2008 Draft

Coeur d'Alene Lake Management Plan

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2008 Draft LMP
Coeur d'Alene Lake Management Plan

June 2008

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Executive Summary

Coeur d'Alene Lake is an increasingly popular recreational destination, an economic catalyst for Northern Idaho and Eastern Washington and the heart of the local community. The lake is part of the aboriginal homeland of the Coeur d'Alene Tribe, and their reservation is located around its southern half. Development along the lake's shoreline has been dramatic in recent years, and it now features multiple resorts and an ever-increasing number of vacation homes. Counties, cities, and towns in the Coeur d'Alene Lake Basin are growing, and the lake is a significant factor in that growth.

As a result of historical mining activity in the Silver Valley, millions of metric tons of metals (e.g., zinc, lead, and cadmium) are present on the lake bottom. Other human activities around the basin, such as logging, farming, and home building, contribute sediments and nutrients (phosphorus and nitrogen) into the lake, often as a result of natural events such as snow, rain, and floods. Water quality in the lake has generally improved since the mid-1970s as the era of large-scale upstream mining-related activities tapered off, environmental cleanup activities got underway in the Silver Valley, and environmental regulations were implemented throughout the basin. The challenge today is to ensure that human activity is managed in ways that will protect the lake's water quality.

Authority to manage the lake's water quality rests with the Tribe, State and Federal governments. However, authority to manage activities around the basin that impact water quality in the lake is the responsibility of local, State, Federal, and Tribal governments. For example, county governments in the basin use their authority under State law to promulgate zoning ordinances that regulate private land uses that can affect water quality conditions in the lake. Federal and State resource agencies also exercise authorities that may influence water quality conditions in the lake. Regulating water quality in tributary waters and upland activities in the basin also involves multiple levels of government.

In an effort to address the many issues facing Coeur d'Alene Lake, the Coeur d'Alene Tribe (Tribe) and the State of Idaho Department of Environmental Quality (DEQ) have collaboratively developed the 2008 Lake Management Plan (2008 LMP) with the goal: *to protect and improve lake water quality by limiting basin-wide nutrient inputs that impair lake water quality conditions, which in turn influence the solubility of mining-related metals contamination contained in lake sediments.* The United States Environmental Protection Agency (EPA) assisted the Tribe and DEQ by convening and participating in an Alternative Dispute Resolution (ADR) process.

Achieving this goal will require concerted, coordinated, and ongoing actions by these government agencies as well as those local, State, and Federal government agencies that manage or regulate activity in the Coeur d'Alene Lake Basin that affects lake water quality. Protecting the lake's water quality depends upon multi-level partnership between governments and the public. Education, understanding, and support from business organizations, environmental groups, and individual residents and visitors is essential. Finally, water quality protection requires funding, from diverse sources, to support the activities described in the 2008 LMP.

The 2008 LMP reflects the shared view of the Tribe and DEQ that a collaborative, adaptive, and data-driven approach is the best option at this time to manage water quality in Coeur d'Alene Lake. The 2008 LMP comprehensively identifies the actions and substantial resources that will likely be required to effectively manage Coeur d'Alene Lake and the large quantities of mining-associated hazardous substances in its waters and lakebed sediments. It is intended to serve as a framework for watershed-based lake management that will achieve the primary 2008 LMP goal and management objectives, described in Section 3, through a public-private partnership model.

The scope of the 2008 LMP encompasses the entire Coeur d'Alene Lake Basin. The reason for this is practical: loading of the lake with metals, sediments, and nutrients results from activities that occur around the lake, in upland areas, and along tributary streams and rivers. This scope is essential to effectively address the key influences on water quality. The scope is intended to follow natural boundaries, promote integrated solutions, and maximize the use of available resources to benefit water quality.

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The 2008 LMP recognizes the importance of setting priorities to accommodate the challenges posed by funding limits. The LMP has the following core components.

- Conduct water quality monitoring and utilize computer modeling to increase scientific understanding
- Conduct a basin-wide nutrient source inventory to set implementation priorities
- Use Management Action Tables to coordinate and evaluate implementation of existing programs with LMP partners
- Education to increase the community's awareness of lake conditions and promote stewardship

Other 2008 LMP components will include: nutrient reduction projects, special studies, and support for TMDL processes.

To accomplish these activities, the Tribe and DEQ plan to use their respective staffs and internal support, and then add staff as funding becomes available, to create a collaborative "Implementation Team" to fully implement the 2008 LMP.

