, it is assumed that land managers know where these new roads are and have or could take appropriate erosion control measures at stream crossings to reduce sediment input from these segments until the roads have stabilized. The majority of erosion from new roads comes during the first 2 years from fillslopes, cutslopes, and ditches until these areas revegetate and/or armor. Erosion control on portions of these surfaces that drain to streams and/or sediment detention measures where ditches enter streams has been shown to effectively reduce sediment input from fresh roads.

The second assumption is that most roads in the watershed are insloped with a ditch. This directs water away from fillslopes, and results in only short lengths (average 50 feet) of fillslopes that deliver sediment to streams at road crossings. Field observations and calculations indicate that erosion from the short, vegetated/armored sections of fillslope that occurs at most stream crossings is much smaller than from other portions of the road prism. Therefore, the model assumes that fillslope erosion is negligible. There may be a few locations in your watershed, such as where a road closely parallels a stream for a long distance, or, as mentioned previously, some new road crossings where this assumption is not valid.

The model also groups erosion from the tread and ditch together, so assigned road widths described below include both the running surface and ditch widths. The result of this assumption is to apply surfacing and traffic factors to the ditch as well as the tread. These two factors will tend to even each other out since most heavily used roads (high traffic factor) have gravel surfacing (lower surfacing factor). Very heavily used gravel roads (main haul roads) will have a very high traffic factor, but applying this to the ditch is probably appropriate since these roads and ditches are likely regraded frequently, disturbing the ditch's armor layer and increasing sediment production.

The average annual volume of sediment delivered to a stream from each road segment is calculated based on the following formulas:

Total Sediment Delivered from each Road Segment (in tons/year) = Tread + Cutslope

Tread = Geologic Erosion Rate x Tread Surfacing Factor x Traffic Factor x Segment Length x Road Width x Road Slope Factor x Precipitation Factor x Delivery Factor

Cutslope = Geologic Erosion Rate x Cutslope Cover Factor x Segment Length x Cutslope Height x Delivery Factor

Values for each factor in the equations are obtained from either model-supplied or user input values or from lookup tables associated with road class, surfacing, slope, or hillside slope obtained from the GIS database. These values are described below.

2.1 Geologic Erosion Rate

The inherent erodibility of a particular road segment is determined by soil attributes where the road is constructed. Soil erodibility is affected by the soil particle size and cohesiveness. Soils with a high silt content are most erodible; clay-dominated soils are less erodible, and soils with a high gravel component are least erodible (Goldman et al. 1986, Burroughs et al. 1992). Since most road prisms are graded into the sub-soil, erodibility is a factor of parent material (geology) and degree of weathering.
The geologic erosion rate is selected for each road segment from the geology coverage used in the model. The default geology coverage is based on the 1:500,000 scale geologic maps of Idaho, Washington, and Oregon supplied with the model (Bond and Wood 1978, Huntting et al. 1961, Walker and MacLoed 1991). Geologic erosion rates for each geologic unit on the maps were assigned based on dominant lithology and age as shown in Table 2.

Table 2. Geologic Erosion Rates for 1:500,000 Scale Map Lithologies (in tons/acre/year)

	Geologic Age of Formation[1]				
Lithology	Quaternary	Tertiary	Mesozoic	Paleozoic	Precambrian
metamorphic	-	15	15	15	15
schist	-	60	60	60	60
basalt	15	15	30	30	30
andesite	15	15	30	30	30
ash	50	50	50	50	50
tuff	50	50	30	30	30
gabbro	-	10	10	10	10
granite	-	20	30	30	30
intrusive	-	15	15	15	15
hard sedimentary	-	15	15	30	30
gravelly sediment	15	15	-	-	-
soft sediment	30	30	-	-	-
fine-grained soft	60	60	-	-	-

sediment						

[1] Some lithology/ages categories do not have geologic erosion rates because these categories do not occur (i.e. there are no Quaternary metamorphic rocks present on the earth's surface).

Geologic erosion rates shown in Table 2 were based on measured road erosion rates reported by researchers with surfacing, traffic, slope, and precipitation factored out (Reid 1981, Reid and Dunne 1984, Swift 1984, Dryess 1975, Ketcheson and Megahan 1996, Foltz 1996, Bilby et al. 1989, Vincent 1985, Luce and Black in press, Kochenderfer and Helvey1987). In addition, research and guidelines on erodibility of different soils/geologies was consulted to extend the table to geology types without road erosion measurements (André and Anderson 1961, Burroughs et al. 1992, Reinig et al. 1991, WDNR 1995). Erosion rates for basalt, andesite, granite, and sedimentary rocks were assumed to be slightly higher for Mesozoic and older rocks because these rocks are subject to chemical weathering that result in deeply weathered, erosive soils.
If the user chooses their own, basin-specific geologic coverage to use to assign the geologic erosion rate, rates for various lithologies should be based on Table 2 since these rates are scaled to the precipitation and traffic factors the model uses.

2.2 Tread Surfacing Factor

Road surfacing factors are based on surfacing information linked to road arcs in the GIS database. Surfacing factors for various road treatments are shown in Table 3 (based on WDNR, 1995, Burroughs and King 1989, Swift 1984, Foltz and Burroughs 1990).

Table 3. Road Tread Surfacing Factor.

Surface Type	Surfacing Factor
Asphalt	0.03
Gravel	0.2
Pitrun	0.5
Grassed Native	0.5
Native surface	1
Native with ruts	2

2.3 Road Width and Traffic Factors

Road width and traffic factors are based on the road class assigned each road arc in the GIS database. Width and traffic factors for various road classes are shown in Table 4. Traffic Factors are based on WDNR (1995), Reid and Dunne (1984), and Foltz (1996). Road widths include both the running surface (tread) and ditch. These values are based on average measurements taken during road erosion inventories on road segments that drain to streams.
Select the road use category that most closely fits each road type in your road file. Average traffic use for both log truck traffic and residential/recreational/administrative traffic (vehicles/day) is provided as a guideline. Use of specific roads by log trucks changes over time as timber sales occur in different parts of a watershed. If the purpose

of your modeling is to determine average road erosion in the watershed, pick the long-term average traffic rates on each road type. If the purpose of modeling is to determine sediment input from a specific timber sale, select use rates that best fit the traffic rates on that road during the sale.

Table 4. Road Width and Traffic Factors.

Road Class	Description	Average passes/day Log Truck	Average passes/day Pickup/car	Road Width (ft)	Traffic Factor
Highway	Highway	>5	>5	40	120
Main Haul	Heavily used by log truck traffic throughout the year; usually the main access road in a watershed that is being actively logged	>4	n/a	30	120
County Road	Wide, county-maintained road that receives heavy residential and/or log truck use	1-4	>10	35	50
Primary Road	Receives heavy to moderate use by log trucks throughout all or most of the year. Usually roads branching off main haul road that head up tributaries or that access large portions of the watershed	1-4	5-10	25	10
Secondary Road	Receives light log truck use during the year. May occasionally be heavily used to access a timber sale. Receives car/pickup or recreational use.	<1	1-5	18	2
Spur Road	Short road used to access a logging unit. Used to haul logs for a brief time while unit is logged. On the average receives little use	<1	<1	15	1
Abandoned/ blocked	Road is blocked by a tank trap, boul3ders, etc. or is no longer used by traffic	0	0	15	0.1

2.4 Road Slope Factor

A road slope factor is assigned to each road segment based on the slope of the road tread as calculated by the GIS. Factors are shown in Table 5 (based on Luce and Black in press, Reinig et al. 1991).

Table 5. Road Slope Factor.

Road Tread Slope	Slope Factor
< 5 percent	0.2
5-10 percent	1.0
> 10 percent	2.5

2.5 Cutslope Height

Cutslope height is assigned based on hillside gradient. The model calculates hillside gradient and groups it into one of 4 categories. Cutslope height for each gradient category (Table 6) is based on the average of cutslope heights measured during road erosion inventories. The field measurements were mean cutslope height over the length of road that drained to the stream. These averaged heights may be lower than expected because they take into account the low (or non-existent) cutslope height close to a stream crossing.

Table 6. Cutslope Height.

Hillside Gradient	Cutslope Height (ft)
0-15 percent	2.5
15-30 percent	5
30-60 percent	10
> 60 percent	25

2.6 Cutslope Cover Factor

The model assumes a default value of 70 percent vegetative and/or rock cover on cutslopes, with a corresponding cover factor of 0.254. The 70 percent cover value was the average of cutslope cover during the road erosion inventories. Table 7 lists cover factors for other percent cover values if you feel another value is more appropriate for your watershed (based on WDNR 1995).

Table 7. Cutslope Cover Factor.

Percent Vegetation or Rock Cover	Cover Factor
100	0.1023
90	0.1500
80	0.2003
70	0.2540
60	0.3116
50	0.3742
40	0.4435
30	0.5222
20	0.6155
10	0.7700
0	1.0000

2.7 Precipitation Factor

A precipitation factor is assigned based on the average annual precipitation (inches) in the basin and the following formula (based on Reid 1981):

$$\text{Precipitation Factor} = \left[\frac{\text{Average Basin Precipitation (inches)}}{\text{60 inches}}\right]^{0.8}$$

2.8 Delivery Factor

Delivery from each road segment is assigned by the model based on whether or not the segment drains directly or indirectly to a stream as described in Section 3.1 and displayed in Table 8:

Table 8. Road Delivery Factors.

Drainage from Road Segment Flows	Percent of Sediment Delivering
Directly to Stream	100
Within 200 feet of stream	10
Greater than 200 feet from stream	0

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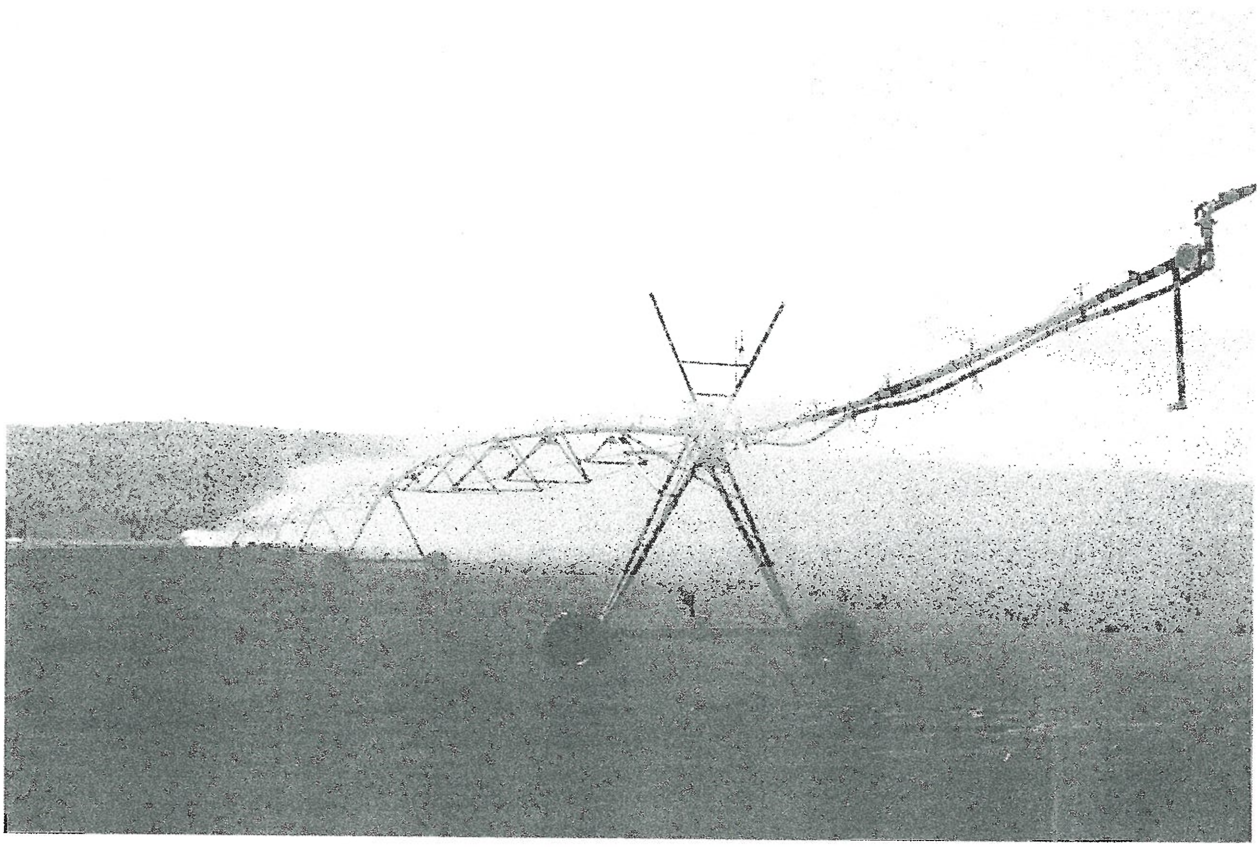
Agricultural Implementation Plan

Cascade Reservoir Phase II Watershed Management Plan



June 2000

Submitted to the
Cascade Reservoir Technical Advisory Committee
and the Cascade Reservoir Coordinating Council
as part of the

Implementation Plan
for the
Cascade Reservoir Phase II Watershed Management Plan

Cascade Reservoir Watershed Management Plan
Implementation of Agricultural Source Plan
Phase II TMDL

Revised

March 9, 2000

Final Draft

Introduction

The purpose of this implementation plan is to expand on the Cascade Reservoir Management Plan - Phase II document providing for conception of a detailed plan of action for design, implementation and evaluation of best management practices (BMPs). These BMPs are to be put into practice on agricultural land in the Cascade Reservoir watershed. This implementation plan is not static but is meant to be a dynamic document with implementation changes and modifications occurring as data and documentation becomes available throughout the life of the management plan.

Availability of cost-share funds to agricultural producers will be necessary for the success of this plan and the final reduction of nutrient loading necessary to meet the TMDL requirements. These funds will need to come from multiple sources such as federal, state and private funds and should be made available to producers in all of the seven subwatersheds (see listing in appendix A) that are present in the Cascade Reservoir watershed.

Objectives

Overall objectives of the implementation plan focuses on the application of BMPs on agricultural lands, measurement of effectiveness of implementation of BMPs, potential reduction of phosphorus loading to surface water systems, schedule of implementation and projected costs of the implementation process.

1. Application of BMPs -. The implementation of BMPs will be planned on a watershed basis but will be prioritized from definite subwatershed criteria such as phosphorus loading factors established from cost versus phosphorus removal ("biggest bang for the buck"). Cost analysis developed in this plan will allow for the evaluation of cost versus reduction.

2. Reduction of Phosphorus loading - The goal of the implementation plan is tied to the TMDL and reduction of phosphorus loading transported into Cascade Reservoir and the watershed's surface water system. This load reduction is paramount to the success of this plan as well as meeting the goals established for the TMDL. Reductions will be calculated with numbers that were developed in the Phase II - Agricultural Source Plan document.

3. Schedule of Implementation - Implementation will follow the availability of funds providing for the assistance in the installation of BMPs. If funds become available for the watershed then specific criteria based upon location to riparian areas, areas with critical or degraded acres or subwatersheds with high loading coefficients will be address with a priority. A ranking system for individual BMPs as well as complete resource systems where BMPs are implemented as groups or systems will be produced based upon calculated costs versus reductions.

4. Projected Costs of Implementation – A cost projection of total dollars required to reach the 30% total phosphorus reduction may be calculated dependant upon load reduction for existing practices versus the total dollars spent. This cost estimate will be used as a tool for the acquisition of further cost-share funds required for the implementation of additional BMPs necessary to reach total reduction goals. Projection will also be made as to the cost associated with the application of individual BMPs or a group of BMPs composing a system.

5. Milestones and Measuring Devices - Specific implementation goals have been set during the Phase II - Agricultural Source Plan. To determine where agriculture stands in achieving the desired goals a series of BMP spot checks, annual reviews and evaluations will be used to determine advancement toward reduction goals. A database and GIS analysis will also be developed for accurate accounting of implementation, reductions and dollars spent. If evaluations produce significant question as to obtaining reduction goals, then efforts and funds could be funneled into more cost-worthy implementation projects.

Methods have also been discussed in the source plan, which could be used for the measurement of actual success of BMP implementation. These measuring devices and tools are discussed in section discussing monitoring. These tools will be used to help in the evaluation of obtaining the final 30% load reduction specified by the Phase II Management Plan. Reports and summaries that are submitted to cooperating agencies may use these measuring tools as a basis for milestone measurements.

Load Allocations and Reduction by Watershed

The Phase II Agricultural Source Plan developed and set load allocations and reduction necessary to meet the TMDL 30% reduction goal. The loads and reductions are outline in Table 1 of Appendix A and are broken down by tiers as well as by individual subwatersheds.

Load reductions and acres required to meet established goals have determined the priorities of this implementation plan. To meet the reduction goals for tier 1, the average subwatershed acreage implementation required is 83 per cent of all tier 1 lands. Some of the tier 1 subwatersheds will require up to 100 per cent of their total tier 1 acreage's implemented with BMPs. Because of this high implementation per cent requirement a goal for tier 1 BMPs has been set at 100 per cent treatment of the acreage.

Likewise for tier 2 acres, the average implementation required for all subwatersheds is at 71 per cent. Because of this the second priority set for an implementation goal is the treatment of 75 per cent of tier 2 acres. This goal would achieve the 30 per cent reduction in all subwatershed except for Gold Fork, Cascade and West Mountain subwatershed where 98 to 100 % of tier 2 acres would require treatment and would be the targeted goal of implementation.

Because of the low return on costs associated with phosphorus reductions from BMPs implemented on tier 3 acres the movement of loading from one tier to another has been accomplished in the case of tier 3 acres. The loads and acres calculated for tier 3 acres were transferred from tier 3 acres and allocated to more responsive tier 1 or 2 acres. This is the case in all subwatershed. This process eliminated all BMP implementation in low cost-efficiency tier 3 acres except for the case of the West Mountain and Gold Fork subwatersheds where tier 3-acre reduction requirements exceeded the amount that could be transferred to other tiers. West Mountain or Gold Fork could be an example where the remaining tier 3 acres could be transferred to another subwatershed where implementation goals have been exceeded.

Priorities for implementation will be set for subwatersheds where the loading coefficients calculated in the Phase II - Agriculture Source Plan show that these watersheds have the highest loads not because of the size of the subwatershed but based upon the loading coefficient. If subwatersheds with high load coefficients are set with a high priority, the BMPs implemented should have results of greatest return based upon monies spent. The Boulder/Willow, Lake Fork and North Fork of the Payette River are good examples for priority implementation. These three subwatersheds have the highest loads, the highest loading coefficients for both tier 1 and 2 as well as the greatest potential for load reduction per cost based upon load coefficients.

Implementation of Agricultural BMPs

Agricultural systems and associated BMPs have been listed in the Phase II - Agricultural Source Plan in the Appendix D of the document. The tier of land that they correspond to, such as tier 1, 2 or 3 have individual BMPs listed. These BMPs have also been grouped in systems where if installed and implemented in a system the best possible reductions would most likely occur. Individual component practices may be installed by themselves or in any combination within the BMP system. The more of the component practices that are implemented within the system the greatest possible reduction is believed to be achieved (dependant upon management practices and efficiencies). Costs of installation as well as annual costs have been calculated for each BMP listed within each system (appendix C). The costs were calculated using cost lists from the SAWQP and EQIP conservation programs.

Based upon the cost associated with the implementation of previous statewide projects from existing federal and state cost share programs, estimated dollar projection may be made for each of the subwatersheds in the Cascade Reservoir watershed. Table 2 in Appendix A shows the cost requirements of future programs needs for meeting the 30 per cent load reductions required to meet the TMDL goals. The total dollars cost associated with the implementation plan to meet the TMDL reduction goal has been estimated to reach $17,700,000. With reduction trading within subwatersheds however, that cost could be significantly reduced.

Reasonable Assurances of Implementation

BMP implementation for agriculture is a voluntary incentive-based programs. Historically, cost-share incentives have been available to producers from state and federal conservation programs. The state incentive program was the SAWQP program. This program was established to assist agricultural producers in subwatesheds where critical acres are determined in initial planning stages. These critical acres are defined as the acres contributing to the defined problem associated to the decline in water quality. In the Cascade Reservoir those subwatersheds that have a SAWQP plan developed is Boulder, Willow and Mud Creeks. Contracts were developed and work has proceeded on these contracts through the Valley Soil and Water Conservation District (VSWCD). The SAWQP program has been historically funded through the Idaho Pollution Control Account. That fund has been projected to run out of available funds in 1999. All funds from this account have been allocated and the ability to write new contracts has been frozen.

A new statewide cost-share program has been written and approved by the supporting state agencies. The request for a new conservation program was presented to the State Legislature and was approved and funded for the state fiscal year 2000. At the time this plan is being written there are no available funds or programs for writing cost-share incentive contracts administered by the State of Idaho. Funds will become available July, 1999.

Federal Programs have been available for cost-share programs. These programs historically include Agriculture Conservation Program (ACP), Conservation Reserve Program (CRP), as well as Habitat Improvement Program (HIP), Wildlife Habitat Incentive Program (WHIP) and the most recent program, the Environmental Quality Incentive Program (EQIP). This program has been available to landowners or producers for the implementation of BMPs or practices which when in place will have a positive impact upon the land and surrounding water quality. The federal programs are developed outside the State of Idaho. Availability of funds, longevity of the program as well as rules of the programs is not options of local management for the programs. A level of environmental consciences has been present as of late in the U.S. Congress. This has brought about the continuation of programs such as the CRP program or the development of new programs such as EQIP. The continuation of federal cost-share programs should continue on into the future to assist meeting the requirements of the TMDL.

Some programs are administered through local avenues such as with the VSWCD. As the movement toward locally led conservation becomes more prevalent, the conservation district could become a new avenue for direct cost-share incentive programs. With the planning and potential setup of nonprofit arm of the conservation districts in the state of Idaho the possibility for grant awards for conservation work may become a reality. The grants would be written within districts for implementation of conservation work within the boundaries of the district. All of these programs; federal, state or local, share one common goal for the landowner. That is for the education and increasing management level required by landowners in the efficient running of their agricultural enterprises. The implementation of BMPs upon the property of a landowner requires an increase in management levels do occur for the efficient and successful implementation of the BMP. Without this increased management level, decreasing levels of pollutants to the level necessary to meet the TMDL will not become a reality.

Schedule for Implementation

With the establishment of a new state conservation program for the fiscal year 2000, contracting for implementation of conservation work could begin in July of 1999. This program will be very similar to the previous SAWQP program. Contracting could be initiated on the previous listed subwatershed which have the highest loading coefficient and the greatest potential for recovery.

Federal contracting for the EQIP program continues at the time this document is being prepared with a new signup period is scheduled for June, 1999. Since the Cascade Watershed is not considered a high priority area, competition for funds are established on a statewide scoring system and all contracts are competing for a limited pool of funds.

Monitoring Plan

Once BMPs are put into place, are they being maintained, are they continuing to work as design and are specified reduction from that BMP still being achieved? These questions may be answered with the development of a monitoring plan for all the subwatersheds. The monitoring plan will include spot monitoring checks to see if BMPs are in place as designed, BMP evaluation to see if the BMP is performing as designed and the reduction numbers being reported are achievable.

Initial review for BMP implementation provides for the estimation and evaluation of landowners and subwatershed contribution to the water quality of the watershed. During the development of the Phase II - Agriculture Source Plan, two methods for conservation assessment were included within the plan. These are the Phosphorus Index Rating, which is a visual assessment of the land where BMPs may be applied. This Index allows for the estimation as to the potential of the land to contribute to the water quality degradation based upon field conditions. This index may then be used to plan and apply appropriate BMPs for required reduction.

A BMP system matrix was also developed for planning and implementing BMPs. These practices may be scored as to the potential for efficiency, possible reduction achievable with the implementation of the system and the component parts and the cost associated with the removal of the pollutant and the implementation of the practices. Both of these evaluation tools are located in appendix B.

Spot check could be included with the annual reviews now used for the SAWQP program. Landowners are contacted and visits to the property are scheduled. Contracts are reviewed with the owners and problems or modifications to contracts and BMPs are listed. These are filed with all contracts every year. Spot checks could be a quality control device for evaluating BMPs that are implemented. BMP evaluation for effectiveness has been used in the past with the SAWQP contracts. These effectiveness reviews look at the BMPs that have been put into place and make a quantitative analysis based upon visual observations. No qualitative analysis is done within the BMP effectiveness evaluations. Examples of BMP effectiveness evaluation forms may be found in appendix D.

Federal programs provide for both spot checks and evaluations of resources during initial planning stages. Planning for conservation on federal projects provides for the assessment of the land using a field problem checklist. This checklist provides for the visual evaluation of the land for soils, water, air, plants and animals.

Measuring and Reporting Milestones

With the use of spot check of BMP implementation as well as monitoring of existing and new conservation work, data can be accumulated and reported on a yearly basis. These reports may be used as a tool for tracking pertinent information such as acres treated, dollars spent, visual resource condition and improvement (if difference in condition can be assessed).

They results may be presented on a yearly basis in a written report made available to cooperating local, state and federal agencies as well as interested private citizens. These reports would be published in hard copy form as well as made available on the Cascade Reservoir watershed web site. This site will be developed in the near future.