The following general concepts serve as a basic framework for cost estimates.

- Funding is essential to support core LMP components
- Costs are yearly and long-term
- 5-year plans will identify implementation priorities and funding needs above and beyond core needs

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Forward

Nothing in this LMP is or shall be construed to be a waiver of the sovereignty, jurisdiction, ownership or any claim of the Coeur d'Alene Tribe or the State of Idaho. Each party reserves, and nothing in the LMP affects, any rights, powers, and remedies of any Party now or hereafter existing in law or equity by statute, treaty executive order, regulation, court decision or otherwise. The LMP creates no rights in third parties or any right to judicial review.

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Glossary of Key Terms

303(d) – Refers to section 303 subsection "d" of the Clean Water Act. Section 303(d) requires states and tribes to develop a list of water bodies that do not meet water quality standards. It also requires that total maximum daily loads (TMDLs) be prepared for listed waters. Both the list and TMDLs are subject to U.S. Environmental Protection Agency approval.

Aboriginal Rights – Aboriginal rights are often viewed as specific rights - rights that are grounded in the specific practices and customs of particular aboriginal peoples.

Algae – Small aquatic plants lacking stems, roots, or leaves that occur as single cells, colonies, or filaments.

Anoxic – The condition in which a water body has become deficient or completely depleted of dissolved oxygen.

Beneficial use – Any of the various uses that may be made of the water, including, but not limited to domestic water supplies, support of cold water aquatic life, salmonid spawning, recreation in and on the water, wildlife habitat, ceremonial, spiritual, and aesthetics.

Benthic flux – The rate that chemicals dissolved in water flow out of or into the bottom of aquatic systems. More specifically, benthic flux (sometimes referred to as internal recycling) represents the transport of dissolved chemical species across the solid-liquid interface at the bottom of aquatic systems. The flux of solutes can be either positive (into the water column from the sediment) or negative (out of the water column into the sediment) and can vary over multiple temporal and spatial scales.

Best Management Practices (BMPs) – Accepted methods for controlling nonpoint source pollution. BMPs may include one or more physical, structural, and/or managerial conservation practices that reduce or prevent pollution from entering a water body.

Bioaccumulation – The process by which a compound from the environment is taken up by and accumulated in the tissues of an aquatic organism, both from water sediments and through food.

Bio-magnification –The increase in concentration of a substance that occurs in a food chain as a consequence of food chain energetics or low (or nonexistent) rate of excretion/degradation of the substance.

CERCLA – The Comprehensive Environmental Response, Compensation, and Liability Act. In CERCLA Section 104 (i), as amended by the Superfund Amendments and Reauthorization Act (SARA), the Agency for Toxic Substances and Disease Registry (ATSDR) and the U.S. Environmental Protection Agency (EPA) are required to prepare a list, in order of priority, of substances that are most commonly found at facilities on the National Priorities List (NPL) and that are determined to pose the most significant potential threat to human health due to their known or suspected toxicity and potential for human exposure at these NPL sites (often called

Superfund sites). CERCLA also requires this list to be revised periodically to reflect additional information on hazardous substances.

Chlorophyll *a* – The dominant green, photosynthetic pigment in plants, that is one measure of aquatic plant abundance and biomass.

Clean Water Act (CWA) – The primary federal law in the U.S. governing water pollution, initially based in the Federal Water Pollution Control Amendments of 1972. The CWA established the goals of eliminating releases to water of large amounts of toxic substances, eliminating additional water pollution by 1985, and ensuring that surface waters would meet standards necessary for human sports and recreation by 1983. Major amendments were the **Clean Water Act of 1977** enacted by the 95th U.S. Congress and the **Water Quality Act of 1987** enacted by the 100th U.S. Congress.

Designated use – Those water uses identified in water quality standards that must be achieved and maintained as required under the Clean Water Act.

Discharge – In the simplest form, discharge means an outflow. The use of this term is not restricted as to a watercourse or location and it can be used to describe the flow of water from a pipe, channel, or drainage basin. Other words related to discharge are runoff, flow, and yield.

Dissolved oxygen (DO) – The oxygen dissolved in water. Adequate DO is vital to fish and other aquatic life.

ELCOM-CAEDYM model – A computer model made available through the Centre for Water Research at the University of Western Australia that has been developed and applied to examine specific processes and basin scale dynamics in lakes. The 3-dimensional hydrodynamic model, Estuary and Lake Computer Model (ELCOM), was customized to simulate the hydrological regime in Coeur d'Alene Lake including river loading of metals/nutrients and river plume flow through the lake. ELCOM was coupled to the Computational Aquatic Ecosystem Dynamics Model (CAEDYM) to simulate lake processes such as primary production, organic matter cycling within the water column, benthic flux of metal contaminants to/from lakebed sediments, and the interactive effects of dissolved zinc and algal productivity.

Epilimnion – The topmost layer in a thermally stratified lake, occurring above the deeper hypolimnion. The epilimnion is warmer and typically has a higher pH level and higher dissolved oxygen concentration than the hypolimnion. Being exposed at the surface, it typically becomes turbulently mixed as a result of surface wind-mixing. It is also free to exchange dissolved gases (e.g., oxygen and carbon dioxide) with the atmosphere.

Erosion – The wearing away of the landscape by water, wind, ice, or gravity.

Euphotic zone – Measured as the water depth where photosynthetically active radiation is 1% of the light incident on the surface. The euphotic zone is the theoretical upper layer that has sufficient light to support viable photosynthetic activity.

Eurasian watermilfoil – A submersed perennial plant that has fine feather-like leaves arranged in whorls of four. The leaf generally has 12 or more leaflet pairs (not to be confused with the

native plant Northern watermilfoil, that has fewer than 12 leaflet pairs). This invasive aquatic noxious weed forms very dense mats of vegetation on the water's surface. These mats interfere with water-based recreation such as fishing, boating, water skiing, and swimming. Swimmers have been known to become entangled and drown in these surface mats. The dense mats increase the pH of the water and, under certain circumstances, can reduce the amount of dissolved oxygen, killing fish and other life.

Eutrophic – This term generally refers to a fertile, biologically productive body of water. It contrasts with oligotrophic and means literally, "nutrient rich."

Eutrophication – The natural process by which lakes and ponds become enriched with dissolved nutrients and sediments, resulting in increased growth of algae and rooted aquatic plants and reduced water clarity. Cultural eutrophication is a term for the acceleration of the eutrophication process caused by humans' land use activities.

Flow – The amount of water flowing in a stream or river channel at the time of measurement. Flow is usually expressed as cubic feet per second (cfs).

Geochemical –This term refers to alterations in the earth's crust as a result of chemical changes; focused on the distribution of the earth elements.

Heavy metal-laden sediment – Sediment contaminated with heavy metals such as lead, cadmium, arsenic, zinc, antimony, copper, and mercury.

Hypolimnion – The lowermost, non-circulating layer of cold water in a thermally stratified lake, often deficient in oxygen.

Limnology – The branch of science pertaining to the study of the physical, chemical, biological, and ecological aspects of fresh water; the structure and dynamics of ponds, lakes, streams, and wetlands.

Littoral zone – That portion of a lake or pond extending from the shoreline into the lake to the greatest depth occupied by rooted aquatic plants.

Load – The amount of substance, usually nutrients or sediment, discharged past a point. Load is expressed in amount of weight per unit of time.

Macrophyte – The larger, non-microscopic aquatic plants (often rooted) found in shallow areas of lakes and streams.

Mesotrophic – This term generally refers to a moderately fertile, biologically productive body of water, that means literally, "moderate nutrients."

Metalimnion – Also called the thermocline, the metalimnion is the middle layer of a stratified lake where water temperature changes rapidly with depth (more than 1 °C per meter).

Mixing zone – The portion of water body adjacent to a point source discharge where mixing results in the dilution of the effluent with the receiving water.

Model – A simulation by descriptive, statistical, or other means of a process otherwise difficult or impossible to observe directly. Often, the term refers to results of computerized modeling.

Nitrogen – An essential nutrient for plants and animals. Atmospheric molecular nitrogen comprises 80% of the earth's atmosphere.

Nonpoint source pollution – A dispersed source of pollutants generated from a geographic area when pollutants are dissolved or suspended in runoff and then delivered into receiving waters. Nonpoint sources are without a discernable point or origin. They include, but are not limited to: atmospheric deposition; surface water runoff from agricultural lands, urban areas, or forest lands; and subsurface or underground sources.