One avenue that may be used in the near future for data recording and presentation of a Geographical Information System (GIS) will be the development of a database. This database will be used for developing current analysis of work that has been done within the watershed. This data will in turn be used for report generation, TMDL goal reviews and GIS analysis and representation with maps. One unique way that this may be accomplished is through the development of a module within the Idaho One-Plan project. This project may allow for the initial data input on an Internet platform with the analysis and GIS perform within the One-Plan user interface. The possible development of this would allow for the input of common data statewide for multiple projects. This possible project is in the initial planning stages and the feasibility of the platform has not been investigated to any great depth at the time this report is being prepared.

The TMDL management plans calls for the review of the source plans that have been developed along with the management plan. This review is the phase III juncture of the TMDL process for Cascade Reservoir. The plan calls for the evaluation of the plan and the related parts before January, 2003. This review will look at work that is being done and evaluations will be review for the analysis of predefined goals. If these goals are not being met, at this time the implementation plan will be review and revised where it is believed that the plan has not achieved the goals. A new implementation plan will then be developed for review by appropriate agencies.

Information and Education

The conservation district has been involved in various efforts to increase the knowledge as well as increase the awareness of conservation practices for the landowners. This has been advanced with methods such as with newsletters, workshops, articles and conservation planning.

Newsletters are mailed out to producers, landowners and interested residents of the district. These newsletters are produced at the district and provide general information about conservation practices as well as current events occurring at the district.

Workshops are held on an annual basis and they cover topics, which are of special interest in the district. These topics include ranchette management, weed identification and animal health.

These workshops have been well attended by the general public.

The district has also provided local media with articles about singular issues of interest that will be occurring within the near future. Inserts from the local paper have been funded by and produced by the district. Subjects such as riparian management have been covered by this method.

Education of landowners and producers occurs on a personal level when district planners visit and work with such person and develop conservation plans. These plan provide for the direct education of the producers while they provide contact of the planners with the people who are involved with the implementation of BMPs on the agricultural lands.

Conclusion

The priorities for this plan are listed as follows:

> The subwatersheds of priority where implementation of BMPs would have the largest impact based upon the loading coefficients (the highest load) are the Boulder/Willow, the Lake Fork and the North Fork of the Payette River.
>
> A priority that was established in the Phase II -Agriculture Source Plan was the work to be done in the tier 1 acres with a goal of implementation set at 100% and the work being done in the tier 2 acres with an implementation goal of 75%.
>
> A relational database will be set up that will track the implementation of the work that is being done in the watershed, which includes BMP implementation, reductions achieved, monies spent and total costs. This database will then be used to develop maps using a geographical information system (GIS). A possible tool for the development of this database may be the Idaho One-Plan.
>
> Evaluation tools that will be used for the measure implementation efficiency, effectiveness and to be used during the planning process will include tools used by the federal and state from previous conservation programs. Planning tools developed during the Phase II - Agriculture Source Plan will be used for planning conservation work.
>
> A timeframe will be developed for the determination of implementation goals. This timeframe will be used for the measurement of milestone achievement. These achievement will be reported in a yearly report that will produced and sent out to all appropriate agencies. Included in this report will be projects completed, reduction achieved, total dollars spent, monitoring and evaluation work and *how far do we have to go*. This report will include GIS projects for the work done.

Appendix A

Appendix A is a compilation of data obtained from the Phase II Cascade Reservoir Management Plan – Agricultural Source Plan presented in table form which outlines the requirements of the agricultural community for meeting the TMDL goals set forth in the source plan document. Table 1 projects the total amount of acres requiring implementation based upon the calculated acres and loads for each listed subwatershed.

Tables 2 is used for the determination of the total monetary requirements that are projected for meeting the 30 per cent load reduction within each of the subwatershed. The subwatersheds have also been broken down by tiers as to the amount of money required within each tier that will be needed to meet the reduction goals.

Table 1. Acre by Tier, Load Allocation and Reductions Required to Meet TMDL Goals (Listed by Subwatershed)

Sub Watershed	Tier1 Acres	Tier 1 Acre Load (kg)	Tier 1 Acre 30% Reduction (kg)	Tier 1 Acres Requiring Treatment [1]	Tier 2 Acres	Tier 2 Acres Load(kg)	Tier 2 Acres 30% Reduction (kg)	Tier 2 Acres Requiring Treatment [2]	Tier 3 Acres	Tier 3 Load (kg)	Tier 3 Acre 30% Reduction*	Tier 3 Acres Requiring Treatment [3]
Boulder/ Willow	1,079	376	170	638	8,304	1,910	732	5,306	2,213	67	0	0
Cascade	727	26	18	717	4,132	145	92	3,796	3,259	117	0	0
Gold Fork	890	98	72	874	3,143	314	200	3,133	3,437	399	40	861
Lake Fork	1,228	424	261	1,015	6,504	1,821	697	4,151	2,668	256	0	0
Mud Creek	1,062	126	51	549	9,290	576	221	5,930	491	8	0	0
NF Payette	1,374	272	195	1,320	5,762	1,268	567	4,209	4,256	446	0	0
W Mtn	1,238	113	82	1,229	121	6	3	111	5,166	325	84	3,357
Total	**7,598**	**1,435**	**849**	**6,342**	**37,256**	**6,040**	**2,512**	**26,636**	**21,490**	**1,618**	**124**	**4,218**

* Because of the declining cost-efficiency of treating Tier 3 acres, all acres required for reduction except in the case of West Mountain have been reallocated to the Tier 1 and 2 redu requirements. This allows for the implementation of BMPs in tiers where the most beneficial use may be obtained with the money spent.

[1] Tier 1 acres requiring treatment based upon calculations made in the Phase II Agricultural Source Plan using an efficiency rating of 70% for BMPs implemented in tier I acres

[2] Tier 2 acres requiring treatment based upon calculations made in the Phase II Agricultural Source Plan using an efficiency rating of 60% for BMPs implemented in tier II acres

[3] Tier 3 acres requiring treatment based upon calculations made in the Phase II Agricultural Source Plan using an efficiency rating of 40% for BMPs implemented in tier III acres

Table 2. Projected Cost Associated with the Implementation of Agriculture BMPs, All Tiers

Sub watershed	Tier 1 Acres	Acres Requiring Treatment	Aver Cost/ Acre for BMP [1]	Total Dollars, $	Tier 2 Acres	Acres Requiring Treatment	Aver Cost/ Acre for BMP [1]	Total Dollars, $	Tier 3 Acres	Acres Requiring Treatment	Aver Cost/ Acre for BMP [1]	Total Dollars, $	Total Dollars, all Tier
Boulder/ Willow	1,079	638	350	223,300	8,304	5,306	500	2,653,000	2,213	0	500	0	2,876,300
Cascade	727	717	350	250,950	4,132	3,796	500	1,898,000	3,259	0	500	0	2,148,950
Gold Fork	890	874	350	305,900	3,143	3,133	500	1,566,500	3,437	861	500	430,500	2,302,900
Lake Fork	1,228	1,015	350	355,250	6,504	4,151	500	2,075,500	2,668	0	500	0	2,430,750
Mud Creek	1,062	549	350	192,150	9,290	5,930	500	2,965,000	491	0	500	0	3,157,150
NF Payette	1,374	1,320	350	462,000	5,762	4,209	500	2,104,500	4,256	0	500	0	2,566,500
West Mtn	1,238	1,229	350	430,150	121	111	500	55,500	5,166	3,357	500	1,678,500	2,164,150
Total	**7,598**	**6,342**		**2,219,700**	**37,256**	**26,636**		**13,318,000**	**21,490**	**4,218**		**2,109,000**	**17,646,700**

[1] Average cost per acre for BMP implementation derived from BMPs that have been installed in the State of Idaho

APPENDIX B

The matrices listed within this appendix have been developed for the listing and determination of costs associated with the application of individual BMPs or complete systems on tiers within the watershed. With the development of costs associated with the application of these BMPs, a ranking of efficiency associated with load reduction and costs have also been developed.

Explained below is the explanation of the methodology used to develop the matrix costs and rankings. The following was used:

1. Based upon the loading coefficients determined in the Agricultural Source Plan for each subwatershed and for each tier the loads were average and listed under each listed BMP system.

2. Efficiencies for each BMP system are listed from a low to high efficiency. The efficiency was estimated during early planning meetings of the Agricultural Source Plan Committee. These estimates of efficiency are considered best professional judgment.

3. The average load coefficient was used to multiply to the range of efficiencies to determine the total phosphorus that the system will remove. This column is listed as kilogram of phosphorus removed per acre (kg/ac).

4. A range of construction/implementation cost were developed using the cost lists associated with the NRCS Environmental Quality Incentive Program (EQIP) or the State Agricultural Water Quality Program (SAWQP). The range is used to allow for the flexibility associated with individual agriculture producer's implementation, from the installation of an individual BMP to a complete BMP system. The range listed is from the cheapest practice to the costliest system for each tier.

5. The construction/implementation costs are divided by the total phosphorus removed category based upon the fact that the lowest amount of phosphorus reduction will occur from single BMP practice installation (which will have lowest removal efficiency)and will be divided into the lowest cost of implementation. The highest value listed for phosphorus removal will also be divided into the highest construction/implementation cost (complete system) with the highest efficiency related to the implementation of a complete system. These calculations will provide for a range of values listed in the Unit Cost column. This column units is listed as dollars per kilogram phosphorus removed per acre ($/kg TP/ac) and would be used to evaluated the efficiency of load reduction per dollar spent or as sometimes stated "biggest bang for the buck'. This bang for the buck is used to evaluate the systems and provide for a means of ranking the practices with the highest removal for money spent being rated as number 1 and continues down to the end ranking. Because a system might rank low upon this evaluation that does not mean that similar systems should not be looked at. Individual practices or systems should be looked at on a case-by-case situation, if warranted.

VSWCD AG SOURCE PLAN BOULDER CREEK TIER 1 LOWLAND IRRIGATED ACRES

Critical Treatable Acres:___________ Tier 1 Acres: ______________	Site Information		Source Control or Treatment	Primary Characteristics Removal 0-25% = 1 26-50% = 2 51-100% = 3 Weight Factor X 2				Costs, $					Secondary Characteristic Removal (Check Boxes. One Point for Each)						Additional (Tertiary) Watershed Benefits? (Check Boxes. One Point for each)						
TIER 1 RIPARIAN/WETLAND BMPs	Project Size (acres)	Level of Participation	(1 point for source control; 0 points for treatment)	Orthophosphate Removal %	Phosphorus Removal %	Sediment Removal %	Subtotal Points	Total P Removed (kg)	Unit Cost ($/kg TP)	Construction/ Implementation	Annual Maintenance	Total Annual Cost/Present Worth	Rank	Nitrogen	Temperature	pH	DO	Subtotal Points	Fisheries	Instream Flows	Aesthetics	Economics	Public Health	Recreation	Subtotal Points
1. Planned Grazing Systems-High Potential for Recovery 34-75% Efficiency -Ave Load – 0.006			1	1	3	1	12	.002-.0045	5000-64,000	10-287.50	1-29	11-316.50	7	1	1	0	0	2	1	0	1	1	0	0	3
2. Planned Grazing Systems-Low Potential for Recovery 45-70% Efficiency -Ave Load – 0.281			1	0	1	0	4	.001-.096	10,000-6,026	10-578.5	1-58	11-636.5	5	0	0	0	0	0	0	0	1	1	0	0	2
3. Non-Grazing Systems-High Potential for Recovery 54-85% Efficiency- Ave Load – 0.006			1	3	3	1	16	.003-.0051	3,333-50,490	10-257.5	1-26	11-283.5	6	1	1	0	0	2	1	0	1	0	1	1	4
4. Non-Grazing System- Low Potential for Recovery 45-70% Efficiency -Ave Load – 0.281			1	2	1	0	8	.048-.112	208-2290	10-257.5	1-26	11-283.5	1	0	0	0	1	3	0	0	1	0	0	0	2
5. Structural Systems 17-40% Efficiency -Ave Load – 0.40			1	0	2	1	8	.068-.160	882-6,106	60-977	6-98	66-1075	3	0	1	0	0	1	1	0	0	0	0	0	1
6. Vegatational System 45-70% Efficiency -Ave Load – 0.50			1	1	2	1	10	.105-.250	123-3,692	13-923	1.50-93	14.50-1016	2	1	1	0	0	2	1	0	1	0	0	1	3
7. Wetland Development and Restoration 25-50% Efficiency -Ave Load – 0.50			0	3	3	1	14	.270-.425	48-7,456	13-3169	1.50-3,480	14.50-3486	4	1	0	0	0	1	0	0	1	0	0	1	2

VSWCD AG SOURCE PLAN BOULDER CREEK TIER 2 LOWLAND IRRIGATED ACRES

Critical Treatable Acres:___________ Tier 2 Acres: __________________	Site Information		Source Control or Treatment	Primary Characteristics Removal 0-25% = 1 26-50% = 2 51-100% = 3 Weight Factor X 2				Costs, $					Secondary Characteristic Removal (Check Boxes. One Point for Each)						Additional (Tertiary) Watershed Benefits? (Check Boxes. One Point for each)						
TIER 2 LOWLAND IRRIGATED BMPs	Project Size (acres)	Level of Participation	(1 point for source control; 0 points for treatment)	Orthophosphate Removal %	Phosphorus Removal %	Sediment Removal %	Subtotal Points	Total P Removed (kg)	Unit Cost ($/kg TP)	Construction/ Implementation	Annual Maintenance	Total Annual Cost/Present Worth	Rank	Nitrogen	Temperature	pH	DO	Subtotal Points	Fisheries	Instream Flows	Aesthetics	Economics	Public Health	Recreation	Subtotal Points
1. Planned Grazing Systems 25-50% Efficiency Ave Load – 0.120			1	2	2	1	12	0.03-0.06	50-17284	1.50-1037	1-105	2.50-18321	5	1	1	0	0	2	0	0	1	1	0	0	3
2. Planned Cropland Systems 45-70% Efficiency Ave Load – 0.120			1	2	3	2	16	0.054-0.084	5.60-1619	0.30-136	0.03-14	33-150	1	1	1	1	0	3	1	1	1	0	0	0	3
3. Non-Grazing Systems 10-25% Efficiency Ave Load – 0.120			0	1	1	1	6	0.012-0.03	834-4970	10-164	1-16.50	11-180.50	2	0	1	0	1	2	1	1	1	0	0	0	2
4. Irrigation Structures and Water System 45-70% Efficiency Ave Load – 0.120			0	1	1	1	6	0.054-0.084	1019-14345	55-1205	5.50-120	60.50-1325	3	1	1	0	1	3	1	1	1	0	0	0	3
5. Water Structure Systems 25-50% Efficiency Ave Load – 0.120			0	1	2	2	10	0.03-0.06	1250-16867	37.50-1012	3.75-101	41.25-1113	4	1	0	0	0	1	1	0	1	0	1	0	3
6. Wetland Development Restoration 45-70% Efficiency Ave Load – 0.120			0	2	1	3	12	0.054-0.084	241-37131	13-3119	1.30-310	14.30-3429	6	1	0	0	0	1	1	1	1	0	1	0	4
7. Waste Management and Handling 25-50% Efficiency			1	1	2	1	10	0.03-0.06	83-88217	2.50-5293	.25-530	2.75-5823	7	3	0	1	1	5	0	0	0	0	1	0	1

VSWCD AG SOURCE PLAN TIER 3 NON-IRRIGATED UPLAND

Critical Treatable Acres:__________ Tier 3Acres: __________	Site Information		Source Control or Treatment	Primary Characteristics Removal 0-25% = 1 26-50% = 2 51-100% = 3 Weight Factor X 2				Costs, $						Secondary Characteristic Removal (Check Boxes. One Point for Each)					Additional (Tertiary) Watershed Benefits? (Check Boxes. One Point for each)						
TIER 3 Non-Irrigated BMPs	Project Size (acres)	Level of Participation	(1 point for source control; 0 points for treatment)	Orthophosphate Removal %	Phosphorus Removal %	Sediment Removal %	Subtotal Points	Total P Removed (kg)	Unit Cost ($/kg TP)	Construction/ Implementation	Annual Maintenance	Total Annual Cost/Present Worth	Rank	Nitrogen	Temperature	pH	DO	Subtotal Points	Fisheries	Instream Flows	Aesthetics	Economics	Public Health	Recreation	Subtotal Points
1. Planned Grazing Systems 25-50% Efficiency Ave Load – 0.120			1	2	2	1	12	0.03-0.06	50-17284	1.50-1037	1-105	2.50-18321	5	1	1	0	0	2	0	0	1	1	0	0	3
2. Planned Cropland Systems 45-70% Efficiency Ave Load – 0.120			1	2	3	2	16	0.054-0.084	5.60-1619	0.30-136	0.03-14	33-150	1	1	1	1	0	3	1	1	1	0	0	0	3
3. Non-Grazing Systems 10-25% Efficiency Ave Load – 0.120			0	1	1	1	6	0.012-0.03	834-4970	10-164	1-16.50	11-180.50	2	0	1	0	1	2	1	1	1	0	0	0	2
4. Water Structure Systems 25-50% Efficiency Ave Load – 0.120			0	1	1	1	6	0.054-0.084	1019-14345	55-1205	5.50-120	60.50-1325	3	1	1	0	1	3	1	1	1	0	0	0	3
5. Waste Management and Handling 25-50% Efficiency Ave Load – 0.120			1	1	2	1	10	0.03-0.06	83-88217	2.50-5293	.25-530	2.75-5823	4	1	0	0	0	1	1	0	1	0	1	0	3

BMP Installation Evaluation Reporting Form

		Tier	Total Acres	Efficiency	Reduction
Owner's Name: ____________ Address: ____________ Subwatershed: ____________ Location of Property: ____________	Describe Individual BMP Installation:				
Describe Agriculture Setting: ____________ ____________ Describe Reason for Installation of BMPs:					
	Fill in Total Acres and Reductions:				

Phosphorus Index Rating

Eight site characteristics used in the Phosphorus Index Rating to assess a particular site. Each characteristic must be scored by value ratings that are listed below.

Soil Erosion - Is defined as the loss of soil (in tons/acre/year) along the slope or unsheltered distance caused by the processes of water and wind. Soil erosion is predicted from models currently used (USLE or RUSLE for water erosion and WEQ for wind erosion).

Irrigation Erosion - Potential phosphorus loss resulting from furrow irrigation induced erosion is considered by a rating system based on soil susceptibility to particle detachment by hydraulic shear and flow rate of water in the furrow (see cited work for complete description and worksheets).

Runoff Class - The runoff class of the site can be determined from soil survey data. Guidance in determining the runoff class is based on the soil saturated hydraulic conductivity (K_{sat}) and the percent slope of the site (see cited work for complete description and worksheets).

Soil P Test - A soil sample from the site is necessary to assess the level of available P in the surface layer of the soil.

P Fertilizer Application Rate - The phosphorus application rate is the amount (lb./acre) of phosphate fertilizer that is applied to the crop.

P Fertilizer Application Method - The manner in which phosphorus fertilizer is applied to the soil and the time that the fertilizer is exposed on the soil surface until crop utilization.

Organic P Source Application Rate - The organic phosphorus application rate is the amount (lb/acre) of potential phosphate (P_2O_5) that is contained in manure.

Organic P Source Application Method - The manner in which organic phosphorus (manure) fertilizer is applied to the soil and the time that the fertilizer is exposed on the soil surface until crop utilization.

Value Ratings - user establishes these ratings for each of the eight characteristics:

none	= 0
low	= 1
medium	= 2
high	= 4
very high	= 8

PHOSPHORUS INDEX RATING CHART

FACTOR	NONE (0)	LOW (1)	MEDIUM (2)	HIGH (4)	VERY HIGH (8)	SUM FOR FACTORS
SOIL EROSION (1.5)						
IRRIGATION EROSION (1.5)						
RUNOFF CLASS (0.5)						
SOIL P TEST (1.0)						
P FERTILIZER RATE (0.75)						
P FERTILIZER APP. METHOD (0.5)						
ORGANIC P RATE (1.0)						
ORGANIC P APP. METHOD (1.0)						
VEGATATIVE TYPE (1.0)						
STUBBLE HEIGHT (1.0)						
				TOTAL		

SITE VULNERABIITY	SUM WEIGHT RATINGS
LOW	< 8
MEDIUM	8-14
HIGH	15-32
VERY HIGH	> 32

APPENDIX C

The following appendix is composed of agricultural BMPs listed by tier as well as within a system and individually. The costs of each BMP implemented have been obtained from the cost lists available for both the SAWQP and EQIP programs. The annual costs are calculated based on the normal contract life of ten (10) years.

Tier 1 - Riparian/Wetland Systems

Best Management Practices Systems	Component Practices	Cost,$	Annual Costs, $
1)Planned Grazing Systems-High Potential			
	Deferred Grazing	10/ac	10/ac/yr
	Pasture and Hayland Management	10/ac	10/ac/yr
Stream Types	Trough or Tank	1100	110/yr
A, B, C and E	Proper Woodland Grazing	10/ac	10/ac/yr
(Appendix E for definition)	Spring Development	1000	100/yr
	Fencing	375/ac	37.50/ac/yr
	Proper Grazing Use, Riparian	10/ac	10/ac/yr
2) Planned Grazing System-Low Potential			
	Deferred Grazing	10/ac	10/ac/yr
	Fencing	375/ac	37.50/ac/yr
Stream Types	Heavy Use Area Protection	2000	200/yr
F and G	Proper Grazing Use, Riparian	10/ac	10/ac/yr
(Appendix E for definition)	Spring Development	1000	100/yr
	Pasture and Hay land Management	10/ac	10/ac/yr
	Trough or Tank	1100	110/yr
	Proper Woodland Grazing	10/ac	10/ac/yr
	Nutrient Management	75/ac	7.50/ac/yr
	Pest Management	16/ac	16/ac/yr
3) Non-Grazing Systems-High Potential			
	Fencing	375/ac	37.50/ac/yr
Stream Types	Livestock Exclusion	10/ac	10/ac/yr
A, B, C and E	Spring Development	1000	100/yr
	Trough or Tank	1100	110/yr
4) Non-Grazing-Low Potential			
	Fencing	375/ac	37.50/ac/yr
Stream Types	Livestock Exclusion	10/ac	10/ac/yr
F and G	Spring Development	1000	100/yr
	Trough or Tank	1100	110/yr
5) Structural Systems			
	Grade Stabilization Structures	1170	117/yr
	Streambank and Shoreline Prot.	600	60/yr
	Stream Channel Stabilization	1500	150/yr
	Structures for Water Control	3000	300/yr
	Channel Vegetation	3500	350/yr
6) Vegetation Systems			
	Streambank and Shoreline Prot.	600	60/yr
	Stream Channel Stabilization	1500	150/yr
	Channel Vegetation	3500	350/yr
	Filter Strip	130	13/yr
	Ephemeral Watercourse Planting	3500	350/yr
7) Wetland Development Restoration			
	Wetland Development Rest.	13560	1356/yr
	Pond	8000	800/yr
	Structure for Water Control	3000	300/yr
	Channel Vegetation	3500	350/yr
	Filter Strip	130	13/yr
	Sediment Basin	3000	300/yr
8) Waste Management and Handling			
	Waste Management Systems	46900	4690/yr
	Waste Utilization	2.50/ac	2.50/ac/yr

Tier 2-Lowland: Mostly Irrigated Crop and PastureLand

Best Management Practices Systems	Component Practices	Cost,$	Annual Costs,$
1) Grazing Systems			
	Irrigation Water Management	6.50/ac	6.50/ac/yr
	Nutrient Management	75/ac	7.50/ac/yr
	Pest Management	16/ac	16/ac/yr
	Deferred Grazing	10/ac	10/ac/yr
	Fencing	375/ac	37.50/ac/yr
	Livestock Exclusion	10/ac	10/ac/yr
	Pasture and Hay land Planting	76/ac	7.60/ac/yr
	Pasture and Hay land Management	10/ac	10ac/yr
	Planned Grazing Systems	1.50/ac	1.50/ac/yr
	Proper Grazing Use	10/ac	10ac/yr
	Proper Woodland Grazing	10/ac	10ac/yr
	Pond	8000	800/ac/yr
	Trough or Tank	1100	110/ac/yr
2) Cropland Systems			
	Chiseling and Subsoiling	16/ac	1.60/ac/yr
	Conservation Cropping Sequence	0.30/ac	0.30/ac/yr
	Conservation Tillage	13.50/ac	13.50/ac/yr
	Critical Area Planting	355/ac	35.50/ac/yr
	Filter Strip	130	13/ac/yr
	Irrigation Water Management	6.50/ac	6.50/ac/yr
	Nutrient Management	75/ac	7.50/ac/yr
	Pest Management	2.50/ac	2.50/ac/yr
	Irrigation Systems	550/ac	55/ac/yr
3) Non-Grazing Systems			
	Fencing	375/ac	37.50/ac/yr
	Livestock Exclusion	10/ac	10/ac/yr
	Grade Stabilization Structures	1165	116.50/ac/yr
4) Irrigation Structures and Water Systems			
	Diversion	2000	200/yr
	Irrigation Pit/Regulating Reservoir	4000	400/yr
	Irrigation Storage Reservoir	4000	400/yr
	Irrigation Systems	550/ac	55/ac/yr
	Irrigation Water Conveyance	750/ac	75/ac/yr
	Pipeline	750/ac	75/ac/yr
5) Water Structure Systems			
	Pond	8000	800/ac/yr
	Pipeline	750/ac	75/ac/yr
	Spring Development	1000	100/yr
	Fencing	375/ac	37.50/ac/yr
	Trough or Tank		
6) Wetland Development Restoration			
	Wetland Development Rest.	13560	1356/yr
	Pond	8000	800/yr
	Structure for Water Control	3000	300/yr
	Channel Vegetation	3500	350/yr
	Filter Strip	130	13/yr
	Sediment Basin	3000	300/yr
7) Waste Management and Handling			
	Waste Management Systems	46900	4690/yr
	Waste Storage Pond or Structure	6000	600/yr
	Waste Utilization	2.50/ac	2.50/ac/yr