Nutrient loading – The addition of nutrients, usually nitrogen or phosphorus, to a water body (often expressed in amount of weight per unit of time). The majority of nutrient loading in a lake usually comes from its tributaries.

Nutrients – Elements or compounds essential to life, including but not limited to, oxygen, carbon, nitrogen, and phosphorus. The term commonly refers to those elements in short supply, such as nitrogen and phosphorus, which can limit growth.

Oligotrophic – Generally refers to a water body with low biological productivity, and is the opposite of eutrophic: literally meaning, "nutrient poor."

Phosphorus – An essential nutrient for plants and animals derived from inorganic phosphate rocks. Phosphorus (a limiting nutrient) often controls phytoplankton growth in lakes. Phosphorus is incorporated into human-made products such as fertilizers and detergents.

Phytoplankton – Free-floating microscopic (usually) aquatic plants consisting of single cells or filaments, or colonies. Some phytoplankton are flagellated. For example, free-floating diatoms are phytoplankton.

Point source pollution – Pollutants discharged from any discernible, confined, and discrete conveyance, including, but not limited to: any pipe, ditch, channel, sewer, tunnel, conduit, well, discrete fissure, container, concentrated feeding operation, marine vessel or other floating craft.

Pollutant – Generally, any substance introduced into the environment that adversely affects the usefulness of a resource or the health of humans, animals, or ecosystems.

Primary production – The synthesis of organic compounds by green plants in the presence of essential elements (e.g., nitrogen, phosphorus) and light energy.

Receiving waters – Those waters which receive pollutants from point or nonpoint sources.

Riparian area – The area of land next to a stream, river, or lake. Maintenance of natural plants in the riparian area serves to protect water temperature and acts like a filter for runoff.

Riverine – Relating to, formed by, or resembling a river.

Sediment – Fragmented organic and inorganic material derived from the weathering of soil, alluvial, and rock materials removed by erosion and transported by water, wind, ice, and gravity.

Senescence – Refers to the biological processes of a living organism approaching an advanced age (i.e., the combination of processes of deterioration that follow the period of development of an organism). In Coeur d'Alene Lake the term is most often used for the annual deterioration of aquatic rooted plants that leads to an organic load to the water column and lakebed sediments.

Sentinel site – A site identified to monitor annual variability and extreme events.

Sewage – The water-carried human and animal waste from residences, buildings, industrial establishments, or other places, together with such infiltrated ground water and surface water as may be present.

Sink – A depression where materials are held (e.g., sediment, nutrients, metals).

STORET – The U.S. Environmental Protection Agency maintains two data management systems containing water quality information for the nation's waters: the Legacy Data Center (LDC) and STORET. The LDC is a static, archived database and STORET is an operational system actively being populated with water quality data.

Storm water runoff – Surface water runoff is usually associated with urban development, carrying both natural and human-caused pollutants. Storm water runoff can be conveyed to lakes, ponds, and streams either through point or nonpoint sources.

Stratification – The vertical separation of lake waters into three distinct layers, typically occurring from early summer into fall, due to differences in water density from warm water to cold water. The three layers are the epilimnion, the top of the lake, metalimnion (or thermocline), the middle layer that may change depth throughout the day, and the hypolimnion, the bottom layer.

Suspended sediment – Solids, either organic or inorganic, that are found suspended in a body of water and can be removed by filtration. The origin of suspended matter may be human-made wastes or natural sources such as silt.

Total Maximum Daily Load (TMDL) – A TMDL is a water body's maximum load capacity of pollutants in which beneficial uses are still fully supported. A TMDL can be expressed on a time basis other than daily if appropriate. Sediment loads, for example, are often calculated on an annual basis. A TMDL can be expressed by the following equation: TMDL (load capacity) = [load allocation (nonpoint source) + waste load allocation (point source) + margin of safety]. In common usage, a TMDL also refers to the written document that contains the statements of loads and supporting analyses, often incorporating TMDLs for several water bodies and/or pollutants within a given watershed.

Thermocline – A layer within a body of water or air where the temperature changes rapidly with depth.

Treatment in the same manner as a state – Congress amended the CWA by adding Sec. 518, in 1987, to address the roles of Indian tribes. Sec. 518 provides a method for tribes to assume the same duties and authorities as states to develop water quality standards for waters within Reservation boundaries.

Trophic status – This term refers to the nourishment status of a water body, i.e., oligotrophic, mesotrophic, eutrophic.