Tier 3 - Upland Grazing Land: Mostly Non-irrigated

Best Management Practices Systems	Component Practices	Cost,$	Annual Costs,$
1) Planned Grazing Systems	Pasture and Hayland Management	10/ac	10/ac/yr
	Pasture and Hayland Planting	25/ac	2.50/ac/yr
	Planned Grazing Systems	1.50/ac/yr	1.50/ac/yr
	Proper Grazing Use	10/ac	10/ac/yr
	Proper Woodland Grazing	10/ac	10/ac/yr
	Nutrient Management	75/ac	7.50/ac/yr
	Pest Management	2.50/ac	2.50/ac/yr
	Fencing	375/ac	37.50/ac/yr
	Pond	8000	800/yr
	Trough or Tank	1100	110/yr
	Stock Trails and Walkways	2000	200/yr
	Livestock Exclusion	10/ac	10/ac/yr
2) Cropland Systems			
	Chiseling and Subsoiling	16/ac	1.60/ac/yr
	Conservation Cropping Sequence	0.30/ac	0.30/ac/yr
	Conservation Tillage	13.50/ac	13.50/ac/yr
	Critical Area Planting	355/ac	35.50/ac/yr
	Filter Strip	130	13/yr
	Irrigation Water Management	6.50/ac	6.50/ac/yr
	Nutrient Management	75/ac	7.50/ac/yr
	Pest Management	16/ac	16/ac/yr
	Irrigation Systems	550/ac	55/ac/yr
3) Non-Grazing Systems			
	Grade Stabilization Structures	1125	112.50/ac/yr
	Brush Management	25/ac	2.50/ac/yr
	Range Seeding	50/ac	5/ac/yr
	Pasture and Hayland Planting	25/ac	2.50/ac/yr
	Nutrient Management	75/ac	7.50/ac/yr
	Pest Management	16/ac	16/ac/yr
4) Water Structures Systems			
	Pipeline	750/ac	75/ac/yr
	Pond	8000	800/yr
	Spring Development	1000	100/yr
	Stock Trails and Walkways	2000	200/yr
	Trough or Tank	1100	110/yr
	Fencing	375/ac	37.50/ac/yr
5) Waste Management and Handling			
	Waste Management Systems	46,900	4690/yr
	Waste Storage Pond or Structure	6000	600/yr
	Waste Utilization	2.50/ac	2.50/ac/yr

Ranchette Acreage

Best Management Practices Systems	Component Practices	Cost,$	Annual Costs,$
1) Planned Grazing Systems	Pasture and Hayland Management	10/ac	10/ac/yr
	Pasture and Hayland Planting	25/ac	2.50/ac/yr
	Planned Grazing Systems	1.50/ac	1.50/ac/yr
	Proper Grazing Use	10/ac	10/ac/yr
	Proper Woodland Grazing	10/ac	10/ac/yr
	Nutrient Management	75/ac	7.50/ac/yr
	Pest Management	16/ac	16/ac/yr
	Fencing	375/ac	37.50/ac/yr
	Pond	8000	800/yr
	Trough or Tank	1100	110/yr
	Stock Trails and Walkways	2000	200/yr
	Livestock Exclusion	10/ac	10/ac/yr
2) Non-Grazing Systems			
	Grade Stabilization Structures	1125	112.50/ac/yr
	Brush Management	25/ac	2.50/ac/yr
	Pasture and Hayland Planting	25/ac	2.50/ac/yr
	Nutrient Management	75/ac	7.50/ac/yr
	Pest Management	2.50/ac	2.50/ac/yr
	Fencing	375/ac	37.50/ac/yr
	Livestock Exclusion	10/ac	10/ac/yr
3) Cropland Systems			
	Chiseling and Subsoiling	16/ac	1.60/ac/yr
	Critical Area Planting	355/ac	35.50/ac/yr
	Filter Strip	130	13/ac/yr
	Irrigation Water Management	2.50/ac	2.50/ac/yr
	Nutrient Management	75/ac	7.50/ac/yr
	Pest Management	16/ac	16/ac/yr
	Irrigation Systems	550/ac	55/ac/yr
4) Irrigation Structures and Water Systems			
	Diversion	500/ac	50/ac/yr
	Irrigation Pit/Regulating Reservoir	4000	400/yr
	Irrigation Storage Reservoir	4000	400/yr
	Irrigation Systems	550/ac	55/ac/yr
	Irrigation Water Conveyance	750/ac	75/ac/yr
	Pipeline	750/ac	75/ac/yr
5) Water Structure Systems			
	Pond	8000	800/yr
	Pipeline	750/ac	75/ac/yr
	Spring Development	1000	100/yr
	Fencing	375/ac	375/ac/yr
	Trough or Tank	1100	110/yr
6) Wetland Development Restoration			
	Wetland Development Rest.	13560	1356/yr
	Pond	8000	800/yr
	Structure for Water Control	3000	300/yr
	Channel Vegatation	3500	350/yr
	Filter Strip	130	13/yr
	Sediment Basin	3000	300/yr
7) Waste Management and Handling			
	Waste Management Systems	46400	4640/yr
	Waste Storage Pond or Structure	6000	600/yr
	Waste Utilization	2.50/ac	2.50/ac/yr

Appendix D

The following monitoring forms will be used for the evaluation of BMP practices or systems that have been installed on agricultural lands. The forms have been used previously by other agencies in other parts of the state or county. The forms include BMP evaluations used by the Idaho Soil Conservation Commission and by the Natural Resources Conservation Service.

BMP Evaluation for Ground Water Protection

District:	Project #	Contract #	Date:
Owner/Operator:		Watershed	Program

Type of Operation ________

Previously Applied Practices: ________

____

Progress in Applying Practices: ________

____

Visual Observation:

Is runoff occurring? ________

Presence of gullies/rills:

____

Soil Loss or Deposition Occurring: ________

Is sufficient stubble present?

____

Calculated Soil Loss?

____

Riparian Condition:

____

Stream bank Condition:

____

Is riparian grazed? ________

Is riparian fenced? ________

Is a buffer present? ________

Width of buffer ________

Is there evidence of mass wasting occurring?

____

Does the riparian area seem to have vegetation diversity from visual observation?

____

____

Water Management:

Is irrigation water management in place?

____

Is there evidence of excess runoff? ________

Is there evidence of excess water use? ________

Is there evidence of reduced crop or grass production :

____

Visual Inspection:

Is turbidity present in water above project? ________

Is turbidity present in water below project? ________

Vegetation

Are plants that are present suited for planned use?

____

Is there unwanted vegetation present?

____

Would an irrigation water management or a weed management program reduce the presence of unwanted vegetation?

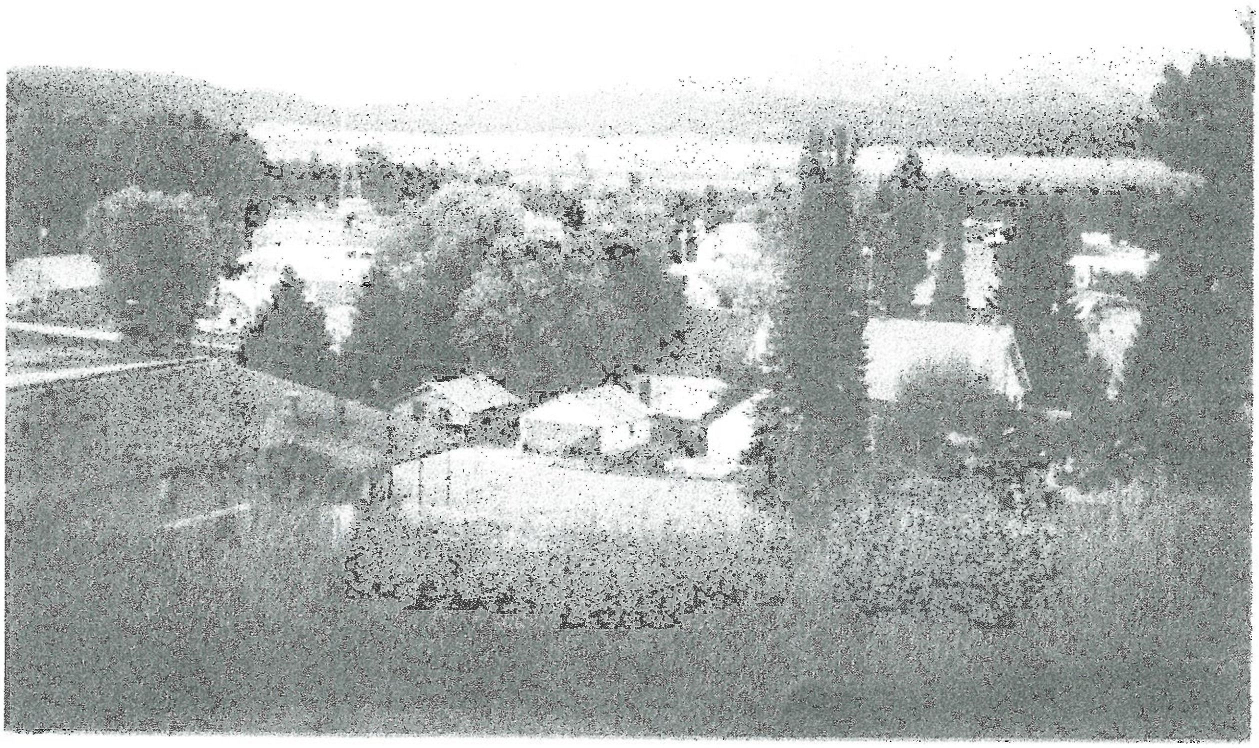
____

Is crop rotation planned for future consideration?

____

Urban/Suburban Implementation Plan

Cascade Reservoir Phase II Watershed Management Plan



June 2000

Submitted to the
Cascade Reservoir Technical Advisory Committee
and the Cascade Reservoir Coordinating Council
as part of the

Implementation Plan
for the
Cascade Reservoir Phase II Watershed Management Plan

Introduction

Within 18 months of the approval of the Cascade Reservoir Watershed Phase II Management Plan (TMDL), the compilation of a watershed-wide implementation plan is required. The purpose of both the TMDL and the Implementation Plan is to improve water quality in Cascade Reservoir through the joint efforts of concerned federal, state and local government agencies, municipalities, and land owners. These efforts will include both planning for future growth and development, and the implementation of best management practices (BMPs) on existing and new land uses. In the construction of the Implementation Plan for Cascade Reservoir Watershed, the Watershed Advisory Group (WAG) and Technical Advisory Committee (TAC) have elected to maintain a source-specific emphasis within the watershed. Three separate, source-specific implementation plans from the Forestry, Agriculture, and Urban/Suburban nonpoint sources will be used to form the framework from which the overall Cascade Reservoir Implementation Plan will be compiled.

The Urban/Suburban Implementation Plan is a consensus-based document authored by members of the Urban/Suburban Source Workgroup, the Cascade Reservoir TAC, WAG and a number of dedicated local citizens. This implementation plan is not static, but is meant to be a dynamic document with implementation changes and modifications occurring as data and documentation becomes available throughout the life of the management plan. This document represents the basis for the urban/suburban portion of the overall Cascade Reservoir Implementation Plan. A watershed approach has been used to address water quality issues related to urban/suburban land use activities and pollutant loads associated with discharges to the Cascade Reservoir and its tributaries. The watershed has been sub-divided into separate subwatersheds (as defined in the TMDL), each of which will be evaluated separately to address the unique set of land use practices and activities it contains.

Background

Urban/suburban land-use totals 25,945 acres within the watershed, representing 9.4% of the total land area. The major urban/suburban centers in the Cascade Reservoir watershed are the incorporated cities and city impact areas of Cascade (population ~1120), Donnelly (population ~200) and McCall (population ~2600). A significant increase in population occurs during summer months when part-time residents and tourists frequent the area. There are three primary components to this implementation plan: municipalities, rural residential subdivisions and roads and highways. Reduction in the phosphorus loading attributable to the transient population will be addressed to the extent possible through structural improvements such as stormwater runoff and roadway improvements, and through changes in behavioral practices encouraged by a strong public education effort. Rural ranchettes with hobby livestock and other domestic livestock, including their respective drives/driveways are included in the Agriculture Implementation Plan. The public and private roads/highways included in the scope of this source plan are exclusive to those covered in the Forestry Source Plan.

As part of the Plan to improve the quality of water in Cascade Reservoir, a 30% overall reduction in total phosphorus loading has been assigned to all areas of urban/suburban land use within the watershed. Pollutant sources of concern to this document are primarily associated with existing and potential urban/suburban and recreational impacts. For the purposes of this document the targeted pollutant is phosphorus.

Phosphorus Loading Identification

Phosphorus loading from urban/suburban sources is recognized to originate primarily from stormwater runoff and sediment transport. These sources were evaluated separately to prioritize loading and reduction potential.

Municipal and Rural Residential Stormwater Runoff

To accurately determine the magnitude of stormwater runoff, land-use acreage, annual precipitation averages and percent impervious surface were determined for urban/suburban lands within the watershed as outlined in the Urban/Suburban Source Plan for the Cascade Reservoir Phase II Watershed Management Plan. Stormwater related phosphorus loading was estimated as shown in Table 1 below.

Table 1. Stormwater-related phosphorus loading

Nonpoint Sources	TP (kg/yr)
City of Cascade	222
City of Donnelly	151
City of McCall	897
Rural residential subdivisions	638
TOTAL	1,908

The estimated total phosphorus load from the City of McCall was adjusted to include only inputs from those drainage basins that inflow to Cascade Reservoir or its tributaries as identified in the Urban/Suburban Source Plan for the Cascade Reservoir Phase II Watershed Management Plan. The phosphorus load attributable to these McCall drainage basins represents the greatest annual pollutant load yield derived from urban land in the watershed, which correlates well with the fact that the City of McCall represents the largest urban center in the watershed.

Sediment Transport from Roads and Highways

Road erosion is the primary sediment source within urban/suburban land use. Many roads within the watershed are steeply sloped, improperly designed, inadequately maintained and cuts and culverts are in poor repair. Proximity to surface water is of primary concern as direct transport of sediment is possible in many areas of the watershed. Sediment transport and erosional processes on these road systems is calculated to produce 15,721 tons of sediment per year, yielding approximately 2,515 kg of phosphorus annually.

Objectives

The primary goal of this document is to accurately identify existing implementation practices and efficacy, and to outline additional practices and procedures necessary to successfully reduce existing phosphorus sources by a minimum of 30% and prevent additional future phosphorus loading to the North Fork Payette River (NFPR) and Cascade Reservoir from urban/suburban-related land use activities and practices.

To this end, recommended BMPs and changes in management practices seek to control phosphorus loading through the reduction or treatment of runoff volumes and sediment transport in an efficient and cost-effective fashion. It is projected that BMPs and other projects associated with the management plan will result in improved water quality in the reservoir and in those listed stream segments potentially impacted by urban/suburban based loading. The majority of BMPs recommended pertain to controlling pollution at the source; and include both residential and commercial development source treatment measures. Source control measures focus on minimizing or eliminating the source of pollution so that pollutants are prevented from contacting runoff or entering the drainage system. Permanent or treatment control measures are designed to remove pollutants after being taken up by runoff.

The implementation projects detailed within this document have an expected application within the Phase II Implementation Strategy. The following documents pertinent to the urban/suburban implementation strategy are summarized for convenience:

1) Technical Memorandum: *Stormwater Retrofit Options for Valley County* (1996);
2) Technical Memorandum: *Procedures and Recommendations for Subwatershed Prioritization of Stormwater BMPs* (1997); and
3) The *Handbook of Valley County Stormwater Best Management Practices, 1997*, and the *Catalog of Stormwater Best Management Practices for Idaho Cities and Counties*

Stormwater Retrofit Options for Valley County. The "Stormwater Retrofit Options for Valley County" provides a list of applicable BMPs, prioritized retrofit projects, and other recommendations for improving both water quantity and water quality on a subwatershed basis. The scope of the project also includes ways of addressing existing practices and natural features, as well as anticipated future preventative measures. The identified options are based on a two-day field survey conducted in the spring of 1996 throughout the County.

The retrofit options and recommendations were subdivided into five main categories: urbanized areas, agricultural areas, residences in surrounding hills, property located at waterside, and transportation corridors.

Procedures and Recommendations for Subwatershed Prioritization of Stormwater BMPs. The "Procedures and Recommendations for Subwatershed Prioritization of Stormwater BMPs" describes a process for prioritizing stormwater BMPs by subwatershed based on the prevailing and site suitable physical conditions. The document is considered a planning tool for assisting in the selection of the most cost effective BMPs by subwatershed. The prioritization procedure ranked BMPs on overall subwatershed characteristics. Final BMP selection is however, more dependent upon site-specific conditions. The technical memorandum concluded that most BMPs are applicable in various portions of all subwatersheds.

The *Handbook of Valley County Stormwater Best Management Practices, 1997*, and the *Catalog of Stormwater Best Management Practices for Idaho Cities and Counties*. These references are recognized as the primary technical references for developers, contractors, design professionals, local agency officials and staff responsible for design, construction, maintenance or the review and approval of stormwater treatment facilities/devices. To prevent future impacts, the *Handbook of Valley County Stormwater Best Management Practices* will serve as a means of implementing consistent county-wide site design treatment considerations. The cities will be proactive and encourage more comprehensive strategies for stormwater planning and management.

The majority of BMPs contained in chapter 4 of the Handbook pertain to controlling pollution at the source (see Table 2), chapter 5 of the Handbook contains residential and commercial development source treatment measures (see Table 3). Source control measures focus on minimizing or eliminating the source of pollution so that pollutants are prevented from contacting runoff or entering the drainage system. Permanent or treatment control measures are designed to remove pollutants after being taken up by runoff.

Treatment controls tend to be more expensive than source controls. Time is the major cost factor with minimizing disturbance, preserving vegetation, and other site management measures. However, the cost factor associated with additional time for minimizing or preserving must be considered within context of reduced needs for costly treatment mitigation and operation and maintenance expenditures. For example, the sediment removal effectiveness of preserving native vegetation (BMP #3) and hence keeping phosphorus in place is 100 %.

Implementation Strategy

Three primary components were addressed for phosphorus load reduction in the Urban/Suburban Source Implementation Plan: municipalities, rural residential subdivisions, and roads and highways. Phosphorus load reduction attributable to the transient population will be addressed to the extent possible through structural improvements, such as stormwater runoff and roadway improvements. Rural ranchettes with hobby livestock and other domestic livestock, including their respective drives/driveways are included in the agricultural sections of the implementation plan. The public and private roads/highways included in this section of the implementation plan are exclusive of those covered in the forestry sections of the implementation plan.

Total phosphorus yield coefficients expressed as kg/acre/yr were used to calculate nonpoint source loads in each subwatershed. These yield coefficients were estimated from monitoring data and associated modeling efforts, as described in the Phase II TMDL and supporting source plans, and

Table 2. Permanent controls, considerations, and comparative cost and applicability taken from the Handbook (1997).

BEST MANAGEMENT PRACTICES		CONSIDERATIONS				COMPARATIVE COST & APPLICABILITY*			
#'s	Name	Phosphorus Removal (>35% effective)	Sediment Removal (>70 % effective)	Area Required	Water Availability	Relative Capital Cost per Acre Served	Relative O & M Cost* Routine	Relative O & M Cost* Non-routine	Primary Treatment Mechanism(s)
38	Vegetated Swale		✗	✗	✗	low	low	mod.	Sedimentation/ filtration
39	Vegetative Filter Strip		✗	✗	✗	low	low	mod.	Sedimentation/ filtration
40	Sand Filter	✗	✗			moderate	mod.	mod.	Sedimentation/ filtration
43	Infiltration Trench	✗	✗			low to mod.	mod.	high	Infiltration
44	Infiltration Basin	✗	✗	✗		low to mod.	low	mod.	Infiltration
45	Wet Pond	✗	✗		✗	moderate	low	mod.	Sedimentation/ biologic uptake
47	Wet Extended Detention Pond	✗	✗			moderate	low	mod.	Sedimentation
48	Dry Extended Detention Pond			✗		moderate	low	mod.	Sedimentation/ biologic uptake
49	Constructed Wetland	✗		✗	✗	mod. to high	high	high	Sedimentation/ filtration
52	Oil/Water Separator					high	low	high	Sedimentation/ Infiltration

* Based on the Boise City Public Works Department: Stormwater BMPs Guidance, 1997.

Table 3. Construction/temporary controls, considerations, and comparative cost and applicability taken from the Handbook (1997).

BEST MANAGEMENT PRACTICES		CONSIDERATIONS				COMPARATIVE COST & APPLICABILITY*			
#'s	Name	Phosphorus Removal (>35% effective)	Sediment Removal (>70 % effective)	Slope Protection	Sediment Collection/ Runoff Diversion	Relative Capital Cost per Acre Served	Relative O & M Cost*		Expected Life based on Longevity Data from Handbook
							Routine	Non-routine	
3	Preserving Existing Vegetation	✗	✗	✗	✗	low	low	low	becomes permanent
11	Mulching	✗	✗	✗		moderate	mod.	mod.	6 - 8 months
13/ 14	Geotextiles & Mats		✗	✗		high	mod.	mod.	6 - 8 months
22	Check Dams		✗			moderate	low	mod.	½ - 1 year
24	Straw Bale Barrier		✗		✗	low	high	high	3 months
25	Silt Fence		✗		✗	moderate	mod.	mod.	2 - 6 months
26	Vegetative Buffer Strip		✗		✗	low	low	low	50 years
27	Sediment Trap		✗		✗	low	mod.	low	6 - 18 months
30	Earth Dike		✗		✗	moderate	low	mod.	2 - 25 years
31	Perimeter Dike/Swale		✗		✗	moderate	low	low	18 months

* Based on the Boise City Public Works Department: Stormwater BMPs Guidance, 1997.

were used as a basis for establishing a subwatershed-based priority ranking for implementation (as described in the preceding sections). These coefficients, on a management or practice specific basis have been used to establish a priority ranking within the nonpoint source-based loading for each subwatershed. Through this prioritization process, the total phosphorus loads from urban stormwater, roadways (private and public), and failing/out-of-compliance septic systems have been identified as the highest priorities for implementation of reduction measures within the Urban/Suburban Source Implementation Plan.

Within this document, septic-related phosphorus loading is discussed separately because of differences in phosphorus load delivery and treatment mechanisms related to this source.

BMPs and Phosphorus Reduction Practices
BMPs are measures or a combination of measures that have been determined to be the most effective and practical means of preventing or reducing contamination to ground water and/or surface water pollution from nonpoint and point sources. The objective in implementing BMPs is to achieve water quality goals and protect the beneficial uses of the water body.

Existing conditions suggest that urban land contributes a disproportionate load of phosphorus from a relatively small area of the landscape. Future development without planning and control measures in place will only increase pollutant loading. BMP devices, facilities and systems that are constructed will be selected based on suitable site conditions and targeted pollutant removal effectiveness (see Appendices C-2 and C-3). More significantly, BMP retrofit projects will be targeted for urban land and transportation components throughout the identified priority subwatershed areas. In minimizing impacts to storm water runoff and protecting against further reservoir eutrophication, BMPs will be selected to maximize the removal of nutrients from runoff and/or trapping of sediment in-place.

Reducing Existing Impacts
Following the assessment of loading and load allocations to urban/suburban sources, a preliminary listing of mechanisms for the reduction of existing phosphorus loading and related water-quality impacts was recommended by the Urban/Suburban Source Group:

1. Estimate the cost-benefit ratio of potential retrofit options from the "Stormwater Retrofit Options for Valley County"; base prioritization on retrofitting McCall drainage basins 9, 11 and 13, and the cities Cascade and Donnelly.

Rationale: McCall drainage basins 9, 11 and 13, and the cities Cascade and Donnelly, are the greatest potential contributors of total phosphorus and suspended solids based on the current land uses. The greatest cost-benefit can be expected in the Willow Creek, Mud Creek, Cascade, and North Fork of the Payette River subwatersheds.

2. Encourage continued water quality monitoring to document trends toward meeting water quality standards.

Rationale: Revise the monitoring strategy and plan to better characterize nonpoint source loading contributed from McCall drainage basins 9, 11 and 13, and the cities Cascade and Donnelly. Future decisions to retrofit BMPs in drainage basins or catchments, believed to be contributing a greater amount of pollutant loading, can be more readily justified with water quality data.

3. Improve county roads that are immediately adjacent or within the floodplain of Cascade Reservoir or any of its tributaries.

Rationale: Improvements on county roads should be based on a prioritized inventory of all public and private roads and highways. A comprehensive inventory was completed by the Valley County Engineer (1997). Many locations with erosion, predominantly those associated with unimproved roads, were observed during the inventory. Reducing sediment derived from nearby roadways would ultimately decrease the amount of sediment loading to the reservoir.

4. Encourage the sewering of the South Lake Recreation and Sewer District or the West Mountain subdivisions.

Rationale: Many of the developed parcels and hence, their respective septic tank systems in the West Mountain subwatershed are pre-1985 and are out of compliance. Reduced septic tank effluent from pre-1985 septic systems would decrease waste loading to Cascade Reservoir.

5. Support the City of Donnelly facilities plan for the wet-extended detention basin project IF properly designed for a water quality design storm.

Rationale: Donnelly has the potential to contribute to further surface water quality impacts to Cascade Reservoir due to its close proximity. A large-scale detention basin would benefit the watershed since it would detain storm water runoff from the city, as well as from the agricultural runoff from adjacent and up-gradient fields.

Preventing Future Impacts

In addition to the preceding, preliminary strategy for reducing existing impacts to water quality, a correlated strategy for preventing future impacts was also formulated by the Urban/Suburban Source Group. Integral to both strategies is the county-wide adoption of the Handbook of Stormwater Best Management Practices. The Handbook should serve as a means of implementing consistent, county-wide site design treatment considerations. As public awareness increases, a broader public acceptance should follow. Rising public awareness can only occur through additional technical education for contractors, developers and land owners. The cities should be proactive and encourage more comprehensive strategies for storm water planning and management. The strategy for preventing future impacts consists of three components.

1. Encourage municipalities throughout Valley County to implement development design strategies that are source-control oriented (i.e., on-site detention program, minimizing directly connected impervious areas, site fingerprinting, local urban forestry, etc.).

Rationale: It is not the individual site development, but rather, the cumulative effect that generates runoff volume during a storm event. Through design, the natural and landscaped site drainage system can work effectively to soak, filter and temporarily pond precipitation. The site drainage system withdraws a small share of the potential cumulative whole, keeping it from running off-site. For example, local on-site detention programs require developers and land owners to manage storm water runoff on commercial, industrial, and often high-density residential sites. These local programs protect water quality through advocating and enforcing when necessary, the assurance that rates of post-development runoff from a given site do not exceed the rate of pre-development runoff.

2. Encourage the adoption of a county-wide erosion and sediment control ordinance that includes provisions for performance standards that allow for a combination removal of both total phosphorus and total suspended solids. Performance standards for removal effectiveness should at least exceed 30% TP and 70% TSS.

Rationale: Suspended solids cause many problems for water quality in addition to increasing concentrations of total phosphorus in the water column. Also, total suspended solid is a much easier constituent to monitor and the improvement to water moving through a treatment measure will literally be visible to the public. Reduction of suspended solids in runoff will result in broader improvements in water quality because BMP selection will not only be driven by TP removal effectiveness.

3. Municipalities throughout Valley County should encourage the set aside and/or donation of sensitive lands that possess intact riparian vegetation, 'classified' wetlands, steep slopes, and areas of highly erodible soil types.

Rationale: The varying natural environment includes many areas of the landscape that are well suited for intensive urban development. There are however, other areas which have a low tolerance for this same type of intensive development. These "sensitive" parts of the landscape, when radically altered, lose their function as natural collection, filtering and storage systems. Kept intact, the natural landscape provides these several functions free of charge to society. If properly accounted for early in the design process, sensitive open space can be used as natural treatment areas for adequately dispersed runoff from impervious surfaces such as pavement, asphalt, concrete, compacted soils and rooftops.

With the formulation of the preceding strategies for the reduction of existing impacts and prevention of future impacts to water quality, a community-based effort has been initiated to identify specific projects which, collectively, would serve to meet the recommended goals and objectives. The following discussion represents a summary of the proposed implementation projects currently recommended or in place under each of the main objectives.

Cost-Benefit Evaluation for Stormwater Upgrades

A preliminary stormwater management plan for implementation has been drafted and initial projects identified for the areas of greatest loading and transport potential. Within the management plan, prioritization of stormwater implementation for the municipalities and rural subdivisions will focus on: (1) Source control measures to minimize or eliminate pollutant impacts to stormwater runoff. (2) Improvement of existing transport 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 discharge into surface waters; and (4) Emplacement of stormwater treatment trains in those locations for which diversion/sedimentation is not possible prior to discharge to surface waters.

An initial goal of treating municipal stormwater loading to achieve a 35 percent total phosphorus reduction (445 kg/yr) was established. A concurrent goal of treating rural residential stormwater loading to achieve a 25 percent (160 kg/yr) total phosphorus reduction was also established. The load reduction goal for rural residential subdivisions was more conservative than that for municipal stormwater because of the lack of centralized stormwater systems in rural subdivisions and the increased difficulty of treating individual runoff locations in these areas.

The cities of Cascade and Donnelly, and City of McCall drainage basins 9, 11, and 13 (Stormwater Retrofit Options for Valley County) were determined to represent the greatest potential contributors of stormwater-based total phosphorus and suspended solids based on the current land uses. The projects with the greatest cost-benefit ratio were determined to be those located in the Boulder/Willow Creek, Mud Creek, Cascade, and North Fork Payette River subwatersheds. This is an on-going effort on the part of the above communities and the watershed in general. A significant amount of progress in the improvement of stormwater runoff treatment has been accomplished recently in the City of McCall and those areas of the City of Cascade that drain into the Cascade Reservoir watershed. These reduction efficiency of efforts will be fully assessed and reported in an annual reporting sequence established for the implementation process (starting Fall 2000).

Future recommended BMPs and changes in management practices will seek to control phosphorus loading through the reduction or treatment of runoff volumes and sediment transport in an efficient and cost-effective fashion. The majority of the recommended BMPs pertain to controlling pollution at the source and include both residential and commercial development source treatment measures. Source control measures will be implemented to focus on minimizing or eliminating the source of pollution so that pollutants are prevented from contacting runoff or entering the drainage system. Permanent BMPs and treatment control measures will be designed to remove pollutants after being taken up by runoff. Additionally, the cost-benefit ratio of potential retrofit options will be calculated to optimize potential projects within the watershed.

Water Quality Monitoring to Document Trends

The objectives of the urban/suburban monitoring plan are to verify that BMPs are properly installed, that they are being maintained, and are working as designed. Monitoring for phosphorus reductions will consist of spot checks, annual reviews and evaluation of advancement toward reduction goals. Monitoring will be either qualitative or quantitative, depending on the project. Proposed projects may need to incorporate project monitoring into new grant proposals. Evaluation of advancement toward reduction goals will be accomplished using the project tracking system and annual reports.

In addition, the comprehensive, watershed-wide inflow and inlake monitoring used by DEQ to establish current loadings will continue as a mechanism to document improvements, identify initial loading trends, assess load reductions achieved and determine when the overall 37% reduction goal is attained. This monitoring is conducted on a monthly basis and can be used in a quantitative sense to determine the collective effectiveness of BMPs installed or implemented on tributary systems.

Improvement of County Roads that Demonstrate a High Risk for Phosphorus Transport to Surface Waters

Road erosion is the primary sediment source within urban/suburban land use. Minimization of sediment-bound phosphorus transport through the control of road-related erosional processes is of high priority. Many roads within the watershed are steeply sloped, improperly designed, inadequately maintained, and include cuts and culverts that are in poor repair. Proximity to surface water is of primary concern, as direct transport of sediment is possible in many areas of the watershed. Sediment transport and erosional processes on these road systems are estimated to generate 15,721 tons of sediment per year, yielding approximately 2,515 kg of phosphorus annually.

Traffic-induced and storm-event erosion from roads and highways was calculated using the approach applied in the Urban/Suburban and Forestry Source Plans. BMP efficiencies were estimated from available data and assumptions used in the initial evaluation of road-based erosion performed by Boise Cascade Corporation and Valley County. Existing road condition and in-place erosion controls were identified to the extent possible. Where traffic and erosion control data were unavailable, best professional judgement was applied. It is expected that as funding becomes available, a more in-depth evaluation of road conditions and upgrade priority will be undertaken by the appropriate City and/or County governments.

Initial transportation-based load reduction goals are to address 80 percent of the unimproved roads, 65 percent of graveled roads, and 35 percent of paved roads. Roads and highways within the Cascade Reservoir watershed will be expected to accomplish a load reduction of 754 kg/yr as outlined in Table 4 below. Although it is not directly accounted for in the load calculations, the Idaho Transportation Department will be upgrading specific sections of State Highway 55 within the Cascade Reservoir watershed, which is also expected to result in water-quality improvements.

Proposed Roadway-Related Implementation Measures

The prioritization of roadway implementation measures target those roadways located in close proximity to a surface water system, in rolling or steep terrain that are especially at risk for rutting, rilling, and gullying. For the most part, this class of unimproved public and private roadway is best described as narrow, low volume traffic and poorly maintained. Approximately half of this class of unimproved public roads have been identified as high priority sites fitting the above description and are therefore proposed to be improved to a level of upgraded service that would stabilize the road surface and improve drainage to reduce erosion.

Table 4. Total Road-Related Sediment Load by Surface Type in Valley County

Non-Subdivision Roads	Surface area (ac)	Phosphorus load (kg/yr)	Surface area to be treated (ac)	Treatment efficiency	Phosphorus reduction (kg/yr)
State Hwy 55	73	234	0	-	0
Paved	149	438	52	45%	69
Graveled	186	613	121	45%	179
Unimproved	20	112	16	85%	76
			Non-Subdivision Total		*324*
Subdivision Roads					
Paved	64	163	23	45%	26
Graveled	230	634	149	45%	185
Unimproved	57	322	46	85%	219
			Subdivision Total		*430*
TOTAL	**779**	**2,515**	**406**		**754**

Roadways that fit the above description located in the Boulder/Willow, West Mountain and Lake Fork subwatersheds will be addressed first. Appropriate BMPs for roads and highways include graveling on native material roads, ditching and cross-drains with gravel interfaces and vegetated swales (on native and graveled roads), and culvert and ditch upgrade/repair for paved roadways.

A 319 grant proposal targeting those roadways located in the West Mountain subwatershed identified as being in poor condition and having the greatest chance for direct transport to the reservoir has been approved. The majority of the work for 1999 has been completed and the remainder scheduled for the 2000 construction season. An additional 319 grant proposal targeted roadways in the immediate vicinity of the reservoir that experience heavy recreational usage has been submitted and approved. Work is scheduled for the years 1999 to 2000. A 319 grant proposal to address failing road crossings in the Boulder/Willow subwatershed and additional private roadways at risk in the West Mountain subwatershed is in preparation and expected to be submitted for the 2002 funding schedule.

Encourage the Sewering of West Mountain At-Risk Subdivisions

Septic systems provide for sewage treatment and disposal in areas lacking municipal wastewater collection and treatment systems. Septic tank/soil adsorption systems may be a significant source of nutrients and other pollutant loadings to shallow groundwater, particularly in saturated soil conditions.

Septic-Related Implementation Measures

Two areas adjacent to the reservoir (within 600 feet) with developed subdivision parcels were identified as potential nutrient source locations due to inadequate retention time and treatment of septic tank effluent caused by high ground water and poor soil retention characteristics. One area includes subdivisions aggregated around the north end of the reservoir, in the vicinity of the three tributary arms of Boulder/Willow Creek and Lake Fork Creek. The other location includes the subdivisions in the southwest reach of the reservoir. It was recognized in the Phase II TMDL that both locations were dominated by high groundwater tables, evidence of groundwater contamination, high septic system density, and poor soil types. The Phase II TMDL estimated the load contributed to the reservoir from septic systems at 2,205 kg/yr based on 1,795 septic systems and a range of effluent quality assumptions.

Proposed Septic-Related Implementation Measures

To address high phosphorus and bacteria loadings identified in the Phase 1 TMDL in the northern arms of the reservoir, the North Lake Recreational Sewer and Water District (NLRSWD) was formed. The NLRSWD is currently providing sewer service to approximately 650 subdivision residences aggregated around the north end of the reservoir, with additional residences expected to be connected to sewer and discontinue use of their septic systems in the near future. Approximately 60 septic systems in this area were unaccounted for as of December 1999. This sewer facility does not discharge to surface water. It is part of a partnership project with the approved City of Donnelly Wastewater Treatment Plant and relies on land application of the treated effluent. Treated effluent is applied at agronomic rates to an area of agricultural land in the eastern portion of the watershed. All application activities are conducted in areas where groundwater is deep below the surface and does not represent a transport potential for phosphorus or other pollutants of concern. The construction of the NLRSWD system has resulted in the removal of septic wastes that previously entered the reservoir in a nearly direct and immediate fashion from failing systems located in very close proximity to the reservoir. With proper decommissioning, the NLRSWD connections are estimated to have reduced the total phosphorus loading to that may contribute to Cascade Reservoir loadings are estimated to be reduced by 838 kg/yr.

A second sewer district, the South Lake Recreational Water and Sewer District (SLRWSD) has been formed for the southwest shore and is currently seeking sources of funding to establish service. The southwest location (in the area of the West Mountain subwatershed) has a high groundwater table, evidence of groundwater contamination, a high density of septic systems and poor soil types. Many of the developed parcels in the West Mountain subwatershed have septic systems that predate 1985 (average age is 23+ years) and are not in conformance with contemporary standards. Two different wastewater treatment plant designs are being considered at this time: (1) Augmentation of the approved City of Cascade Wastewater Treatment Plant to increase the existing capacity to handle additional wastes piped from the SLRWSD area. This plant currently discharges treated effluent to the NFPR downstream of Cascade Reservoir, below the Cascade Reservoir watershed boundaries. (2) Construction of a separate, approved treatment facility in the SLRWSD area that will utilize land application in an area with appropriate soil and ground-water characteristics. All land being investigated as potential land application sites is located south of Cascade Reservoir. The current opinion is that the initial design (partnership with the City of Cascade) will be selected as an interim mechanism for wastewater treatment, followed by the construction of a land application-based treatment facility specific to the SLRWSD as over time, restrictions to surface water discharges are expected to become more stringent. To this end, significant progress has been made toward the eventual sewering of the West Mountain area. Current plans include a joint effort with the City of Cascade to install a holding facility for wastewater at the current Cascade WWTP site. Holding tanks will be installed initially in those lots where septic systems are known or suspected to be failing or out of compliance due to age, high ground water conditions, poor soil characteristics or small lot sizes. These holding tank systems will then be upgraded to accommodate a pressurized sewer system at project completion. A 319 grant proposal for construction of the holding facility has been approved and funded. The work is scheduled for the 2000 to 2002 construction seasons. A second 319 grant proposal to assist in the emplacement of holding tanks in the SLRWSD area has also been approved and funded. The work is scheduled for the 2001 to 2002 construction seasons. At completion, the SLRWSD facility is expected to serve approximately 350 residences initially, with subsequent expansion over time. It is estimated that with proper decommissioning the initial 350 hookups will reduce Cascade Reservoir total phosphorus loadings by 706 kg/yr.

It is recognized that septic systems must be decommissioned properly to result in a 100 percent removal of the potential pollutant load they represent. Current Central District Health Department (CDHD) policy requires that abandoned septic tanks must be pumped, filled with sand or collapsed.

Of the total estimated septic system phosphorus load of 2,205 kg/yr, the NLRSWD reduction of 838 kg/yr and SLRWSD reduction of 706 kg/yr combine for a total load reduction of 1,544 kg/yr.

The cost of NLRSWD sewer connections was approximately $6,000 each, plus $350 to $450 per connection for septic system decommissioning. The total cost for 650 NLRSWD systems is approximately $4,193,000.

The estimated cost of SLRWSD sewer connections range from $8,000 to $11,000 each (which includes decommissioning). The total cost for 350 SLRWSD systems is approximately $3,850,000 (this cost reflects per-site hookup and decommissioning charges only, the current total system construction/operation cost estimates are higher based on additional system requirements).
Using these conservative figures, the total estimated capital cost for the septic system load reduction of 1,544 kg/yr is $8,043,000.

Septic System Load Reduction Monitoring

Monitoring of the septic tank phosphorus load reduction consists of tracking the number of residences that connect to a sewer system and decommission their septic systems. Monitoring includes inspection and reporting of decommissioned septic tanks. This inspection and reporting is the responsibility of the CDHD, the State Plumbing Inspector, and the decommissioning contractor.

In addition, the comprehensive, watershed-wide inflow and inlake monitoring used by DEQ to establish current loadings will continue as a mechanism to document improvements, identify initial loading trends, assess load reductions achieved and determine when the overall 37% reduction goal is attained. This monitoring is conducted on a monthly basis and, as several monitoring sites are located in close proximity to both the NLRSWD and the SLRWSD boundaries, can be used in a quantitative sense to determine the collective effectiveness of septic to sewer conversions, septic decommissioning and other associated measures completed.

Support for the City of Donnelly Stormwater Detention Basin

With the current level of progress in mind, and the subwatershed priority ranking discussed previously, the highest priority ranking for additional treatment of municipal stormwater within the watershed was assigned to the City of Donnelly, located predominantly in the Boulder/Willow subwatershed, as this location experiences significant stormwater flows during snowmelt and spring runoff. As identified in recommendation number 5 previously, Donnelly has the potential to contribute significantly to further surface water quality impacts to Cascade Reservoir due to its close proximity and existing rudimentary stormwater control/treatment system. Current runoff and snowmelt concerns include the desorption of phosphorus from soil particles in anaerobic soil conditions. The collection and control of standing runoff waters through detention mechanisms that allow the removal of sediment while minimizing the occurrence of anaerobic soil conditions and the associated desorption of sediment-bound phosphorus has remained a primary goal within urban/suburban land use.

To this end, two initial projects have been identified for management of stormwater flows in association with the City of Donnelly. Both treatment options will be applied as this location experiences significant stormwater flows during snowmelt and spring runoff.

The first project identified for improving stormwater management targets the ponding of spring runoff water in and around the City of Donnelly. The proposed projects focuses on the involves the manipulation of existing flow channels (located immediately west of the City of Donnelly) through removal of seven small, abandoned irrigation dam structures. This will allow better flow characteristics in the area of Boulder Creek. This will be followed by the augmentation of several existing sediment ponds lower in the drainage and removal of identified debris that obstruct flow and creates the opportunity for significant bank erosion in some areas. manipulation of existing flow channels (located immediately west of the City of Donnelly) through removal of seven small, abandoned irrigation dam structures to allow better flow characteristics in the area of Boulder Creek, followed by the augmentation of several existing sedimentation ponds lower in the drainage, and removal of identified debris that obstructs flow and creates the opportunity for significant bank erosion in some areas.

Preliminary engineering and site assessments have shown that the overall slope for the existing channel system is less than 0.5%. With this shallow slope, water from snow-melt ponds behind the upper, existing seven structures and creates standing pools (often 7 to 9 inches in depth) over large areas of the land within and immediately surrounding the City of Donnelly. This standing water leads to anaerobic conditions in the soil, followed by the subsequent release and transport of phosphorus to surface waters and, eventually, the reservoir. Improvements in the flow channel to encourage slow-flow movement of the runoff water, combined with augmentation of sedimentation ponds on the downstream segments, will reduce ponding/anaerobic potential on the upstream segments, and enhance sediment removal before entering the reservoir. Thus, while ponding will occur, it will be limited to smaller, deeper areas in the form of sediment ponds which result in the removal of both sediment particles and the associated bound phosphorus, not large shallow areas that lead to higher bioavailable phosphorus concentrations in the water discharging to the reservoir. Areas with substantial debris accumulation due to previous high velocity flows will be cleared to allow unrestricted, low velocity movement of water within the re-engineered drainage system and reduce the potential for culvert and bank destabilization from debris accumulation during high flow periods.

The second project involves the installation of stormwater treatment mechanisms in channels that discharge directly to Boulder Creek and are not possible to treat in the above manner. There are three primary drainage paths in the City of Donnelly that discharge directly to Boulder Creek. The stormwater treatment trains installed in these drainages will consist of a physical filtration mechanism to remove large debris, followed by a vortex-based separation mechanism designed to remove sediment, bacteria and non-dissolved organic material, followed in turn by an iron-rich sand filter to remove dissolved phosphorus and fine suspended materials.

Similar systems have been proposed for the treatment of stormwater from the designated drainage basins for the City of McCall. Outside funding support in the form of 319 grant proposals for the City of Donnelly (Boulder/Willow Creek subwatershed) and the McCall drainage basins has been secured. Federal 319 Grant monies were used to complete stormwater upgrades in 1999 and work is ongoing for the 2000 construction season in both Donnelly and the McCall drainage basins. Additional funding for both Donnelly and McCall has been requested for the 2001 through 2003 construction seasons. If attained, work will be initiated in the spring/summer of 2000.

The above projects represent an initial but ongoing effort to improve stormwater runoff to the reservoir. Similar projects will be implemented throughout the watershed. Data and operational information from passive and active treatment systems currently proposed or in place will be used to identify treatment practices and mechanisms that will work effectively for other discharge areas. Proposed stormwater treatment systems for municipal stormwater will include both channel alteration for drainage improvements and emplacement of stormwater treatment mechanisms prior to discharge into surface waters. Both passive (i.e. gravel and vegetated filter strips) and active (i.e. sand filter installation) treatment mechanisms will be implemented.

The Cascade Reservoir Watershed Urban/Suburban Source Implementation Plan contains references the *Handbook of Valley County Stormwater Best Management Practices, 1997*, and the *Catalog of Stormwater Best Management Practices for Idaho Cities and Counties* as these contain a complete list of site-specific BMP projects, phosphorus load reduction efficiencies, comparative costs and applicability for each of the recommended BMPs.

A selection matrix for identifying potential BMPs in the *Handbook of Valley County Stormwater Best*

Management Practices, 1997 will be utilized for BMP selection in correlation with the *Stormwater BMP Selection Suitability Decision Tree* included in Appendix C-1 of this document. Both of these documents will be available to the general public at the Valley County Planning and Zoning Office and the Cascade Satellite Office of DEQ.

Treatment options for urban/suburban stormwater are many and varied. It should be kept in mind that actual BMPs implemented may vary due to site requirements, land availability options, funding availability, and the needs of each separate municipality or subdivision.

Urban/Suburban – Load Reduction Summary

As discussed in the preceding sections, implementation objectives have been identified for the reduction of urban/suburban phosphorus loading. Projects proposed and in progress, combined with changes in management and behavioral practices are expected to result in the required 30% reduction of urban/suburban based phosphorus loading to Cascade Reservoir as summarized in Table 5 below.

Additionally, septic-related loading is expected to decrease by ~70% (1,544 kg/yr)with the completion and proper decommissioning of the systems within the NLRSWD and the SLRWSD. The septic system load reduction results from both water quality and public health driven priorities. Provision of wastewater collection and treatment facilities is accomplished on service area basis as opposed to an individual, site specific basis.

Municipalities

Treatment options for urban/suburban stormwater are many and varied. Available options require a broad range of treatment mechanisms and acreages, and range from sand filters to constructed wetlands. The realm of managing urban stormwater runoff includes existing development, as well as plans for new development. In confronting both the correction of existing and the prevention of future problems, two categories of BMPs are often necessary:

1) Watershed planning source control measures: used to minimize and/or prevent the source(s) of urban pollutants (e.g., limiting impervious area through clustering development).

2) Site design structural measures: designed, constructed, and periodically maintained to interrupt the detachment, transport, and subsequent discharge of pollutants.

Projected stormwater management options that have been discussed to date are outlined in Appendix C-1, Table 1-4. It should be kept in mind that these are proposed management options only. Actual BMPs implemented may vary due to site requirements, land availability options, funding availability, and the needs of each separate municipality or subdivision.

The efficiency range for available options (as outlined in the Handbook) extends from 30% to 65% depending on the selected option, emplacement efficiency, available land area, storm intensity and treatable runoff volume. The average efficiency is 44%. Due to the variability outlined above, a conservative efficiency estimate of 35% was used to calculate stormwater treatment-based load reductions for the cities of Cascade, Donnelly and McCall. It is assumed that the entire existing stormwater system will be evaluated for treatment upgrades within each municipality, hence a value of 100% is listed in the "% land-use treated" column of Table 5. The total projected reduction for municipalities is 445 kg or 35% of the total stormwater-induced load.

Table 5. Phosphorus Reduction Goals for Urban/Suburban Land-Use Categories

Nonpoint Sources	TP (kg/yr)[1]	% Land-use treated[2]	% Efficiency	Load reduction (kg
Municipalities				
City of Cascade	222	100	35%	78
City of Donnelly	151	100	35%	53
City of McCall	897	100	35%	314
Municipal Stormwater Total	**1270**			**445**
Total Municipal Stormwater % Reduction				***35***
Rural Residential Subdivisions	638	100	25%	160
Total Rural Subdivision Stormwater % Reduction				***25***
Roads and Highways				
Unimproved	434	80	85%	295
Graveled	1247	65	45%	365
Paved	601	35	45%	95
State Hwy 55	234			0
Transportation Total	**2515**			**754**
Total Transportation % Reduction				**30**
Grand Total	**4423**			**1359**
Total % Reduction				***31***

1 These figures include management, natural and background loads specific to these sources.
2 The 100 percent treatment designation indicates the intent to pursue a system-wide approach to stormwater management.

The reduction in stormwater-induced pollutant load will be accomplished by careful, site-specific emplacement of stormwater/urban runoff BMPs. Proposed BMPs are outlined in Appendix C-1, Table 1-4. Identification of BMPs for emplacement will be governed by existing site topography and vegetation, flow volume and frequency, and other significant factors as identified.

Both retrofitting of existing systems and inclusion of stormwater handling mechanisms as a design criteria for new construction will be undertaken as part of the implementation plan for urban/suburban sources. Controlling runoff from existing urban areas tends to be more expensive than managing runoff from new development. Restoration and other types of retrofit activities should therefore be based on the greatest ratio between economics and the provided environmental benefit(s).

Stormwater management plans for new development should encourage sustaining pre-development runoff volumes through the use of source control BMPs. Local stormwater management plans that focus not only on water quantity, but also *water quality* should be required for proposed developments. Stormwater management plans should include design strategies to protect sensitive open space areas, minimize site disturbances, and use natural treatment functions.