Turbidity – Cloudiness caused by the presence of suspended solids, such as clay, silt, and microscopic organisms in the water. Turbidity is an indicator of water quality. It can also refer to a scientific measurement of the extent to which light passing through water is scattered by fine suspended materials.

Unstratified – A lake condition of mixed waters, from surface to bottom, with uniform water temperatures throughout (i.e., a lake that is not stratified and lacks definite layers).

Wastewater – Treated or untreated sewage, industrial waste, or agricultural waste, along with such water as is present. Sometimes referred to as effluent.

Water quality – A term used to describe the chemical, physical, and biological characteristics of water with respect to its suitability for a beneficial use.

Water quality standard – State's and Tribe's adopted, and EPA-approved, ambient standards for water bodies. The standards identify those designated uses of a water body and establish the water quality criteria that must be met to protect uses. Standards are legally mandated by the Clean Water Act and are enforceable.

Water year (WY) – The twelve-month period from October 1 to September 30, typically used by water management agencies and designated by the calendar year in which the water year ends (e.g., WY06 ended on September 30, 2006).

Watershed – An area of land that is drained by a distinct stream or river system and is separated from other similar systems by ridgetop boundaries. The waters of those lands that would drain to a lake (also referred to as the lake "basin").

Wetlands – Lands where water saturation of the soil for at least part of the year is the dominant factor determining the nature of soil development and the types of plant and animal communities living within the area and the surrounding environment. Other common names for wetlands are sloughs, ponds, swamps, marshes, bogs, and riparian areas.

Acronyms and Abbreviations

ACOE	U.S. Army Corps of Engineers
ADR	Alternative Dispute Resolution
BEIPC	Coeur d'Alene Basin Environmental Improvement Project Commission (formed in 2002)
BEMP	Basin Environmental Monitoring Program
BMP	Best Management Practices
CBRP	Coeur d'Alene Basin Restoration Project (1991 - 1996)
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
cfs	cubic feet per second
CIA	Central Impoundment Area
CCC	Citizen's Coordinating Council
CCC	Criterion Continuous Concentration (chronic criteria) used only in Appendix A
CLCC	Clean Lakes Coordinating Council
CMC	Criterion Maximum Concentration (acute criteria)
CWA	Federal Clean Water Act
CWE	Cumulative Watershed Effects (IDL protocol)
CY91-92	Calendar Years 1991-1992 sampling from January 1991-December 1992
DEQ	Idaho Department of Environmental Quality
EPA	U.S. Environmental Protection Agency
FERC	Federal Energy Regulatory Commission
FIFRA	Federal Insecticide, Fungicide, and Rodenticide Acts
FPA	Idaho Forest Practices Act
FTE	Full Time Equivalent
GIS	Geographic Information Systems
IDAPA	Idaho Administrative Procedures Act
IDFG	Idaho Department of Fish & Game
IDHW	Idaho Department of Health and Welfare
IDL	Idaho Department of Lands
IDPR	Idaho Department of Parks & Recreation
IDWR	Idaho Department of Water Resources
INFISH	Inland Native Fish Strategy
kg	kilogram

Legislature	Idaho State Legislature
2008 LMP	2008 Coeur d'Alene Lake Management Plan
LSAS	Large Soil Absorption System
MATs	Management Action Tables
m	meter
mg/L	milligrams per liter
MOA	Memorandum of Agreement
MOU	Memorandum of Understanding
NPDES	National Pollutant Discharge Elimination System
NPL	National Priorities List
NRC/ NAS	National Research Council/National Academy of Sciences
NRDA	Natural Resource Damage Assessment
OU	Operable Unit (as defined under CERCLA)
PHD	Panhandle Health District
ROD	Record of Decision
QAPP	Quality Assurance Project Plan
State	State of Idaho
TAS	Treatment as a State
TLG	Technical Leadership Group
TMDL	Total Maximum Daily Load
Tribe	Coeur d'Alene Tribe
TWG	Targeted Watershed Grant (EPA)
TSS	Total Suspended Sediment
UI - CES	University of Idaho, Cooperative Extension Service
µg/L	micrograms per liter
U of I	University of Idaho
USDA	U.S. Department of Agriculture
USFS	U.S. Forest Service
USFWS	U.S. Fish and Wildlife Service
USGS	United States Geological Survey
WAG	Watershed Advisory Group
WCAC	Washington Citizens Advisory Committee
WQM	Water Quality Management
WQS	Water Quality Standards
WPCA	Water Pollution Control Account
WDOE	Washington Department of Ecology
WWTP	Wastewater Treatment Plant
WY04-06	Water Years 2004-2006 sampling from October 2003-August 2006

Acknowledgements

The collaborative team from the Coeur d'Alene Tribe (Phillip Cernera and Rebecca Stevens) and Idaho DEQ (Gwen Fransen and Glen Rothrock), who together drafted the 2008 LMP, would like to acknowledge the unique support provided by several individuals that made completion of this document possible. Michael Harty; who was under contract for mediation services, provided crucial negotiating skills to help the team find agreement and stay on task to meet the ambitious schedule for completing this document. Michael offered sound advice on the structure of the LMP, and produced the initial version of the draft, giving the document concise wording and a true collaborative tone. Don Martin and Mark Masarik of EPA, who attended many of the writing sessions, offered valuable input for content and editing, and gave needed advice on EPA perspectives for the LMP. Special thanks go to Don for always having words of encouragement and good cheer during our many long and difficult writing sessions. Last and most, we want to thank Holly LeBret, who works with the Coeur d'Alene Tribe, for her mastery of the computer and Microsoft Word. Her patience with as many as seven people giving verbal sentence suggestions and editing comments, at times all at once, was infinite. Holly's ability to keep track of the numerous versions of the draft LMP, as they materialized, was truly amazing. Her thoughtful suggestions for simplicity and clarity of language made the LMP much more "reader friendly" and understandable for all.

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Section 1: Introduction and 2008 LMP Goal

Coeur d'Alene Lake is an increasingly popular recreational destination, an economic catalyst for Northern Idaho and Eastern Washington and the heart of the local community. The history of the Coeur d'Alene basin is rooted in the relationship of its inhabitants to Coeur d'Alene Lake its tributaries and rivers (Figure 1). The lake has sustained the Coeur d'Alene Tribe from time immemorial and the non-indigenous settlers since their arrival in the 1850s. The basin's waters were essential to the success of the region's mining, timber, agricultural and hydropower industries during the twentieth century. In particular, mining activities along the South Fork of the Coeur d'Alene River and its tributaries have and will continue to have a significant influence on basin watershed conditions and on the welfare of its inhabitants.

Other human activities around the basin, such as logging, farming, wastewater treatment and home building, contribute to the flow of sediments and nutrients (phosphorous and nitrogen) into the lake, often as a result of natural events such as snow, rain, and floods. Water quality in the lake has generally improved since the mid-1970s as the era of large-scale upstream mining-related activities tapered off, environmental cleanup activities got underway in the Silver Valley, and environmental regulations were implemented throughout the basin. Development along the lake's shoreline has changed dramatically in recent years, and features multiple resorts and an ever-increasing number of vacation homes (Figure 2). Counties, cities, and towns in the Coeur d'Alene basin are growing, and the lake is a significant factor in that growth. The challenge today is to ensure that human activity is managed in ways that will protect the lake's water quality.

The Coeur d'Alene Tribe (Tribe) and the State of Idaho Department of Environmental Quality (DEQ) have collaboratively developed this 2008 Lake Management Plan (2008 LMP) with the goal *to protect and improve lake water quality by limiting basin-wide nutrient inputs that impair lake water quality conditions, which in turn influence the solubility of mining-related metals contamination contained in lake sediments.* The United States Environmental Protection Agency (EPA) assisted the Tribe and DEQ by convening and participating in an Alternative Dispute