Stormwater management plans for identifying and correcting problems address existing stormwater runoff nonpoint sources. Controlling runoff from existing urban areas tends to be more expensive compared to that associated with managing runoff from new development. Since there is no opportunity for planning up-front, the approach tends to be more deficit oriented and often relies on targeting storm water control projects that provide the highest ratio of cost benefit. The first step identifies the priority pollutants and their associated source(s); as priority pollutants are identified and incorporated together within a runoff management plan for an area, pollutant reduction opportunities are identified. Restoration and other types of retrofit activities should be based on the greatest ratio between economics and the provided environmental benefit(s).

Storm water management plans for new development should encourage sustaining pre-development runoff volumes through the use of source control BMPs. A local storm water management plan should focus not only on water quantity, but also *water quality*. Storm water management plans vary and include design strategies to protect sensitive open space areas, minimizing site disturbances, and using the land's natural treatment functions.

Appendix C-1, Table 1-1 contains a subwatershed specific listing of stormwater and urban runoff BMPs recommended for implementation. Table 1-2 gives an estimated cost breakdown for all recommended BMPs over the expected lifetime and a cost/benefit ratio for phosphorus removal for each separate BMP. Emplacement of BMP combinations or systems is recommended for the maximum phosphorus removal efficiency. Table 1-3 outlines projected costs and cost/benefit for the proposed road-related phosphorus reduction BMPs. Table 1-4 summarizes projected costs associated with stormwater handling upgrades for phosphorus reduction, and presents a grand total for work yet to be done to reach the required phosphorus reduction from urban/suburban land uses within the watershed.

Roads and Highways

The BMP efficiencies listed in Table 5 above represent appropriate graveling (on native material roads), ditching and cross-drains with gravel interfaces and vegetated swales (on native and graveled roads), and culvert and ditch upgrade/repair for paved roadways. Initial transportation goals are to address 80% of the unimproved roads, 65% of graveled roads, and 35% of paved roads. The phosphorus load reduction identified for road erosion sources (~754 kg/year) can be accomplished through the graveling of roads currently surfaced by native materials only (>90% efficiency projected), through upgrading existing surfaced roads by addition of culverts and appropriate ditching practices (50% average efficiency projected).

It is expected that existing road condition will be used to assign priority areas and/or road segments. Silvaculture practices (private, state, federal and commercial), have shown that significant reductions in sediment transport and erosion can attained on even very steep roadways with the implementation of appropriate BMPs. These road upgrades include hard-surfacing, culvert replacement and drainage improvement measures, as well as obliteration and re-seeding to establish natural vegetation. Private owners, along with local city and county agencies, are encouraged to improve existing roadways that show significant sediment loads in snow-melt or storm events. The following table contains BMP efficiencies observed for logging roads in the Cascade Watershed.

It is also understood that, while it is not accounted for in Table 5 above, the Idaho Transportation Department will be upgrading specific sections of State Highway 55 within Cascade Reservoir Watershed. The load reduction achieved from these upgrades will also be entered into the Implementation Data Base and will be applied to the overall reduction required from transportation-based Urban/Suburban land uses.

Rural Residential Subdivisions. Due to the lack of centralized storm-sewer systems in rural subdivision areas and the increased difficulty of treating individual runoff locations, a more conservative estimate of BMP efficiency (25%) was used to calculate stormwater treatment-based load reductions for these areas.

As outlined in Table 5, a 31% total load reduction from Urban/Suburban land-use sources is projected if the goals are achieved as listed.

As specific BMP selections, emplacement locations, and priority will be determined by City and County policy, and funding appropriation mechanisms, the listed load reductions have been assigned on a municipal and road-type basis only. It is understood that BMPs will be selected from approved BMP lists (the Handbook or appropriate equivalent). Site specific BMP emplacement will be the responsibility of local government authorities, and should be documented within a facilities plan or other appropriate document. For load-reduction accounting purposes, copies of this documentation and all subsequent site evaluations will be submitted to the Cascade Reservoir TAC for subsequent input to the Cascade Reservoir Implementation Data Base established for all nonpoint sources within the watershed.

Schedule for Completion

A firm schedule for completion of the listed goals and objectives cannot be formulated without assurance of funding sources. Until such are identified, an active program for identification and prioritization will be established which will allow immediate application of funds as they become available.

Funding/Cost

The successful implementation of recommended BMPs and management practices to reduce phosphorus loading within the urban/suburban arena will require the availability of cost share funding, loans, grants, or other sources of funding to complete. Full scale implementation cannot be expected to occur prior to the identification of such funding sources, and is expected to proceed in a piece-meal fashion as specific funding becomes available. Cost of the total recommended implementation plan for Urban/suburban reductions is attached in Appendix B.

Reasonable Assurance

DEQ will rely upon existing authorities and voluntary implementation of additional phosphorus reduction measures to achieve the goals and objectives of this plan. Attainment of water-quality objectives and full support of beneficial uses for Cascade Reservoir, as demonstrated by this plan, will require a significant long-term coordinated effort from all pollutant sources throughout the watershed.
For nonpoint sources, the feedback loop will be used to achieve water-quality goals. DEQ and other involved agencies will conduct instream and/or qualitative monitoring throughout the watershed to evaluate the overall effectiveness of best management practices (BMPs) and other restoration projects in reducing phosphorous loading. If BMPs and other restoration projects prove ineffective they will be modified to ensure effectiveness of existing and future projects. Any modifications to required BMPs will be subject to state rule-making requirements. DEQ will work closely with the Cascade Reservoir Coordinating Council (CRCC), applicable resource agencies and affected parties to review the existing regulatory requirements and determine if there is a need for additional requirements for nonpoint sources activities to achieve the goals of the plan.

DEQ's regulatory and enforcement authorities are generally set forth in the Idaho Environmental Health and Protection Act of 1972, as amended (See Idaho Code Sections 39-101 *et. seq.*).

Additionally, the following mechanisms are in-place or proposed to assist in the attainment of water-quality goals.

Local Regulation
Local ordinances provide a means for which the county or given municipality can assure that site planning and development take potential erosion and stormwater drainage concerns into account. An ordinance is a more long-lasting tool that should be implemented to encourage good practices and prevent the perpetuation of unsound practices throughout the watershed.

A local ordinance can take many forms and degrees, varying in a spectrum from educational to enforcement dominated. Notwithstanding, an ordinance should be based on several clearly stated goals that are consistent with circumstances of the watershed. Cost-effective storm water management considers and incorporates all of the possible source control measures, prior to implementing treatment controls. In the case of protecting Cascade Reservoir water quality, it is especially relevant and cost-effective to target and encourage control of stormwater runoff from commercial and industrial facilities. Erosion and sediment control for new construction activities also lends toward maintaining minimal contributions from erosional background sources.

Valley County Land Use and Development Ordinance

The "Valley County Land Use and Development Ordinance" (1992) contains regulations pertaining to land use and development. The Ordinance was adopted by the Valley County Commissioners and has full authority under the "Idaho Planning Act of 1975," Title 67-6501 through 67-6533. The purpose of the Ordinance is to provide consistent regulatory framework to protect and promote the health, safety, and general welfare of present and future inhabitants of the county.

Site grading, vegetation removal, and construction activities that have any impact on the land surface or adjoining properties is classified as conditional use. A conditional use permit is required prior to start of such an activity. Grading for agricultural activities, timber harvest, and similar permitted uses are exempt from this conditional use classification. The conditional use application includes the preparation of a *site grading plan* and certification of any necessary BMPs for surface water protection, as well as erosion and sediment control. The site grading plan is subject to review and approval of the Valley County Engineer and the Soil Conservation District, prior to the receipt of a conditional use permit.

McCall authority

The City of McCall's building code (MCC Title 2) authorizes the City Engineer to review all applications with the purpose of determining whether a site development project will cause flooding on adjacent properties. The review is also necessary to determine whether the project incorporates appropriate treatment facilities, consistent with any federal, state or local BMP guidance. The City of McCall adopted the Handbook of Valley County Stormwater BMPs for use as the local guidance. For projects involving small parcels with minimal impervious surfaces, appropriate temporary erosion control BMPs are required. For larger-parcel projects with corresponding, permanent treatment BMPs may be necessary.

The City of McCall has adopted Appendix Chapter 33 of the Uniform Building Code (1994 edition). Large scale site development projects are required to obtain a grading permit. The grading permit is subsequently reviewed by the City Engineer, similar to that for building permits.

Following the approval of the Cascade Reservoir Implementation Plan, Phase III of the TMDL document will be prepared (December 2003) using monitoring data to evaluate progress toward attainment of water-quality standards and support of designated beneficial uses. If goals are being reached, or if trend analysis indicates that improvements made are substantial enough to result in attainment of water-quality objectives within a reasonable time frame, the watershed management plan will be a success. If not, the plan will be revised and will outline new goals and a new implementation strategy.

Monitoring

Success in reducing the current annual load of total phosphorus will be measured by comparing individual subwatershed allocations with the measured contributions monitored at or near the mouth of major tributaries. Potential indicators may be quantitative (e.g laboratory analysis of phosphorus concentrations in water exiting a created wetland) or qualitative (e.g. visual determination that there is less sediment in the water passing through a fenced riparian area) depending on the BMP implemented and the overall scope of the project.

Consistent in-stream, and in-reservoir monitoring by the Idaho DEQ is ongoing within the watershed. In-stream monitoring is scheduled to occur on a monthly basis, year round, and includes physical, chemical and microbiological parameters. In-reservoir monitoring is scheduled to occur monthly during ice-free seasons and includes physical, chemical and microbiological parameters. Idaho DEQ monitoring is expected to continue throughout the implementation process (through 2003), as outlined in the Cascade Reservoir Watershed Phase II Management Plan, and will provide a comprehensive assessment of changes in phosphorus and suspended-sediment loading within the watershed. Site or BMP-specific monitoring may be included as part of specific treatment projects if determined appropriate and justified.

Reporting Schedule

Annual reports detailing phosphorus reduction measures implemented, observed emplacement and operation efficiencies, and projected load reductions will be submitted to the appropriate TAC representative for inclusion in the Cascade Reservoir Implementation Data Base. Current scheduling is for preparation and submission of annual reports by November 30 of each year. This may change with refinement of the reporting process and scheduling of the other nonpoint source annual report submission.

Information and Education Efforts

Load reduction information, BMP emplacement mechanisms and performance/efficacy values obtained during the course of implementation will be available to the public through a variety of public forums including reports to the Cascade Reservoir Coordinating Council, Cascade Reservoir Technical Advisory Committee, Cascade Reservoir Implementation Plan Source Groups and other intersected organizations and agencies. The information will also potentially be available to the public through the Cascade Reservoir Implementation Web site, public tours, implementation efforts brochures published as part of the Cascade Reservoir Implementation Plan, and included in the Cascade Reservoir Watershed Phase III Management Plan document which will be completed in 2003.

The Handbook should also serve as a means of increasing public awareness and implementing consistent, county-wide site design treatment considerations. As public awareness increases, a broader public acceptance should follow. Rising public awareness can only occur through additional technical education for contractors, developers and land owners. County and municipal governments will adopt a proactive stance and encourage more comprehensive strategies for stormwater planning and management.

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Appendix C-1

Table 1-1 Recommended BMPs by Subwatershed

Category/Potential BMPs	Payette Lake	Lake Fork	N. Fork Payette	Mud Creek	Boulder Creek	Gold Fork	Willow Creek	West Side	Cascade
Urbanized Areas									
Stormwater Inlets	X				X			X	X
Wetlands/Swales									X
Ditch Maintenance	X				X			X	X
Construction Erosion Control	X	X	X	X	X	X	X	X	X
Addition Erosion Control	X	X				X			
Raised Roadways	X	X	X	X	X				
Clearing Limits	X	X	X	X	X	X	X	X	X
Wet Ponds	X	X			X	X			
Modify Culverts					X				
Bacterial Control	X								
Agricultural Areas									
Traditional Erosion Control				X	X	X	X		
Fencing			X	X	X		X	X	X
Revegetate				X	X		X		
Filter Strips				X	X	X	X		
Wet Ponds			X	X	X		X		
Ditch Maintenance					X	X	X		X

Category/Potential BMPs	Payette Lake	Lake Fork	N. Fork Payette	Mud Creek	Boulder Creek	Gold Fork	Willow Creek	West Side	Cascade
Streambank Erosion			X	X	X		X		
Surrounding Hills									
Road Stabilization	X	X			X	X			
Slope Protection	X	X			X	X			
Topsoil Addition	X	X			X	X			
Detention Pond	X	X			X	X			
Waterside Property									
Filter Strips	X	X	X	X	X	X	X	X	X
Wetlands	X						X	X	X
Biofiltration Swales			X	X	X		X		
Road Stabilization	X							X	
Berms	X							X	X
Transportation Corridors									
Old State Highway							X		
Street Sweeping	X			X	X		X	X	X
Bridge Maintenance			X	X	X				

Table 1-2 BMP effectiveness, considerations and comparative cost and applicability.

BMP	Phos. Removal efficiency	Phos. Removal Range	Sed. Removal efficiency	Sed. Removal Range	Construct. cost	Construct. Cost Range	Life Time	Relative O&M Cost*	Total Ann. Cost
Vegetated Swale	20	0-100	60	0-100			50		
seed (ln ft)					$6.50	$4.50 - 8.50		$0.75	$1
sod (ln ft)					$20.00	$8 - 50		$0.75	$2
Vegetative Filter Strip	40	0-95	65	20-80			50		
natural (acre)					$0	$0		$100	$100
seed (acre)					$400	$200 - 1000		$117	$125
seed/mulch (acre)					$1,500	$800 - 3500		$170	$200
sod (acre)					$11,300	$4.5K - 48K		$700	$474
Sand Filter (cu ft)	50	0-90	80	60-95	$5	$1 - 11	25	7%	$0.45
Infiltration Trench (cu ft)	60	40-100	75	45-100	$4	$2.50 - 7.50	10	9%	$0.60
Infiltration Basin (cu ft)	65	45-100	75	45-100	$0.50	$0.40 - 0.70	25	low	$0.04
Wet Pond	45	10-85	60	-30-91				low	
Wet Extended Detention	65	50-80	80	50-100				low	
Dry Extended Detention Pond	25	10-55	45	5-90				low	
Constructed Wetland	25	-120-100	65	-20-100				high	
Oil/Water Separator	5	5-10	15	0-25	$18,000	$15 - $20K	50	$20	$1000
Name	Phos. Removal efficiency	Phos. Removal Range	Sed. Removal efficiency	Sed. Removal Range	Construct. cost	Construct. Cost Range	Life Time	Relative O&M Cost*	Total Ann. Cost

4 Inch Gravel	92%		92%		$7.58/ln ft		20 yr		$0.38 /ln ft
Asphalt Paving	97%		97%		$23.50 /ln ft		20 yr		$1.18 /ln ft
Armor Ditch Line	92%		92%		$4.96 /ln ft		20 yr		$0.25 /ln ft
Road Closure	75%		75%		$2.00 /ln ft		n/a		n/a
Road Decommission	n/a		n/a		$1.07 /ln ft		n/a		n/a

* Based on the Boise City Public Works Department: Stormwater BMPs Guidance, 1997.

Table 1-3. Projected cost* associated with reduction of road-related phosphorus loading

Non-Subdivision Roads	Avg W ft	surface area (ac)	phosphorus load kg/yr	surface area to be treated	unit cost (per ln ft)	treatment cost	treatment efficiency	phos reduc. kg/yr	reduction cost/kg
State Hwy 55	32	73	234	0	$2.51	$0	-	0	$0
Paved	23	149	438	52	$2.51	$254,968	45%	69	$3,697
Graveled	21	186	613	121	$3.26	$849,180	45%	179	$4,738
Unimproved	17	20	112	16	$8.57	$315,450	85%	76	$4,147
				Non-subdivision Total		$1,419,598		324	
Subdivision Roads									
Paved	22	64	163	23	$2.51	$114,296	45%	26	$4,460
Graveled	23	230	634	149	$3.26	$869,323	45%	185	$4,689
Unimproved	17	57	322	46	$8.57	$1,042,355	85%	219	$4,755
				Subdivision Total		$2,025,974		430	
TOTAL		779	2,515	406		$3,445,572		754	$4,567

* Does not include monies spent to date

Table 1-4. Projected cost* associated with the reduction of stormwater-related phosphorus loading.

	phosphorus load (kg/yr)	proposed treatment	unit cost		treatment cost	% land-use treated	% efficiency of BMPs	load red. kg TP/yr	reduction cost/kg
Stormwater									
Municipalities									
City of Cascade	222	vegetated swale	$1.50	ln/ft	$7,950				
		filter strip	$125.00	acre	$625				
		sand filter	$5.00	cu ft	$2,000				
		const. wetland	variable		$30,000				
		system improvements	variable		$30,000				
		System information			*$70,575*	*100*	*35*	*78*	*$905*
City of Donnelly	151	vegetated swale	$1.50	ln/ft	$11,250				
		filter strip	$125.00	acre	$938				
		sand filter	$5.00	cu ft	$2,000				
		const. wetland	variable		$40,000				
		system improvements	variable		$150,000				
		System information			*$204,188*	*100*	*35*	*53*	*$3,853*
City of McCall	897	vegetated swale	$1.50	ln/ft	$15,000				
		filter strip	$125.00	acre	$1,250				
		sand filter	$5.00	cu ft	$2,000				
		const. wetland	variable		$50,000				
		system improvements	variable		$50,000				
		System information			*$118,250*	*100*	*35*	*314*	*$377*
Subtotal	***1270***				***$393,013***			***445***	***$884***
Rural Residential Subdivisions	638								
		vegetated swale	$1.50	ln/ft	$22,500				
		filter strip	$125.00	acre	$1,875				
		sand filter	$5.00	cu ft	$2,000				
		erosion control	variable		$10,000				
		const. wetland	variable		$40,000				
		system improvements	variable		$35,000				
		System information			*$111,375*	*100*	*25*	*160*	*$696*
Subtotal	**638**				***$111,375***			***160***	***$696***
Stormwater Total	1908				$504,388			605	$834
Transportation Total	2515				$3,445,572			754	$4,570
Grand Total	4423				$3,949,960			1359	$2,908

* Does not include monies spent to date

Appendix C-2

STORMWATER BMP SELECTION SUITABILITY DECISION TREE

SUBDIVISION AND "DRAINAGE" PLAN EVALUATIONS

NOVEMBER 2, 1998 (1ST VERSION)

JUNE 15, 1999 (2ND VERSION)

Prepared by:

STORM WATER PROGRAM
State Technical Services Office
IDAHO DIVISION OF ENVIRONMENTAL QUALITY

STATE OF IDAHO
DIVISION OF
ENVIRONMENTAL QUALITY

1410 North Hilton, Boise, ID 83706-1255, (208) 373-0502

Philip E. Batt, Governor

October 16, 1998

Dear Checklist Users:

The Storm Water Program has been working to coordinate its efforts among the various DEQ programs that support TMDLs and water quality in general. Over the coming few years, more communities across the state will be obligated (much like Boise City) to permit their municipal stormwater discharges through EPA's NPDES program. This ultimately results in stormwater management and control at the local government level. At the state level, to ensure consistency and support TMDL efforts, the Storm Water Program has prepared a comprehensive guidance, entitled: Stormwater BMP Selection Suitability Decision Tree or the "Checklist."

The Checklist is a comprehensive guidance for implementing state regulation or policy as it pertains to storm water management. It should assist regional office staff in clarifying TMDL implementation strategies, the evaluation of subdivision and "drainage" plans, and serve to bridge current state regulation and two policies: "*Policy for No-Net Increase—TMDLs*" (PM 98-2) and "*Ground Water Protection from Storm Water Runoff*" (PM 98-3). In particular, it is directed at two audiences: design professionals and the drainage plan evaluators. The Checklist serves in screening the appropriateness or suitability of selected stormwater practices and methods related to land development.

The Checklist provides technical or state policy implementation and is intended to fill a current regulatory gap that exists at the federal level. Current federal regulation only targets communities greater than 100,000 in population and land disturbing activities greater than 5 acres. The gap will eventually be closed as more Idaho communities progress toward local regulation and management of storm water discharges. EPA's Phase II NPDES storm water program may affect over twenty communities (e.g., greater than 10,000 population), most of which are located on water quality limited segments, and go into effect in 2001.

Sincerely,

Todd Maguire
Water Quality Program Specialist

TM/mg

Introduction

The Water Quality Standards & Wastewater Treatment Requirements, the Ground Water Quality Rule, and subsequent policies provide implementation guidance for reviewing and making recommendations on subdivision and "drainage" plans. The following policies provide legal authority for reviewing subdivision and drainage plans and making recommendations as necessary for storm water quality management:

- "Rules Governing Nonpoint Source Activities" (Implementation Policy, IDAPA 16.01.02.350.01),
- PM 98-2, "Policy for No-Net Increase—TMDLs" (Water Quality Limited Waters and TMDLs, IDAPA 16.01.02.054/55), and
- PM 98-3, "Ground Water Quality Protection from Storm Water Runoff" (Ground Water Quality Rule, IDAPA 16.01.11).

These policies provide guidance for incorporating storm water management practices and methods into land development for water quality protection. Collectively, the scope of implementation only applies to storm water practices and methods during the planning, design, or pre-construction stage.

Evaluator and/or Reviewer

Local jurisdictions such as Boise City Public Works and the Ada County Highway District, do provide subdivision plans and specifications review for storm water drainage plans. The Idaho Department of Water Resources has the authority under the Underground Injection Control (UIC) Program to review and approve appropriate storm water controls when considered a Class V injection well according to IDAPA 37.03.03. However, where there are cases of lacking or insufficient review for water quality considerations, the DEQ can provide guidance as necessary. For example, where a TMDL has not sufficiently identified an authority to provide the necessary reviews of local subdivision drainage plans. This guidance is primarily suited toward assuring that storm water practices and methods are appropriately selected based on site-specific design suitability and targeted pollutants of concern. *Design review for storm water practices and methods is not provided for in this instance.*

Conducting drainage plan evaluations for every project is not realistic. The DEQ Regional Offices or other local public governmental entities are dependent upon mechanisms to assist in prioritizing projects. The "Stormwater BMP Selection Suitability Decision Tree" (or the "Checklist") is a performance-based mechanism for identifying and prioritizing land development projects that present the greatest risk to impacting water quality. The Checklist is a tool for identifying projects that should be targeted for drainage plan evaluations because they present a special need. Screening is not considered a review, but rather, an opportunity to determine whether selected storm water practices and methods have been chosen appropriately based on design "site suitability criteria."

Appropriate storm water practices and methods means that they are suitable for the physical conditions of a site. However, they must also be appropriate for removing "targeted pollutants" of concern. By selecting the appropriate storm water practices and methods, beneficial uses and thus water quality is protected. The Checklist is designed to screen projects that could have impacts to water quality and to focus limited resources on the evaluation of those selected storm water practices and methods, on a project-by-project basis.

Background information is necessary and should be filled in on Table 1 below, prior to working through the decision tree on pages 4-5 (Figure 1). The decision tree outlines the Checklist's (BMP suitability selection) process for evaluators and reviewers. The decision tree involves three levels that are differentiated by several factors. The total impervious surface area proposed by a project initially differentiates the three levels. Additionally, Levels 2 and 3 are both differentiated into whether the discharge is to a surface or subsurface water body. Level 3 is further differentiated from Level 2 by the percentage of impervious surface area for the proposed total project parcel. For example, a surface water BMP option is highly recommended for Level 3 land development projects with equal or greater than 50% impervious surface area. In cases where ground water discharge is imminent, advanced pretreatment becomes a necessity. Also, regardless of level, projects proposing water quality ponds and constructed wetlands should be evaluated by the DEQ. The decision tree for evaluators/reviewers is outlined in further detail on pages 6-7 in a checklist format (Table 2).

TABLE 1. BACKGROUND INFORMATION REQUIRED FOR THE EVALUATOR/REVIEWER DECISION TREE ON PAGES 4-5. THE STEPS IN PARENTHESES CORRESPOND TO STEPS IN THE DECISION TREE.

1. Is the Catalog used as the technical guidance and if so, which BMP is referenced? If not, which type of storm water practice or method is described? ______________

____

2. What is the proposed area of impervious surface coverage*? __________ square feet (STEPS 1 and 2)

   * Impervious surface coverages include but are not limited to surfaces described as being covered by asphalt, concrete, pavement, a building structure (rooftops), and compacted soils (due to clearing and grading practices).

3. What is the percentage of site is impervious? ________% (STEP 8)

4. Does the discharge from the proposed stormwater practice or method go to surface or ground water?____________ (STEPS 3, 4, and 9) If discharging to a surface water body, what is the name and priority?________________________ (STEPS 10 and 11) Is a TMDL completed? __________

4. What is depth to bedrock or parent material?_________ feet (STEP 5)

5. What is site's depth to seasonal high (ground) water table?_________ feet (STEP 6)

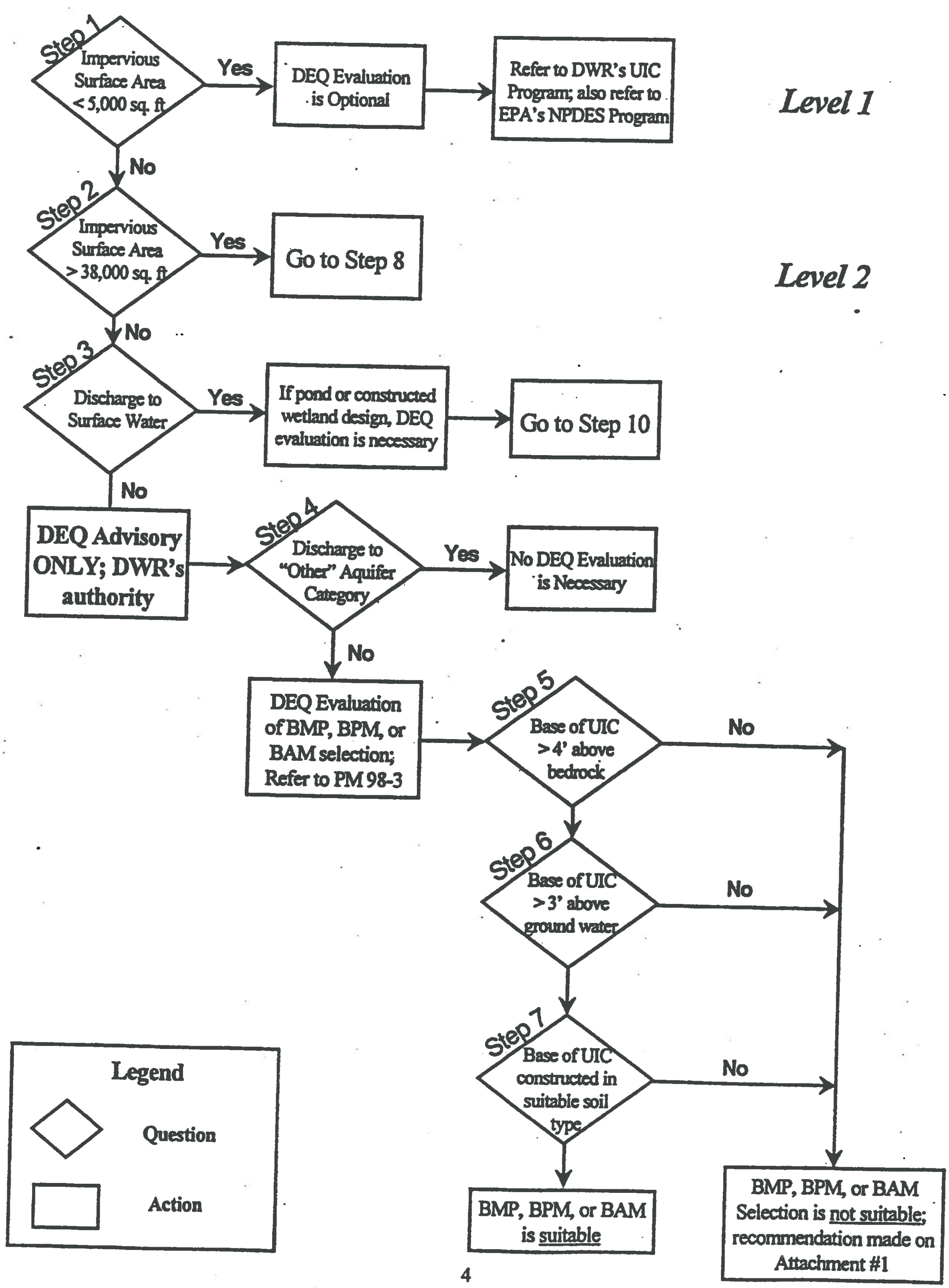
6. What is the site's soil hydrologic group or soil texture description based on Idaho's Catalog or Natural Resource Conservation Service's (SCS) TR-55 manual**?
   ______________________________________ (STEP 7)

   ** As a result of urbanization, the soil profile may be considerably altered and the listed group classification may no longer apply. In these circumstances, use the following to determine soil hydrologic group (*HSG*) according to the *soil texture* of the new surface soil, provided that significant compaction has not occurred (Brackensiek and Rawls, 1983):

HSG	*Soil Textures*
A	Sand, loamy sand, or sandy loam
B	Silt loam or loam
C	Sandy clay loam
D	Clay loam, silty clay loam, sandy clay, silty clay, or clay

7. What is the drainage area in acres of the selected storm water practice or method?
   ____

Stormwater BMP Selection Suitability Decision Tree



Stormwater BMP Selection Suitability Decision Tree

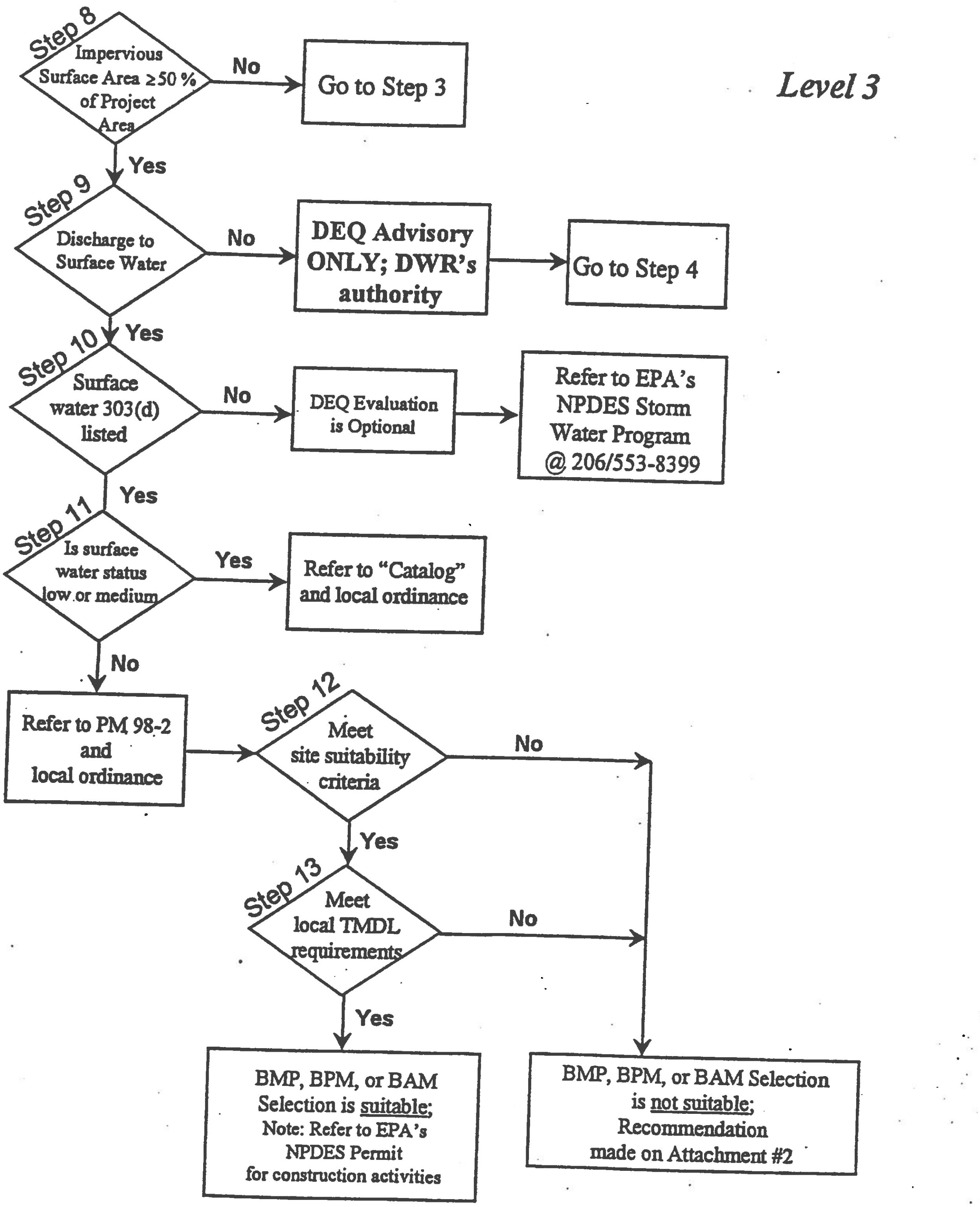


TABLE 2. LEVELS DESCRIBING SCREENING CRITERIA, REQUIREMENTS, AND PREFERRED RECOMMENDATIONS TO SUPPORT THE DECISION TREE FOR EVALUATORS AND REVIEWERS.

LEVEL 1

<u>SCREENING CRITERIA</u>

The proposed site development impervious surface area does not exceed 5,000 square feet (the 5,000-square-foot trigger corresponds roughly to the area of a small parking lot).

<u>REQUIREMENTS</u>

DEQ evaluation is optional.

<u>COMMENTS AND RECOMMENDATIONS</u>

- ☐ A proposed commercial/industrial site development project qualifies for coverage under EPA's NPDES Multi-sector Industrial Permit according to the *Catalog* (Appendix C).
- ☐ A proposed site development project includes the design of a Class V injection well facility, system, or device for storm water control, refer plan and specs to the IDWR for review and approval.

LEVEL 2

<u>SCREENING CRITERIA</u>

A) Proposed site development impervious surface area is equal to or greater than 5,000 square feet <u>and</u> discharges to a §303(d) listed segment <u>or</u> to "General" or "Sensitive" Resource aquifer:

<u>2.1) Surface treatment and disposal to a §303(d) listed segment</u>:

- ☐ low or medium priority listed segment, refer submitter to the use of a technical guidance such as the *Catalog* to follow the preferred standards for storm water management; <u>or</u>
- ☐ high priority listed segment, refer submitter to PM 98-2 or recognized local requirements authorized by a TMDL, and the use of a technical guidance such as the *Catalog* to follow the preferred standards.

<u>2.2) Subsurface treatment and disposal to a "General" or "Sensitive" Resource aquifer</u>:

- ☐ The BMP, BPM, or BAM selection is suitable. The interface between the base of a Class V injection well system or device is:
  - <u>Y</u> <u>N</u> greater than 4-feet above bedrock, and
  - <u>Y</u> <u>N</u> greater than 3-feet above the seasonal "high (ground) water table," and
  - <u>Y</u> <u>N</u> will be constructed within an appropriate "SCS soil type" A or B.
- ☐ The BMP, BPM, or BAM is not suitable.

B) ☐ The proposed site development does not discharge to a §303(d) limited segment or a "General" or "Sensitive" Resource aquifer; no DEQ evaluation is necessary.

<u>REQUIREMENTS</u>

- ☐ For a proposed surface treatment and disposal facility, system, or device, recommendations were made to follow the standards of the *Catalog* or an equivalent technical reference; or

☐ The subsurface treatment and disposal facility, system, or device was *suitable*, recommendations were transferred to the IDWR or a District Health Department office via recommendations on Attachment #1 (page 11); or

☐ The surface or subsurface treatment and disposal facility, system, or device was *not suitable*, recommendations were made on Attachment #1 (page 11).

COMMENTS AND RECOMMENDATIONS

☐ The proposed commercial/industrial site development project qualifies for coverage under EPA's NPDES Multi-sector Industrial Permit according to the *Catalog* (Appendix C). Refer project manager to EPA Storm Water Program (206/553-8399).

☐ ____

____

____

LEVEL 3

SCREENING CRITERIA

Proposed site development impervious surface area is greater than 38,000 square feet and total impervious surface area is less than 50% of the parcel (The 38,000-square-foot trigger roughly corresponds to the area of one city block). [See "Comments and Recommendations" for sites equal or greater than 50 % total impervious surface area]

3.1) Surface treatment and disposal

The BMP, BPM, or BAM selection is suitable, where selection:

☐ meets all specified "Site Suitability Criteria," according to *Catalog* Table 3-1; and

☐ is appropriate for the "Targeted Pollutant" of concern, according to the *Catalog* (Table 3-1) and approved TMDL requirements.

3.2) Subsurface treatment and disposal to a "General" or "Sensitive" Resource aquifer:

☐ The BMP, BPM, or BAM selection is suitable. The interface between the base of a Class V injection well system or device is:

Y N greater than 4-feet above bedrock, and

Y N greater than 3-feet above the seasonal "high (ground) water table," and

Y N will be constructed within an appropriate "SCS soil type" A or B.

☐ The BMP, BPM, or BAM is not suitable.

REQUIREMENTS

☐ The surface treatment and disposal facility, system, or device was *suitable*, a review and approval of plans and specifications was performed; or

☐ The subsurface treatment and disposal facility, system, or device was *suitable*, review was transferred to the IDWR or a District Health Department office that is performing this function; or

☐ The surface or subsurface treatment and disposal facility, system, or device was *not suitable*, recommendations were made on Attachment #2 (page 11).

COMMENT AND RECOMMENDATIONS

☐ The proposed site development does not meet the Level 3 "screening criteria," use Attachment #2 (page 11) for additional comments and recommendations.

☐ Where the proposed site development impervious surface area is greater than 38,000 square feet and total impervious surface area is equal or greater than 50% of the parcel, a surface water BMP option is highly recommended.

Design Professional

Design professionals must use a practical approach to protect water quality from the effects of land development. A practical approach for water quality protection includes incorporating appropriate storm water practices and methods: Best Management Practices (BMPs), Best Practical Methods (BPMs), or Best Available Methods (BAMs) into land development projects.

In choosing appropriate storm water practices and methods, the aim is to fully protect beneficial uses. Thus, selection should focus on design suitability and "targeted" pollutant removal characteristics. A decision tree for design professionals (Figure 2, page 9) is included to assist in selecting appropriate or suitable storm water practices and methods for a land development project. This decision tree can also be used by evaluators/reviewers if necessary. Suitability refers to accepted limitations or restrictions of a storm water practice and method so that it fully protects beneficial uses based on site-specific physical conditions, as defined by the "Catalog of Storm Water Best Management Practices for Idaho Cities and Counties" or an equivalent, locally-recognized technical guidance. The design professional should review Chapter 3 of the Catalog, specifically focusing on Table 3-1 (also contained on page 10 herein) in selecting appropriate storm water practices and methods.

Some of the most important considerations when selecting storm water practices and methods include site-specific physical conditions (factors such as soils, depth to seasonal high water table, slope, and water availability), pollutant removal characteristics, soil erosion, design storms for sizing water quality, and maintenance.

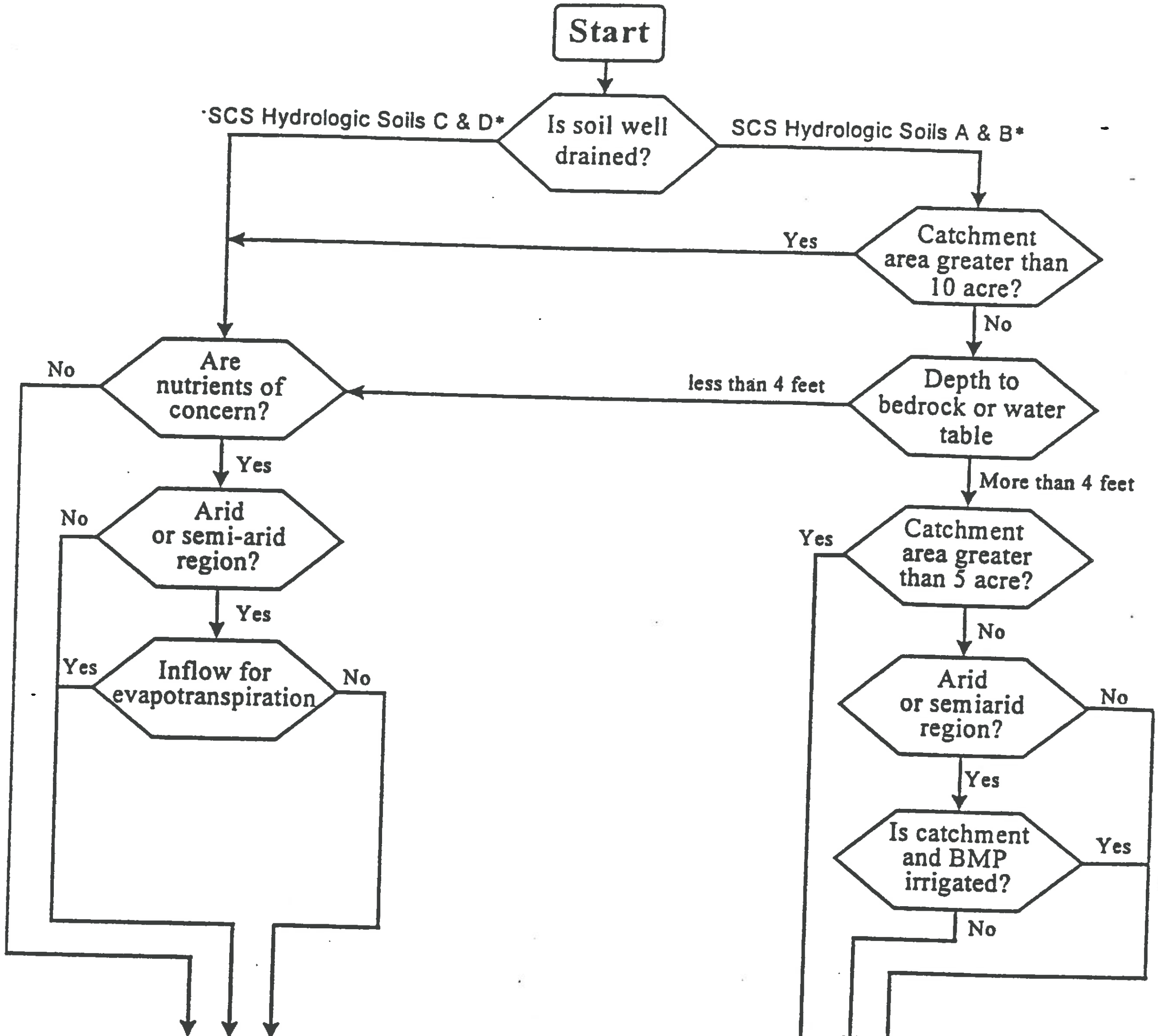
- *Site-specific physical conditions (site suitability criteria)*: soil type according to Soil (Natural Resource) Conservation Service's "hydrologic soil group" classification, depth to seasonal high water table, which cannot be less than a 3-foot minimum, slope sensitivity, and water availability for practices and methods that rely on vegetation or a permanent water pool for pollutant removal.

- *Pollutant removal characteristics (targeted pollutants)*: should be selected based on specific pollutants of concern and the removal effectiveness of a particular storm water practice or method.

- *Soil erosion*: regardless of climate conditions, higher-than-normal sediment loads will affect the performance and maintenance requirements of storm water practices and methods.

- *Design storms for sizing water quality*: differs from that associated with water quantity design storms. Most water quality impacts are related to small, frequent events, generally associated with 2-year storms or less. These smaller storm events carry the vast majority of runoff and suspended pollutants to receiving waters, even in arid to semi-arid climates.

- *Maintenance*: is essential for the continued operation for the duration or expected life-cycle of a storm water practice or method.



X	X	X	Minimize directly connected impervious area within catchment	X	X	X
			Vegetative swale (# 38)	X	X	X
			Vegetative filter strip (# 39)			X
X	X	X	Media filtration (#'s 40-42, 52)	X	X	X
			Infiltration (#'s 43, 44)		X	X
X	X		Pond with permanent pool (#'s 45, 46)	X		
X		X	Extended detention (# 47, 48)	X	X	X
X	X		Constructed wetland (# 49)			

Figure 2. The design professional's decision tree for selecting appropriate storm water practices and methods. The numbers in the above box refer to permanent storm water practices and methods contained in Chapter 5 of the Catalog, as listed by numbered fact sheet. Also, Catalog's Table 3-1 contains targeted pollutants and site suitability criteria (page 9 herein). Based on page 181 of "Urban Runoff Quality Management" (1998, Water Environment Federation and American Society of Civil Engineers). *SCS (or Soil Conservation Service) = Natural Resource Conservation Service.

Table 3–1. Selection Matrix for Choosing Stormwater Best Management Practices

Best Management Practice	Targeted pollutants[1,3]: Sediment	Phosphorus	Trace Metals	Bacteria	Petroleum hydrocarbons	Site Suitability Criteria: Drainage area (acres)	Maximum slope (%)	Minimum depth to bedrock+ (ft)	Depth to high water table (ft)	SCS soil type[2]	Use with freeze/thaw cycle	Drainage/flood control	Expected life[4]
Construction/Temporary BMPs													
General Construction Site Guidelines (Section 4.3)													
1. Timing of construction	◐	○	○	○	○	unlimited	unlimited	N/A	N/A	ABCD	good		
2. Staging areas	◐	○	○	○	○	unlimited	15	N/A	N/A	ABCD	good	✓	
3. Preservation of existing vegetation	●	○	○	○	○	unlimited	unlimited	N/A	N/A	ABCD	good		
4. Clearing limits	●	○	○	○	○	unlimited	unlimited	N/A	N/A	ABCD	good		
5a. Stabilization of construction entrance/roads/driveways	●	◐	◐	○	◐	unlimited	15	3	N/A	ABCD	good		2+ years
5b. Erosion prevention on temporary and private roads	●	◐	◐	○	◐	unlimited	15	3	N/A	ABCD	good		
Housekeeping (Section 4.4)													
6. Dust control	●	○	◐	○	◐	N/A	5	N/A	N/A	N/A	N/A		
7. Cover for materials and equipment	●	○	●	○	●	N/A	N/A	N/A	N/A	N/A	N/A		
8. Spill prevention and control	○	○	◐	○	◐	N/A	N/A	N/A	N/A	N/A	N/A		
9. Vehicle/equipment washing and maintenance	●	●	●	○	●	N/A	5	N/A	N/A	BCD	N/A		
10. Waste management	◐	○	◐	○	○	N/A	N/A	N/A	N/A	N/A	N/A		
Slope Protection (Section 4.5)													
11. Mulching	●	◐	○	○	○	2	50	N/A	N/A	ABCD	fair		6–8 months
12. Hydromulching	●	◐	○	○	○	2	15	N/A	N/A	ABCD	fair		6–8 months
13. Geotextile	●	○	○	○	○	100	100	N/A	N/A	ABCD	good		6–8 months
14. Matting	●	○	○	○	○	100	100	2	N/A	ABCD	good		6 months
Temporary seeding and sodding (see BMPs #35 & 36)	●	◐	◐	○	○	unlimited	5–14	2	2	ABCD	fair		
15. Pipe slope drain	●	○	○	○	◐	5	30	2	5	ABCD	good	✓	1 year–permanent
16. Slope roughening	●	○	○	○	○	1	20	3	5	BCD	good		
17. Gradient terracing	●	○	○	○	○	10	30	6	6	BCD	good	✓	
18. Retaining walls	●	○	○	○	○	unlimited	67	N/A	3	ABCD	fair		
Channel and Stormdrain Protection (Section 4.6)													
19. Gabions	●	○	○	○	○	unlimited	40	N/A	2	ABCD	good		
20. Riprap Slope and Outlet protection	●	○	○	○	○	5	40	N/A	N/A	ABCD	good		Permanent
21. Inlet protection	●	○	○	○	○	1	5	2	2	ABCD	good		1 year
22. Check dams	●	○	○	○	○	10	50	2	N/A	ABCD	good	✓	6 months–1 year
23. Temporary stream crossing	●	○	○	○	◐	N/A	N/A	2	N/A	ABCD	good	✓	6 months
Sediment Collection and Runoff Diversion (Section 4.7)													
24. Straw bales/biofilter bags	●	○	○	○	○	1 ac/400 ft	2 (bales) 10 (bags)	2	2	ABCD	fair		3 months
25. Silt fence	●	○	○	○	○	1 ac/100 ft	30	2	2	ABCD	good		6 months (synthetic) 2 months (burlap)
26. Vegetative buffer strip	●	○	○	○	○	unlimited	20	5	3	ABCD	fair		50 years
27. Sediment trap (basin)	●	○	◐	○	○	5	10	5	2	BCD	good		6–18 months
28. Portable sediment tank	●	○	◐	○	○	depends on size	NA	NA	NA	NA	good		Permanent
29. Temporary swale	●	○	○	○	○	10	15	5	3	BCD	fair	✓	2 years
30. Earth dike	●	○	◐	○	○	10	10	5	5	ABC	fair	✓	2–25 years
31. Perimeter dike/swale	●	○	◐	○	○	2	10	5	5	ABC	fair	✓	2 years
32. Temporary berms (sandbags)	●	○	○	○	○	5	50	N/A	N/A	ABCD	good	✓	
33. Temporary stormdrain diversion	●	○	◐	○	○	5	50	N/A	N/A	ABCD	good	✓	
Permanent BMPs													
Slope Protection and Stabilization (Section 5.2)													
34. Topsoiling	●	○	○	○	○	unlimited	50	3	2	N/A	fair		
35. Seeding	●	◐	◐	○	○	unlimited	5	2	2	ABCD	fair		Permanent
36. Sodding	●	◐	◐	○	○	unlimited	14	2	2	ABCD	fair		Permanent
37. Planting	●	◐	◐	○	○	unlimited	50	1	1	ABCD	fair		Permanent
Stormwater Filters (Section 5.3)													
38. Vegetated swale (biofiltration)	80%	30%	◐	◐	◐	15	14	5	3	BCD	fair	✓	50 years
39. Vegetative filter strip	80%	30%	◐	◐	◐	5	14	5	3	BCD	fair		50 years
40. Sand filter	85%	55%	◐	◐	◐	5 (inlets), 50 (basin)	10	3	3	N/A	fair	✓	25 years
41. Compost stormwater filter	85%	40%	●	◐	●	1	N/A	N/A	N/A	N/A	fair		20+ years
42. Catchbasin inserts	35%	5%	◐	○	◐	5,000 s.f.	N/A	N/A	N/A	N/A	fair		
Infiltration Facilities (Section 5.4)													
43. Infiltration Trench	75%	55%	●	●	●	15	25	4	3	AB	fair		10 years
44. Infiltration Basin	75%	65%	●	●	●	5–50	5	4	3	AB	fair	✓	25 years
53. Injection Well (Dry Well)	●	◐	●	◐	●	0.1–3	1–2	6–8	6–8	AB	NA	✓	
Detention Facilities (Section 5.5)													
45. Wet pond (conventional pollutants)	80%	45%	●	◐	◐	15–20	10	3	2	CD	good	✓	50 years
46. Wet pond (nutrient control)	80%	65%	●	◐	◐	5–20	10	3	2	CD	fair	✓	50 years
47. Wet extended detention pond	80%	65%	●	◐	◐	10–50	10	3	2	CD	good	✓	50 years
48. Dry extended detention pond	45%	25%	◐	○	◐	10–50	10	6	4	ABC	good	✓	50 years
49. Constructed wetland	75%	45%	●	◐	●	25–50	5	3	2	CD	fair	✓	50 years
50. Presettling/sedimentation basin	80%	30%	◐	○	○	10+	10	3	2	CD	good	✓	
51. Wet vault/tank	80%	30%	◐	○	○	5	15	12	12	ABC	fair	✓	
Other Structural Controls (Section 5.6)													
52. Oil/Water separator	15%	5%	◐	○	●	1	15	8	8	ABC	fair		20+ years

[1] ○ least effective (expected to remove <30% of pollutant) ◐ moderately effective (expected to remove 30 to 70% of pollutant) ● very effective (expected to remove >70% of pollutant)

[2] SCS soil types (A, B, C, D) range from A = high infiltration rate to D = little or no infiltration

[3] The pollutant removal efficiencies given above are for PLANNING PURPOSES ONLY—actual removal efficiencies are dependent on specific site characteristics, maintenance levels, and other factors. The following sources were used to determine the most likely average removal rate for conditions prevalent in Valley County: California 1993, Dale and Reese 1995, King County 1994, King County 1995, Maine 1995, Minnesota 1989, North Carolina 1993, Panhandle Health District 1996, Portland 1991, Portland 1995, and USEPA 1995. Refer to the individual BMP fact sheets in Chapters 4 and 5 for additional details about removal efficiencies and limitations on use of the data (see Catalog of Stormwater BMPs for Idaho Cities and Counties, 1997).