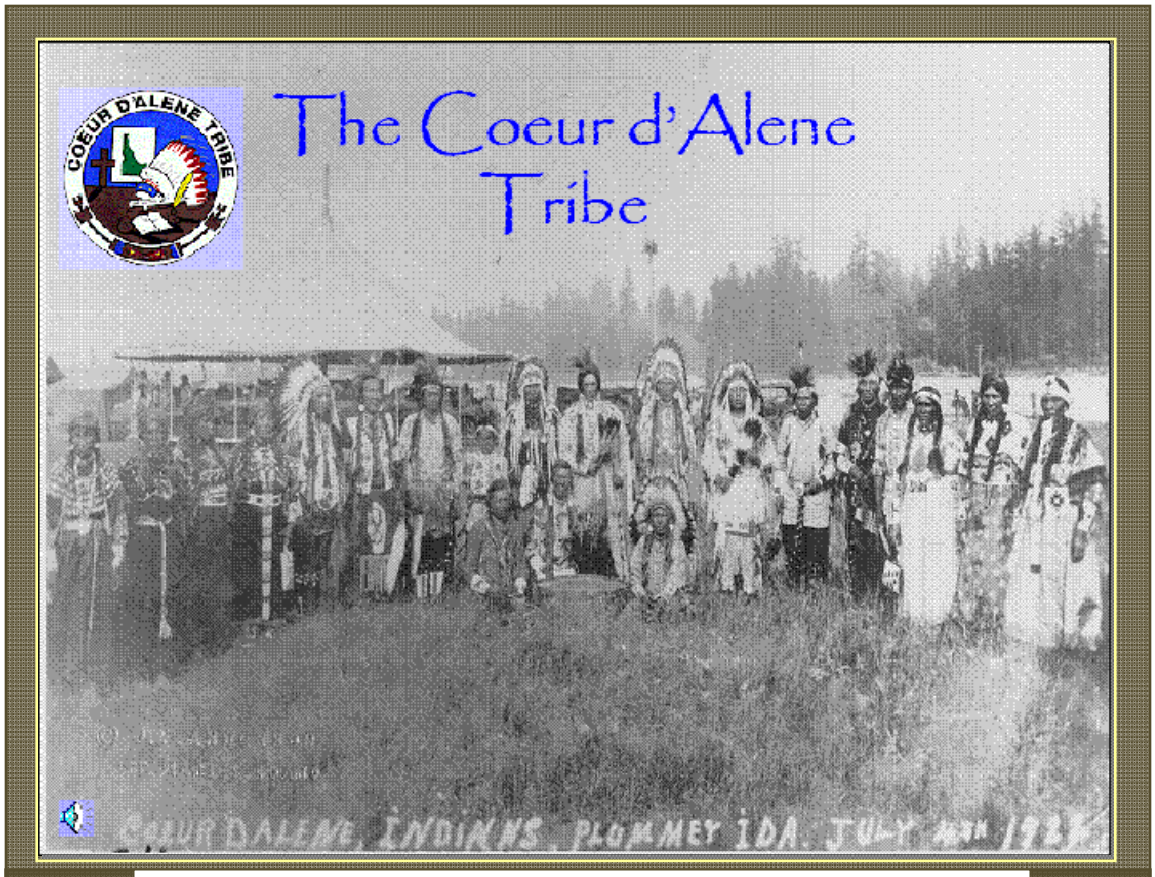
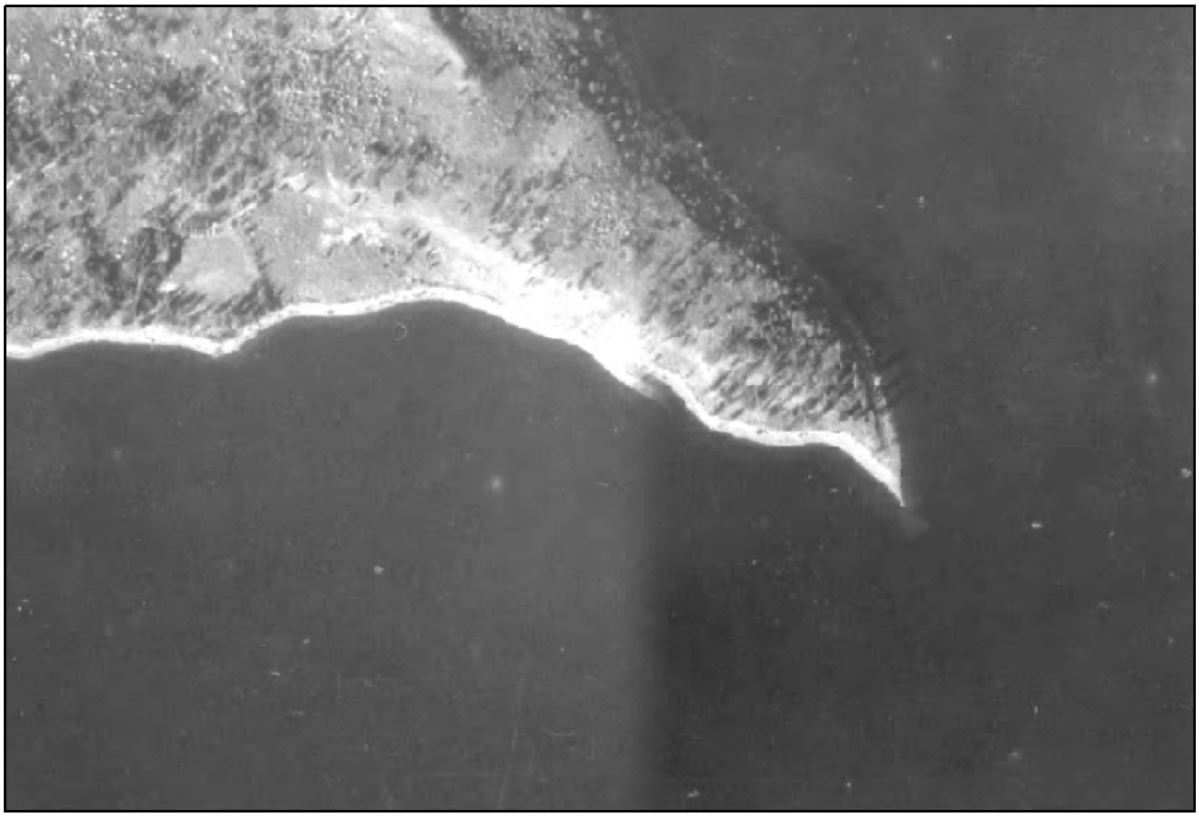