[4] Longevity data collected from various sources, including Panhandle Health District 1996, Boise City 1997, and EPA 1993. The numbers shown represent industry guidelines; the actual life expectancy is dependent on proper design and placement of BMPs, and most importantly, routine maintenance.

N/A = Not Applicable.

Appendix C-3

Handbook of Valley County Stormwater Best Management Practices

April 1997

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Disclaimer

This handbook was developed to assist local agencies and the development community in Valley County, Idaho with the selection, design, installation and maintenance of best management practices (BMPs) to reduce stormwater pollution. The information contained herein, to the best of the authors' knowledge, is true and correct. It is not, however, all inclusive, nor is it intended to be. Due to site specific conditions, this handbook must be used in conjunction with best professional judgement and sound engineering principles to assure proper selection, design, function and performance of the BMPs in the handbook. The authors will not take responsibility for the misuse of misapplication of, or any errors contained herein.

The local permitting authority should be consulted for additional local requirements prior to use of this document.

Any brand names mentioned in the handbook do not constitute any product endorsements by the authors, and are named only as examples.

This document will be updated as errors are identified, local conditions change, and/or new BMP products, technologies and engineering information becomes available.

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Unnumbered figures are also provided immediately following each BMP fact sheet in Chapters 4 and 5.

Local and Regulatory Agency Contact Information for Valley County, Idaho

Responsibility for stormwater management in the County is held collectively by landowners and several agencies and districts. Persons wishing to discharge stormwater runoff into a drainage facility should contact the appropriate agency or district about special conditions, including permitting, that may apply. Use the following phone numbers to obtain information about requirements and permits for new and redevelopment, discharge to waterways and drainage systems, and other land use issues.

City of Cascade	(208) 382-4297
City of McCall, Engineer	(208) 634-7142
City of Donnelly	(208) 325-8755
Valley County	
Building Department	(208) 382-4251
Road Department	(208) 382-4257
Central District Health Department	(208) 634-7194
Idaho Transportation Department (ITD)	(208) 334-8300
Idaho Department of Health and Welfare, Division of Environmental Quality (IDEQ)	
Southwest Idaho Regional Office	(208) 373-0550
Central Office	(208) 373-0502
Stormwater Library	(208) 373-0115
U.S. Environmental Protection Agency (EPA), Region X Stormwater Division	(206) 553-8399

Landowners are principally responsible for stormwater runoff from their property. In subdivisions with a stormwater quality facility (e.g., detention pond) that collect runoff from the entire development, the developer or local homeowners' association may assume responsibility for maintenance. Alternately, the facility could have an easement to allow for maintenance by the city or county. In this case, the local agency may charge the developer or homeowner's association for the cost of such maintenance.

The Cities of McCall, Cascade and Donnelly are responsible for operating and maintaining the public roads and all drainages in the incorporated areas of the County within their city limits, including piped systems, open channels, and natural streams. The cities control land use and issue grading and building permits for new construction and development within their limits. The City of McCall is also responsible for building permits in the McCall Impact Area, outside the city limits, which is covered by a Planning and Zoning Commission that makes recommendations to the McCall City Council.

The Valley County Road Department is responsible for maintaining roads in the unincorporated areas of the County, including all drainage contained in the road right-of-way. The Road Department is also responsible for the roads in the City of McCall Impact Area, located outside the city limits. For the most part, the drainage system associated with the County roads consists of natural drainages (e.g., streams), irrigation canals, and roadside ditches.

The Valley County Building Department is responsible for reviewing and issuing building permits in the unincorporated County. However, they are not responsible for building permits in the McCall Impact Area.

The Central District Health Department (CDHD), through its on-site septic system review process, works closely with county landowners outside the sewered areas. The CDHD also monitors public health related water quality parameters, supports the efforts of local sewer districts, and tracks performance of on-site systems. For centralized sewer systems, DEQ assumes the responsibility for review.

The Idaho Transportation Department is responsible for building, operating, and maintaining all state roads and highways (e.g., Hwy 55), including all of the approaches from County roads contained within the state highway right-of-way. Within the McCall city limits, ITD and the city share maintenance responsibilities. ITD is responsible for maintaining the drainage systems (roadside ditches and stream, canal, and river crossings) associated with state roads in Valley County.

Irrigation Districts and Ditch Companies, and individual farmers operate irrigation systems throughout the County.

The Idaho Department of Health and Welfare, Division of Environmental Quality (DEQ) has been studying the causes of, and possible solutions to, regional water quality problems, such as those in Cascade Reservoir. DEQ is the lead agency for development of the Phase 1 TMDL for Cascade Reservoir.

The Environmental Protection Agency (EPA), Region 10 (Seattle) is the NPDES permitting authority for the State of Idaho. As such, the agency is responsible for permitting discharges to waters of the United States. In Valley County, this includes the North Fork of the Payette River. EPA Region 10 is also responsible for issuing NPDES stormwater permits to construction activities disturbing 5 acres or more and those industrial activities listed in Appendix A. These permit requirements are <u>in addition to</u> local regulations.

The Bureau of Reclamation (BOR) operates the dam and Cascade Reservoir and has jurisdiction over activities associated with the reservoir, such as the recreational sites, boating, etc.

CHAPTER 1
INTRODUCTION

1.1 Purpose of the Handbook

This Handbook provides guidance for selection and basic design of stormwater best management practices (BMPs) in Valley County, with particular emphasis on new and redeveloping areas that drain to Cascade Reservoir and Big Payette Lake. It is primarily intended for developers and the contractors and design professionals (e.g., engineers, landscape architects) that work for them, as well as local agency officials and staff responsible for design and construction or review and approval of development permits.

There are several reasons why guidance regarding stormwater management for Valley County is needed at this time:

- Cascade Reservoir is not in compliance with state water quality standards. Beneficial uses of the reservoir, such as fishing, swimming, boating, and agricultural water supply, are impaired due to excessive algal growth caused by high levels of phosphorus. Studies in recent years have demonstrated that phosphorus is entering the reservoir from nonpoint sources (primarily spring runoff and irrigation returns) in addition to point sources. This Handbook provides guidance for controls to reduce pollutants, including phosphorus and sediments that typically carry phosphorus, from nonpoint sources in the watershed.

- Valley County is one of the fastest growing areas in Idaho, with an additional 4,000 residents projected by the year 2000. This growth does not include the visitor population related to tourism, which is also on the rise. The increase in population translates to rapid growth in land development, a recognized source of pollution. This Handbook includes BMPs that help to prevent discharge of pollutants from newly developing areas, both during the construction phase and for the life of the project.

- Historically, drainage has been a problem for many properties in the County because of the high water table. Standing water is common in most parts of the County during the wet season, particularly in the spring. Consequently, infiltration BMPs are not recommended for Valley County unless site specific testing demonstrates that infiltration will work. Two possible infiltration BMPs are presented in this handbook. Other water quality BMPs (i.e., detention) included in this handbook can also help to alleviate drainage problems if the facilities are properly located, designed, and maintained.

The BMPs included in this Handbook are those that are appropriate for application in Valley County, considering its unique features such as the drainage problems due to the high water table and freeze/thaw conditions. The majority of the practices focus on controlling pollution at its source, before it enters runoff; however, BMPs that treat runoff and remove pollutants that have already entered the drainage system are also included. The structural facilities described in this Handbook will reduce pollutant loads in post-construction site runoff, provided that the facilities are properly designed, installed, and maintained.

This Handbook presents general guidelines; specific conditions may require site-specific modifications of the practices described.

In order to illustrate the use and application of certain BMPs, manufacturer and product names may be used in the Handbook. This does not represent an endorsement of a product.

1.2 Organization and How to Use the Handbook

Following this introduction, Chapter 2 provides a brief, informative overview of stormwater best management practices. It includes a matrix that shows how to select the most effective BMPs for a particular project, based on unique site conditions such as drainage area, slope, and soil type. Information is also presented regarding the effectiveness of each BMP at removing various types of stormwater pollutants. Chapter 3 presents general standards for Valley County and jurisdictional policy sections as adopted by the Valley County and the cities of Cascade, Donnelly, and McCall.

Chapters 4 and 5 include BMP fact sheets in two categories: construction/temporary BMPs (Chapter 4) and post-construction/permanent BMPs (Chapter 5). The fact sheets provide greater detail on application and limitations of each BMP, as well as design parameters, construction guidelines, and operation and maintenance tips to ensure effective performance.

Chapters 6 and 7 are a glossary and a bibliography, respectively. The appendices to the Handbook present additional guidance for determining site suitability for various BMPs, regulatory information, and detailed design information, all of which are too lengthy to include in the main body of the text.

First-time users should read Chapters 1 and 2 carefully for background on why stormwater controls are needed and how storm water is managed in Valley County. Chapter 2 contains an overview selection matrix (Table 2.1) that presents a range of potentially applicable non-structural and structural BMPs. The matrix should be used to determine which BMPs are *not* applicable due to site specific conditions. Once the range of suitable BMPs are known, the fact sheets in Chapters 4 and 5 may be reviewed to learn more details about design, construction, and maintenance. This additional information will assist in final selection of BMPs.

The Handbook is intended for use in conjunction with local city and county requirements, such as applicable planning and building codes. Once local stormwater and/or erosion control policy is adopted, as governed by a local ordinance, policy is inserted into Chapter 3. Refer to Chapter 3 for the respective municipality where the development project is taking place. If the jurisdiction does not have policy currently, check with the local permitting authority. If the development project is taking place outside city limits or an area of city impact, the reader is then referred to the policy as adopted by Valley County (chapter 3.5).

For construction activities of 5 acres or more, and many industrial sites (see Appendix A), the EPA mandates separate National Pollutant Discharge Elimination System (NPDES) stormwater permit requirements. These separate NPDES requirements must be met *in addition to* local agency requirements. For all projects, local authorities should be consulted to determine specific requirements for the project and the types of stormwater BMPs being proposed.

Because this Handbook is not all-inclusive, it should be used along with reference books and manuals published by other agencies. The references listed in Chapter 6 can be reviewed and/or checked out of the DEQ Stormwater Library.

1.3 Types of Best Management Practices (BMPs)

In general, there are two types of BMPs for stormwater pollution control: source control and treatment. Source control practices focus on minimizing or eliminating the source of the pollution so that pollutants are prevented from contacting runoff or entering the drainage system. Treatment controls are designed to remove the pollutants after they have entered runoff. They tend to be more expensive than source control. Examples of source control BMPs include good housekeeping and education, while structural BMPs include detention ponds and oil/water separators. Most source control practices tend to be non-structural, and most treatment BMPs tend to be structural, although there can be exceptions. For example, a roof over a materials storage area at an industrial site would be considered a structural source control.

Cost-effective stormwater management considers and incorporates all of the source control measures possible, prior to implementation of treatment facilities. As the old saying goes: "an ounce of prevention is worth a pound of cure."

BMPs are presented in this handbook for use during construction (temporary BMPs) and after construction is complete (permanent BMPs). Detailed guidance information is included in Chapters 4 and 5 for each BMP. The following describes the organization of the BMPs in the handbook.

Temporary BMPs

<u>General Construction Site Guidelines</u>

BMP #1	Timing of Construction
BMP #2	Staging Areas
BMP #3	Preservation of Existing Vegetation
BMP #4	Clearing Limits
BMP #5a	Stabilization of Construction Entrance and Roads
BMP #5b	Erosion Prevention on Temporary and Private Roads

Housekeeping

BMP #6	Dust Control
BMP #7	Cover for Materials and Equipment
BMP #8	Spill Prevention and Control
BMP #9	Vehicle/Equipment Washing and Maintenance
BMP #10	Waste Management

Slope Protection

Slope protection BMPs are designed to minimize and protect exposed soil surfaces to help reduce erosion and the associated discharge of sediment to nearby streams and the storm drainage system.

BMP #11	Mulching
BMP #12	Hydromulching
BMP #13	Geotextile
BMP #14	Matting
BMP #15	Pipe Slope Drain
BMP #16	Slope Roughening
BMP #17	Gradient Terracing
BMP #18	Retaining Walls

Storm Drain and Channel Protection

This group of BMPs is designed to protect storm drains, natural channels and ditches during construction activities to prevent or reduce the amount of sediment and debris entering the drainage system and to prevent scouring and undercutting.

BMP #19	Gabions
BMP #20	Riprap Slope and Outlet Protection
BMP #21	Inlet Protection
BMP #22	Check Dams
BMP #23	Temporary Stream Crossing

Sediment Collection and Runoff Diversion

The BMPs included in this category are measures designed to collect sediment on a construction site, divert run-on from entering the site, keep runoff from leaving the site, or divert runoff away from sensitive areas or certain site activities.

BMP #24	Straw Bales/Biofilter Bags
BMP #25	Silt Fence
BMP #26	Vegetative Buffer Strip
BMP #27	Sedimentation Trap (Basin)
BMP #28	Portable Sediment Tank
BMP #29	Temporary Swale
BMP #30	Earth Dike
BMP #31	Perimeter Dike/Swale
BMP #32	Temporary Berms (includes sand bags)
BMP #33	Temporary Storm Drain Diversion

Permanent BMPs

Slope Protection and Stabilization

Several vegetative BMPs are presented to help permanently protect and stabilize slopes. Any of these BMPs can be implemented during the construction phase to control construction erosion and then kept in place (with simple retrofits) for use after construction is complete.

BMP #34	Topsoiling
BMP #35	Seeding
BMP #36	Sodding
BMP #37	Planting

Stormwater Filters

Stormwater filters are designed to filter pollutants out from runoff through straining and settling, which allow capture of coarse to fine sediments and the pollutants adhered to them. The filters discussed in this handbook employ a media of vegetation, sand, compost or synthetic materials to provide treatment. Vegetated filters can be less expensive than piped systems and are typically more economical than separators, vaults, or other structural controls. As an added benefit, vegetated filters can be aesthetically pleasing, can reduce peak flows in site runoff, and can be considered part of the on-site landscaping. Stormwater filters will require pretreatment if site runoff is expected to contain high sediment loads over long periods, and filters may need liners in areas where groundwater contamination is a concern.

BMP #38	Vegetated Swale (biofiltration)
BMP #39	Vegetative Filter Strip
BMP #40	Sand Filter
BMP #41	Compost Stormwater Filter
BMP #42	Catchbasin Inserts

Infiltration Facilities

Infiltration facilities are designed to intercept surface runoff and retain it long enough to allow it to enter the underlying soil. The infiltration BMPs in this handbook include layers of coarse gravel, sand or other filtering media to filter the runoff before it infiltrates the soil. In Valley County, infiltration may be allowed on a case-by-case basis, depending on the soil and water table conditions at the site. Site-specific testing will be required to demonstrate that the infiltration rate for the site is at least 0.4 inches/hour. To help prevent clogging, pretreatment will be required whenever possible.

BMP #43 - Infiltration Trench
BMP #44 - Infiltration Basin

Detention Facilities

Detention BMPs capture stormwater runoff and remove pollutants through settling and/or biological uptake. The BMPs presented in this handbook can reduce streambank erosion and flooding by temporarily detaining runoff before releasing it at flowrates and frequencies similar to those occurring under natural hydrologic conditions. They can be designed to enhance wildlife habitat, provide an aesthetic amenity and satisfy some of the site landscape needs. In some areas of Valley County, they may require liners to prevent groundwater contamination. Additionally, consideration should be made of the maintenance and sediment disposal requirements of detention BMPs before they are applied.

BMP #45	Wet Pond (Conventional Pollutants)

BMP #46 Wet Pond (Nutrient Control)
BMP #47 Wet Extended Detention Pond
BMP #48 Dry Extended Detention Pond
BMP #49 Constructed Wetland
BMP #50 Presettling/Sedimentation Basin
BMP #51 Wet Vault/Tank

Other Structural Controls
Oil/water separators function within the piped drainage system by slowing flows and allowing both settling of particulates and separation of floatable materials and oil/grease. The BMP described in this handbook is most applicable to urbanized or industrial sites where land availability is low, or for pretreatment preceding other types of stormwater BMPs. The oil/water separator works best when designed as an off-line device allowing high flows from large storm events to bypass the device without resuspending previously deposited materials. In general, the BMP has relatively low pollutant removal capability and high maintenance requirements.

BMP #52- Oil/Water Separator

1.4 Updates to the Handbook

The practice of stormwater management is quickly evolving. Design information for various BMPs is expected to change as more people apply the practices and learn from their experience. New BMPs will also be added to the mix. To accommodate these changes, a Technical Review Committee will convene annually to review the Handbook. Each participating jurisdiction will submit their respective policy and/or amendments to their current policy section upon the completion of the annual review by the Technical Review Committee. The Technical Review Committee does not have authority over a given jurisdiction's policy section, but will collaborate and lend technical support if necessary.

The Valley County Commissioners shall appoint the Technical Review Committee that will be assume the task of reviewing and amending the technical and administrative components of the Handbook annually. The technical components of the Handbook include: Table 2.1, chapters 3.1, 4, and 5. The administrative components of the Handbook include: the table of contents, chapters 1, 2, 6 and 7. The appendices are supportive tools for the entire Handbook and can be amended through either recommendation to the Technical Review Committee from a given jurisdiction or through final authority assumed in the reviewing and amending process of the Technical Review Committee. All updates and amendments that are made to the Handbook will be distributed to registered users. Revision dates should be located on each page or respective fact sheet in the lower left-hand corner for chapters 3, 4 and 5.

The Technical Review Committee shall be composed of three (3) municipal representatives, one (1) at-large developer representative, one (1) at-large construction contractor representative, one (1) professional engineer licensed in the State of Idaho, one (1) professional soil scientist or certified erosion control specialist, one (1) representative from Central District Health, one (1) representative from the Division of Environmental Quality, two (2) at-large non-voting ex-officio representatives from Valley County, and the Valley County Engineer. The Valley County

Engineer shall serve as the Commissioners representative on the Technical Review Committee. The Valley County Commissioners will have final approval over modifications that are proposed by the Technical Review Committee.

Terms of service for the Technical Review Committee: Initially three (3) committee members shall be appointed to each of one (1), two (2), and three (3) year terms. Appointments to vacancies thereafter shall be three (3) year terms.

CHAPTER 2
STORMWATER MANAGEMENT

2.1 Stormwater Quantity and Quality: Problems and Solutions

Traditionally, the objective of stormwater management has been to transport runoff as quickly as possible through the drainage system in order to prevent flooding and protect lives and property. This is referred to as quantity control. Although public health and safety are still the most important goals, other objectives must now be met as well, such as preservation of water quality and natural habitat. Historical flood and quantity control methods are not always suitable under current conditions, because they can contribute to downstream water quality problems and do not provide for habitat. Likewise, some water quality and habitat solutions, such as naturally vegetated drainages, can contribute to flooding problems by reducing the carrying capacity of the drainage system.

Today it is necessary to balance both quantity and quality goals. This balance can be achieved by pursuing regional solutions, such as effective land use planning, which minimizes impervious areas and preserves natural vegetation, especially riparian areas along streams and lakes. Local ordinances and codes can also help to reduce impervious areas and increase vegetation by limiting the extent to which a site can be developed. Quantity and quality goals can also be met at the local level through proper site planning and appropriate design that carefully considers the various impacts of development and application of BMPs to minimize problems.

Quantity. The quantity or volume of stormwater runoff from urban and suburban land uses depends on three factors: (1) the intensity of a given storm event; (2) the duration of the event; and (3) the amount of impervious area such as pavement, buildings and compacted soils. Urbanization increases the quantity of runoff, and therefore has a serious impact on receiving waters. As shown in Figure 2-1, the natural water balance is disrupted when an area develops. Paved surfaces and buildings replace vegetation that once intercepted the rain, allowed it to soak into the ground, and returned water to the air through evapotranspiration. Heavily compacted surfaces, such as well-used pastures, act much the same as pavement in preventing water from seeping into the ground. Snowmelt, especially when accelerated by rain, also increases the chance of flooding. As the volume and flow rate (speed) of the runoff increases, water reaches streams and lakes more quickly and typically there is less recharge to groundwater to contribute baseflow to streams. The higher runoff volumes and rates lead to overland erosion, scouring or undercutting of streambanks, flooding, and loss of habitat.

Quality. Urbanization also adversely affects the quality of stormwater runoff, which in turn has a serious impact on receiving waters. Runoff collects and transports pollutants, including the following:

- *nutrients* such as phosphorus and nitrogen
- *bacteria and viruses* from humans and animals

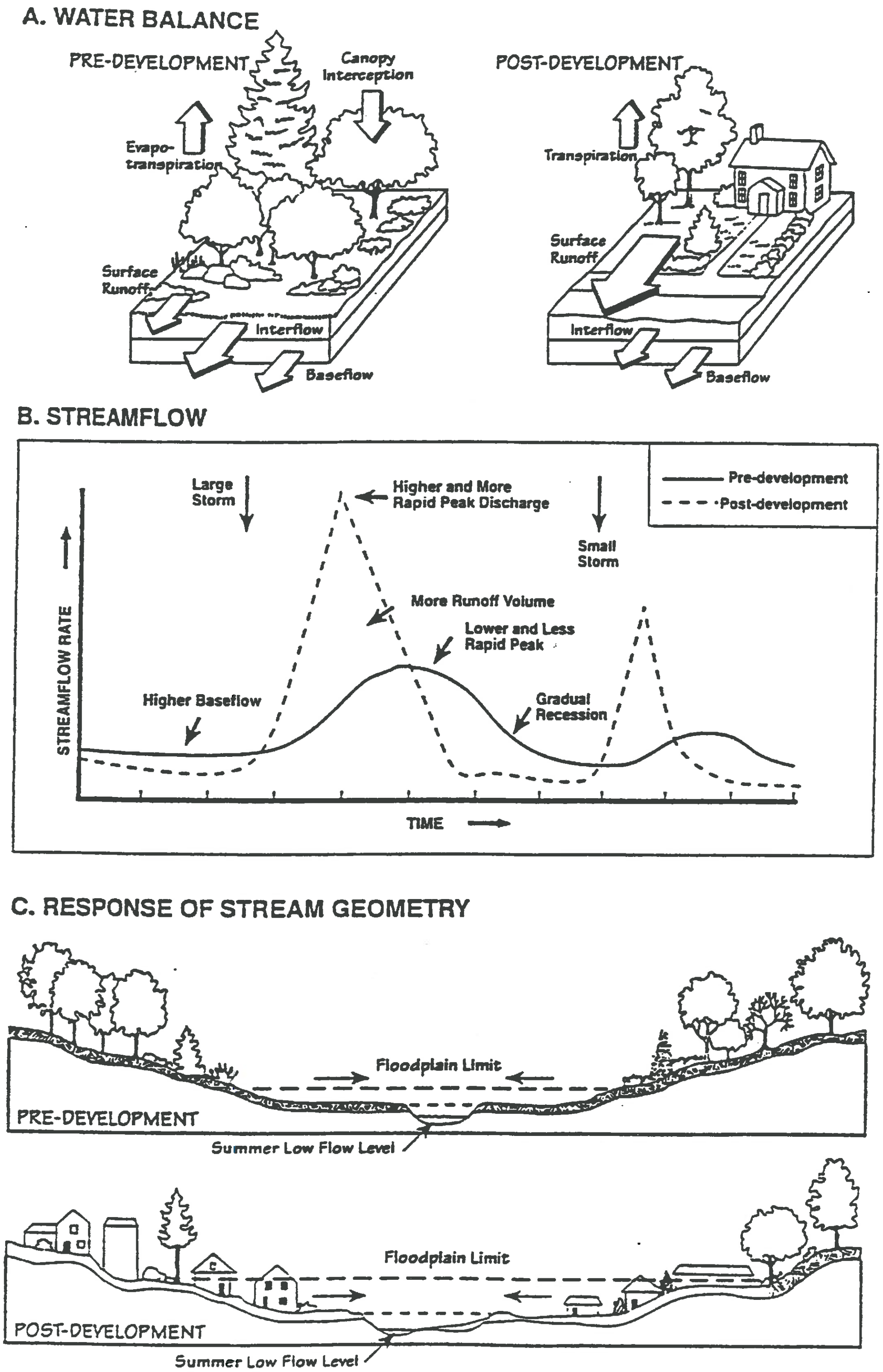

Figure 2-1. Impact of Urbanization on Watershed Hydrology

- *organic chemicals*, such as pesticides and hydrocarbons
- *heavy metals* such as lead, copper, zinc and cadmium that are usually associated with sediments
- *sediment* such as silt (fine particulates), which can carry other pollutants and can smother fish eggs

Some sources of these stormwater pollutants in urban and suburban areas such as Valley County include the following:

- automobiles
- construction and new development activities
- atmospheric fallout from vehicle and industrial emissions
- dust from construction/mining/logging/agricultural activities
- overuse and improper disposal of toxics, pesticides, herbicides, and fertilizers
- illegal discharges such as dumping
- disturbed or exposed soils
- decaying plants and animal wastes from natural and agricultural sources

2.2 Stormwater Characteristics of Valley County

Most of Valley County is rural in nature. Most runoff travels through ditches or irrigation canals until it reaches one of the major streams crossing the valley floor. These streams, such as Mud Creek, then drain into one of the three main waterbodies in the county: Cascade Reservoir, Payette Lake or the north fork of the Payette River. Much of the annual precipitation falls as snow and in the spring, snowmelt can be a major source of runoff and erosion. The water table underlying most of the valley floor reaches its highest elevation in the spring and standing pools of water are evident in many locations.

2.3 Choosing and Designing BMPs

Table 2-1 at the end of this chapter provides an overview of selected requirements and pollutant removal effectiveness for various types of construction/temporary BMPs and permanent BMPs presented in Chapters 4 and 5. The following describes the information presented in Table 2-1:

- **Targeted pollutants** - an indication is given of the expected pollutant removal effectiveness for typical pollutants of concern in urban and suburban stormwater runoff: sediment, phosphorus, trace metals (e.g., lead, copper, cadmium), bacteria, and petroleum hydrocarbons (e.g., gasoline, oil and grease).

Estimated values are provided for phosphorus and sediment removal for most of the permanent BMPs, based on available data from other areas. For the other pollutants, a more qualitative estimate is provided through full, half, and empty circles. A full circle on the table indicates that the BMP is very effective at controlling the pollutant (70 percent or greater of the pollutants may be removed). A half-filled circle represents moderate effectiveness (greater than or equal to 30 percent and less than 70 percent of the pollutants may be removed). Finally, an empty circle indicates little or no effectiveness (less than 30 percent of the pollutants may be removed).

- **Drainage area** - The maximum contributing drainage area for the BMP.

- **Maximum slope** - The maximum allowable site slope for placement of the BMP.

- **Minimum depth to bedrock** - the minimum allowable depth to bedrock for placement of a BMP on a site.

- **Depth to high water table** - Shall be based on the seasonal high ground water level, which is the highest elevation of ground water that is maintained or exceeded for a continuous period of one week a year. The minimum allowable depth to the high water table for locating a BMP on a site.

- **SCS soil type** - Soil type is classified as A, B, C or D, based on the Natural Resources Conservation Service (formerly SCS) table presented in Appendix B.2. Soil type A has the most rapid infiltration rate (e.g., sands), while soil type D allows little to no infiltration (e.g., clays). The BMP is most suited for the soil types given on the table.

- **Use with freeze/thaw cycle** - BMP performance during the winter and spring freeze/thaw cycles is indicated as good, fair or poor.

- **Drainage/flood control** - A checkmark in this column of the table indicates that the BMP can be used to provide drainage and flood control as well as water quality control.

- **Expected life** - A number that represents industry guidelines, the actual life expectancy is dependent on proper design and placement of BMPs, and most importantly, routine maintenance.

2.4 Installing and Maintaining BMPs

Once the permits are obtained, the final construction schedule can be developed. The following points should be kept in mind when establishing the schedule:

- Comply with seasonal restrictions for earthmoving and exposed soil established by the local permitting authority;
- Schedule installation of BMPs some of the temporary BMPs should be installed before earthmoving activities begin;
- implement housekeeping BMPs (e.g., covering stockpiles) as soon as possible after the project breaks ground;
- schedule regular inspections of the site and the stormwater BMPs throughout the construction process and repair or replace BMPs as needed;
- maintain the BMPs as specified in the maintenance plan;
- schedule removal of the temporary BMPs (or retrofit them for permanent use) at the end of the construction project.

The BMP fact sheets in Chapters 4 and 5 contain detailed installation and maintenance guidelines to ensure optimum performance of each BMP. **Without proper maintenance, most BMPs will fail.**

Table 2-1 Guidance for Selecting Stormwater Best Management Practices

Best Management Practice	Targeted pollutants[1,3]					Drainage area (acres)	Maximum slope (%)	Minimum depth to bedrock+ (ft)	Depth to high water table (ft)	SCS soil type[2]	Use with freeze/thaw cycle	Drainage/ flood control	Expected life[4]
	Sediment	Phosphorus	Trace Metals	Bacteria	Petroleum hydrocarbons								
CONSTRUCTION/TEMPORARY BMPs													
General Construction Site Guidelines *(see Section 4.3)*													
1. Timing of construction	◐	○	○	○	○	unlimited	unlimited	N/A	N/A	ABCD	good		
2. Staging areas	◐	○	○	○	○	unlimited	15	N/A	N/A	ABCD	good	✓	
3. Preservation of existing vegetation	●	○	○	○	○	unlimited	unlimited	N/A	N/A	ABCD	good		
4. Clearing limits	●	○	○	○	○	unlimited	unlimited	N/A	N/A	ABCD	good		
5a. Stabilization of construction entrance/roads/driveways	●	◐	◐	○	◐	unlimited	15	3	N/A	ABCD	good		2+ years
5b. Erosion prevention on temporary and private roads	●	◐	◐	○	◐	unlimited	15	3	N/A	ABCD	good		
Housekeeping *(Section 4.4)*													
6. Dust control	●	○	◐	○	◐	N/A	5	N/A	N/A	N/A	N/A		
7. Cover for materials and equipment	●	○	●	○	●	N/A	N/A	N/A	N/A	N/A	N/A		
8. Spill prevention and control	○	○	◐	○	◐	N/A	N/A	N/A	N/A	N/A	N/A		
9. Vehicle/equipment washing and maintenance	●	●	●	○	●	N/A	5	N/A	N/A	BCD	N/A		
10. Waste management	◐	○	◐	○	○	N/A	N/A	N/A	N/A	N/A	N/A		

1 ○ least effective (expected to remove <30% of pollutant) ◐ moderately effective (expected to remove 30 to 70% of pollutant) ● very effective (expected to remove >70% of pollutant)

2 SCS soil types (A, B, C, D) defined in Appendix B. A = high infiltration rate; D = little or no infiltration

3 The pollutant removal efficiencies given above are for planning purposes only - actual removal efficiencies are dependent on specific site characteristics, maintenance levels, and other factors. The following sources were used to determine the most likely average removal rate for conditions prevalent in Valley County: California 1993, Debo and Reese 1995, King County 1994, King County 1995, Maine 1995, Minnesota 1989, North Carolina 1993, Panhandle Health District 1996, Portland 1991, Portland 1995, and USEPA 1995. Refer to the individual BMP fact sheets in Chapters 4 and 5 for additional details about removal efficiencies and limitations on use of the data.

4 Longevity data collected from various sources, including Panhandle Health District 1996, Boise City 1997, and EPA 1993. The numbers shown represent industry guidelines; the actual life expectancy is dependent on proper design and placement of BMPs, and most importantly, routine maintenance.

N/A Not Applicable.

Table 2-1 Guidance for Selecting Stormwater Best Management Practices (continued)

Best Management Practice	Targeted pollutants[1,3]: Sediment	Phosphorus	Trace Metals	Bacteria	Petroleum hydrocarbons	Drainage area (acres)	Maximum slope (%)	Minimum depth to bedrock+ (ft)	Depth to high water table (ft)	SCS soil type[2]	Use with freeze/thaw cycle	Drainage/ flood control	Expected life[4]
Slope Protection (*see Section 4.5*)													
11. Mulching	●	◐	○	○	○	2	50	N/A	N/A	ABCD	fair		6 - 8 months
12. Hydromulching	●	◐	○	○	○	2	15	N/A	N/A	ABCD	fair		6 - 8 months
13. Geotextile	●	○	○	○	○	100	100	N/A	N/A	ABCD	good		6 - 8 months
14. Matting	●	○	○	○	○	100	100	2	N/A	ABCD	good		6 months
Temporary seeding and sodding (see BMPs #35 & 36)	●	◐	◐	○	○	unlimited	5- 14	2	2	ABCD	fair		
15. Pipe slope drain	●	○	○	○	◐	5	50	2	5	ABCD	good	✓	1 year - permanent
16. Slope roughening	●	○	○	○	○	1	20	3	5	BCD	good		
17. Gradient terracing	●	○	○	○	○	10	50	6	8	BCD	good	✓	
18. Retaining walls	●	○	○	○	○	unlimited	67	N/A	3	ABCD	fair		
Channel and Stormdrain Protection (*see Section 4.6*)													
19. Gabions	●	○	○	○	○	unlimited	40	N/A	2	ABCD	good		
20. Riprap Slope and Outlet protection	●	○	○	○	○	5	40	N/A	N/A	ABCD	good		Permanent
21. Inlet protection	●	○	○	○	○	1	5	2	2	ABCD	good		1 year
22. Check dams	●	○	○	○	○	10	50	2	N/A	ABCD	good	✓	6 months - 1 year
23. Temporary stream crossing	●	○	○	○	◐	N/A	N/A	2	N/A	ABCD	good	✓	6 months

[1] ○ least effective (expected to remove <30% of pollutant) ◐ moderately effective (expected to remove 30 to 70% of pollutant) ● very effective (expected to remove >70% of pollutant)

[2] SCS soil types (A, B, C, D) defined in Appendix B. A = high infiltration rate; D = little or no infiltration

[3] The pollutant removal efficiencies given above are for planning purposes only—actual removal efficiencies are dependent on specific site characteristics, maintenance levels, and other factors. The following sources were used to determine the most likely average removal rate for conditions prevalent in Valley County: California 1993, Debo and Reese 1995, King County 1994, King County 1995, Maine 1995, Minnesota 1989, North Carolina 1993, Panhandle Health District 1996, Portland 1991, Portland 1995, and USEPA 1995. Refer to the individual BMP fact sheets in Chapters 4 and 5 for additional details about removal efficiencies and limitations on use of the data.

[4] Longevity data collected from various sources, including Panhandle Health District 1996, Boise City 1997, and EPA 1993. The numbers shown represent industry guidelines; the actual life expectancy is dependent on proper design and placement of BMPs, and most importantly, routine maintenance.

N/A Not Applicable.

Table 2-1 Guidance for Selecting Stormwater Best Management Practices (continued)

Best Management Practice	Targeted pollutants[1,3]: Sediment	Phosphorus	Trace Metals	Bacteria	Petroleum hydrocarbons	Drainage area (acres)	Maximum slope (%)	Minimum depth to bedrock+ (ft)	Depth to high water table (ft)	SCS soil type[2]	Use with freeze/thaw cycle	Drainage/ flood control	Expected life[4]
Sediment Collection and Runoff Diversion ***(see Section 4.7)***													
24. Straw bales/biofilter bags	●	○	○	○	○	1 ac/400 ft	2 (bales) 10 (bags)	2	2	ABCD	fair		3 months
25. Silt fence	●	○	○	○	○	1 ac/100 ft	33	2	2	ABCD	good		6 months (synthetic) 2 months (burlap)
26. Vegetative buffer strip	●	○	○	○	○	unlimited	20	5	3	ABCD	fair		50 years
27. Sediment trap (basin)	●	○	◐	○	○	5	10	3	2	BCD	good		6 - 18 months
28. Portable sediment tank	●	○	◐	○	○	depends on size	N/A	N/A	N/A	N/A	good		Permanent
29. Temporary swale	●	○	◐	○	○	10	14	5	3	BCD	fair	✓	2 years
30. Earth dike	●	○	◐	○	○	10	10	5	5	ABC	fair	✓	2 - 25 years
31. Perimeter dike/swale	●	○	◐	○	○	2	10	5	5	ABC	fair	✓	2 years
32. Temporary berms (sandbags)	●	○	○	○	○	5	50	N/A	N/A	ABCD	good	✓	
33. Temporary stormdrain diversion	●	○	◐	○	○	5	50	N/A	N/A	ABCD	good	✓	
PERMANENT BMPs													
Slope Protection and Stabilization ***(see Section 5.2)***													
34. Topsoiling	●	○	○	○	○	unlimited	50	3	2	N/A	fair		
35. Seeding	●	◐	◐	○	○	unlimited	5	2	2	ABCD	fair		Permanent
36. Sodding	●	◐	◐	○	○	unlimited	14	2	2	ABCD	fair		Permanent
37. Planting	●	◐	◐	○	○	unlimited	50	3	3	ABCD	fair		Permanent

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2 SCS soil types (A, B, C, D) defined in Appendix B. A = high infiltration rate; D = little or no infiltration

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4 Longevity data collected from various sources, including Panhandle Health District 1996, Boise City 1997, and EPA 1993. The numbers shown represent industry guidelines; the actual life expectancy is dependent on proper design and placement of BMPs, and most importantly, routine maintenance.

N/A Not Applicable.

Table 2-1 Guidance for Selecting Stormwater Best Management Practices (continued)

Best Management Practice	Targeted pollutants[1,3]					Drainage area (acres)	Maximum slope (%)	Minimum depth to bedrock+ (ft)	Depth to high water table (ft)	SCS soil type[2]	Use with freeze/thaw cycle	Drainage/ flood control	Expected life[4]
	Sediment	Phosphorus	Trace Metals	Bacteria	Petroleum hydrocarbons								
Stormwater Filters ***(see Section 5.3)***													
38. Vegetated swale (biofiltration)	80%	30%	◐	◐	◐	15	14	5	3	BCD	fair	✓	50 years
39. Vegetative filter strip	80%	30%	◐	◐	◐	5	14	5	3	BCD	fair		50 years
40. Sand filter	85%	55%	◐	◐	◐	5 (inlets), 50 (basin)	10	3	3	N/A	fair	✓	25 years
41. Compost stormwater filter	95%	40%	●	◐	●	1	N/A	N/A	N/A	N/A	fair		20+ years
42. Catchbasin inserts	35%	5%	◐	○	◐	5,000 s.f.	N/A	N/A	N/A	N/A	fair		
Infiltration Facilities ***(see Section 5.4)***													
43. Infiltration Trench	75%	55%	●	●	●	15	25	4	3	AB	fair		10 years
44. Infiltration Basin	75%	55%	●	●	●	5-50	5	4	3	AB	fair	✓	25 years
Detention Facilities ***(see Section 5.5)***													
45. Wet pond (conventional pollutants)	80%	45%	●	◐	◐	15-20	10	3	2	CD	good	✓	50 years
46. Wet pond (nutrient control)	80%	65%	●	◐	◐	5-20	5	3	2	CD	fair	✓	50 years
47. Wet extended detention pond	80%	65%	●	◐	◐	10-50	10	3	2	CD	good	✓	50 years
48. Dry extended detention pond	45%	25%	◐	○	◐	10-50	10	6	4	ABC	good	✓	50 years
49. Constructed wetland	75%	45%	●	◐	●	25-50	5	3	2	CD	fair	✓	50 years
50. Presettling/sedimentation basin	60%	30%	◐	○	○	10+	10	3	2	CD	good		
51. Wet vault/tank	60%	30%	◐	○	○	5	15	12	12	ABC	fair	✓	
Other Structural Controls ***(see Section 5.6)***													
52. Oil/Water separator	15%	5%	◐	○	●	1	15	8	8	ABC	fair		20+ years

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[4] Longevity data collected from various sources, including Panhandle Health District 1996, Boise City 1997, and EPA 1993. The numbers shown represent industry guidelines; the actual life expectancy is dependent on proper design and placement of BMPs, and most importantly, routine maintenance.

N/A Not Applicable.

CHAPTER 3
STORMWATER MANAGEMENT POLICY

3.1 Stormwater Management Plan Checklist

The guidelines and requirements in the following sections of this chapter are intended to establish the basic criteria by which a Storm Water Management and/or Erosion Control Report will be prepared. A Storm Water Management and/or Erosion Control Report will be required for all land development activities that pose high risk to the quality of Valley County water bodies. **To determine whether a land development project qualifies and is required to meet minimum standards described in this section, proceed to the respective jurisdictional policy section:**

- 3.2 Policy as adopted by the City of Cascade;
- 3.3 Policy as adopted by the City of Donnelly;
- 3.4 Policy as adopted by the City of McCall and City's impact area, requires *Storm Water Management Report*;
- 3.5 Policy as adopted by Valley County, requires *Erosion Control Report*.

Each of these jurisdictional policy sections must first be adopted by the given jurisdiction. Once adopted, the given policy section provides guidance and requirements to developers and design engineers. Developers and/or their design professionals are required to adhere to the requirements outlined in each jurisdictional policy section of the chapter, as governed by the respective enacting ordinance of the jurisdiction. Failure to furnish the required information will result in delays in processing applications. The subsequent sub-sections provide <u>only</u> general county-wide standards that apply to site development projects based on the specific jurisdictional policy requirements.

A) BASIN CHARACTERISTICS

A description of the proposed development site, including contributing upstream tributary areas, is required. All information provided should be supported by appropriate mapping. On-site area topography must be evaluated based on use of a topographic map or by field generation of a contour map with at least 5 foot intervals (unless otherwise stated under a jurisdictional policy section). Off-site drainage areas may also be delineated using USGS quad maps.

Project Site (required for a Storm Water Management and/or Erosion Control Plan):

- Total site area (acres).
- Development area (acres).
- Development density (housing units per acre).
- Area of streets, sidewalks, and driveways (acres).
- Estimated roof area (acres).
- Total impervious area (acres).

A summary of the physical conditions on-site as well as for the upstream contributing area. Provide the following information for the pre-development and post-development conditions (required for a Storm Water Management and/or Erosion Control Plan):

- Percent impervious.
- Drainage length.
- Average slope of the drainage.
- Wetlands (on-site only).

Existing drainage facilities impacted by the proposed development on the site and downstream of the proposed development (required for a Storm Water Management Plan):

- Location of facilities.
- Type of facilities.
- Size of facilities
- Capacity of facilities.
- General condition of the facilities.

B) EROSION AND SEDIMENT CONTROL PLAN

A parcel of land is most susceptible to erosion and sediment loss during construction, when site clearing and grading are occurring. Chapter 4 contains a general discussion of erosion and sediment control BMPs.

The following minimum information is required for an erosion and sediment control plan:

1) Description of existing site prior to activity. This description must include:
- Total site area in acres, and existing areas, in square feet, of cover (i.e., asphalt, roof top, concrete, bare soil, grass, etc.).
- Identify where off-site runoff is currently entering the project site, how it flows across the site and where it leaves the site.

2) Description of land development activity.
- Areas, in square feet, of proposed cover (i.e., asphalt, roof top, concrete, bare soil, grass, etc.).
- Identify how proposed improvement will modify existing drainage patterns through the site.

3) A plan which demonstrates the methods for erosion and sediment control, should indicate the size, location and method for installation or implementation of the BMP.

4) Details and specifications for the proposed BMP which describe their installation and maintenance procedure (see chapter 2.4).

5) A sequence and schedule of construction activities, including when erosion and sediment control devices and practices will be implemented. The sequence and schedule must include a timetable for project finish and a strategy for long term site stabilization and removal of temporary BMP's.

C) CONVEYANCE SYSTEM

Perform a hydrologic analysis to accurately assess the upstream maximum contributing drainage area to the project site. Use either the *Rational Method* or a modified *SCS Curve Number Method* (Appendix D-2). Provide a complete set of computations showing all calculations, assumptions and methods. Minimum design storm frequencies and rainfall intensities shall be based upon the jurisdictional policy section of each municipality.

Check the local permitting authority to determine whether detailed construction plans are required for a preliminary concept review. If detailed construction plans are required, schematics of principal control facilities and structures are required in sufficient detail to develop the drainage concept and determine feasibility. Prepare a drainage plan by showing all proposed drainage facilities.

The final design submittal shall show detailed information for all proposed drainage facilities and improvements. The following minimum information will be required for final submittal:

1. Post development peak runoff which will include: design storm frequency, time of concentration calculations, design storm duration (hours), design storm intensity, (inches per hour), and design storm runoff (cfs).

2. Identify existing upstream flows and volumes which are tributary to the project site or drainage facilities to be developed for the site.

3. In floodplain areas, sites with upstream drainage area exceeding 250 acres, and/or areas where significant property damage may result from a major flood event, additional flood plain analysis, including delineation of the 100 year flows and extent of flooding, shall be required.

4. Overall Drainage System Configuration - Provide an overall drainage plan which shows the location, configuration and size of all conveyance facilities. Identify inlets, outlets, control structures, piping, wetlands, easements and topography (using proper contour intervals based on jurisdictional requirements). For pipes and ditches provide: slope, velocity, size, materials, and capacities.

5. Details - Provide design details for all facilities showing location, configuration, sizes, typical sections, etc., sufficient to evaluate intended function and feasibility of the design and to construct the facilities.

6. Identify potential downstream problems and proposed impact mitigation measures. This can include existing structures in the drainage way, adjacent downstream property, other development areas, and other drainage systems.

D) FIRST FLUSH STORM TREATMENT

The first flush can be defined as runoff associated with the most frequently occurring storms which are typically high intensity and low duration. It is during these storms where the greatest amount of sediment and associated nutrients are washed off non-stabilized soils and deposited downstream.

Perform a hydrologic analysis to accurately assess the upstream maximum contributing drainage area to the project site. Use either the *Rational Method* or a modified *SCS Curve Number Method* (Appendix D-2). Provide a complete set of computations showing all calculations, assumptions and methods. Minimum design storm frequencies and rainfall intensities shall be based upon the jurisdictional policy section of each municipality.

The following minimum information is required:

1. Post development peak runoff for the 2 year storm, which will include: time of concentration calculations, design storm duration (hours), design storm intensity, (inches per hour), design storm runoff (cfs), and design storm runoff (total inches).

2. Identify existing upstream flows and volumes which are tributary to the project site or drainage facilities to be developed for the site.

3. In floodplain areas, sites with upstream drainage area exceeding 250 acres, and/or areas where significant property damage may result from a major flood event, additional flood plain analysis, including delineation of the 100 year flows and extent of flooding, shall be required.

4. Provide design data used to size and layout first flush treatment/detention facility. Identify design freeboard, working volume, total volume, inflow rate(s), emergency outflow capacity and outlet control device(s).

5. Provide design details for all facilities showing configuration, sizes, and typical sections sufficient to evaluate intended function and feasibility of the design and to construct the facility.

6. Identify potential downstream problems and proposed impact mitigation measures. This can include existing structures in the drainage, adjacent downstream property, other development areas, and other drainage systems.

E) PERMANENT BMPs

Perform a hydrologic analysis to accurately assess the upstream maximum contributing drainage area to the project site. Use either the *Rational Method* or a modified *SCS Curve Number Method* (Appendix D-2). Provide a complete set of computations showing all calculations, assumptions and methods. Minimum design storm frequencies and rainfall intensities shall be based upon the jurisdictional policy section of each municipality.

The following minimum information is required:

1. Pre- and post- development peak runoff which will include: design storm frequency, time of concentration calculations, design storm duration (hours), design storm intensity, (inches per hour), design storm runoff (cfs), and design storm runoff (total inches).

2. Identify existing upstream flows and volumes which are tributary to the project site or drainage facilities to be developed for the site.

3. In floodplain areas, sites with upstream drainage area exceeding 250 acres, and/or areas where significant property damage may result from a major flood event, additional flood plain analysis, including delineation of the 100 year flows and extent of flooding, shall be required.

4. Provide design data used to size and layout detention facility. Identify design freeboard, required storage volume, working volume, total volume, inflow rate(s), emergency outflow capacity and outlet control device(s).

5. Provide design details for all facilities showing configuration, sizes, and typical sections sufficient to evaluate intended function and feasibility of the design and to construct the facility.

6. Identify potential downstream problems and proposed impact mitigation measures. This can include existing structures in the drainage, adjacent downstream property, other development areas, and other drainage systems.

F) OPERATION AND MAINTENANCE PLAN

Maintenance is the most critical factor to the success of a stormwater conveyance, detention or treatment system. The following minimum information on maintenance is required:

1. A description of operation and maintenance requirements must be included which addresses the following situations:

    a. Regularly scheduled maintenance interval(s) and procedures.
    b. Maintenance requirements for various BMP's following a large runoff event.

2. A description of safety procedures, routine operation and control procedures must be

included.

3. Identify any unique elements of the system.

4. Provide a statement which clearly identifies the party responsible for operation and maintenance and demonstrates their financial capability to do so.