Figure 1. Coeur d'Alene Tribe

Figure 1. Silver Valley Mining

Figure 2. Comparison of Lake Shoreline Development - Rockford Point



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Resolution (ADR) process. Achieving this goal will require concerted, coordinated, and ongoing actions by these government agencies as well as those local, State, and Federal government agencies that manage or regulate activity in the Coeur d'Alene Lake basin that affects lake water quality. Protecting the lake's water quality depends upon multi-level partnership between governments and the public. Education, understanding, and support from business organizations, environmental groups, and individual residents and visitors are essential. Finally, water quality protection requires long-term funding from diverse sources to support the activities described in the 2008 LMP.

The 2008 LMP is intended to serve as a framework for basin-wide lake management that will achieve the goal and objectives described in Section 3 through a public-private partnership model. The need for water quality improvement and protection has been historically recognized: in prior LMP efforts, in the 2002 Coeur d'Alene basin Record of Decision (ROD), and recently in the National Research Council of the National Academy of Sciences (NRC/NAS, 2005), that states: "Lake Coeur d'Alene is not included in the interim action, because its cleanup is to be addressed via a lake management plan… under separate regulatory authorities. Lake Coeur d'Alene will be addressed in a future ROD (EPA, 2004b)."

The 2008 LMP reflects agreement between the Tribe and DEQ, about the state of lake water quality and lake management goals, objectives and strategies. It is the product of extensive efforts to understand and address the key interests of local, State, and Federal government agencies whose partnership is critical for future success. It is also the product of efforts to begin partnerships with the business community, environmental groups, and individual citizens to promote education, understanding, and support for effective lake management.

1.1 Organization of the 2008 LMP

The LMP has six sections, each of which are described briefly below.

Section 1: Introduction and 2008 LMP Goal

This section focuses on a brief description of the basin and its history, including past efforts to implement effective lake management and the circumstances leading to the 2008 LMP, and the LMP Goal.

Section 2: State of Lake Water Quality - 2008

This section presents a summary of the current state of water quality in the lake.

Section 3: Lake Management Objectives and Strategies

The 2008 LMP is organized around five management objectives and strategies to achieve those objectives. This section covers these topics in detail.

Section 4: Administrative Structures for Lake Management

The 2008 LMP relies on existing structures and authorities and does not propose creation of a new level of government or new laws or regulations. This section describes existing structures and highlights the task of coordinating use of existing legal authorities to support effective lake management.

Section 5: Performance Actions and Milestones to Evaluate Effectiveness

This section describes the adaptive management approach that serves as the 2008 LMP foundation and proposes specific ways to evaluate progress and adapt to new information or circumstances.

Section 6: Budgets and Schedules

This section presents a detailed look at estimated costs to achieve the 2008 LMP goal of protecting and improving lake water quality including a schedule of priority tasks.

1.2 Physical Setting and Historical Background

Coeur d'Alene Lake is located in North Idaho within the Spokane River Basin. The drainage area to the lake is approximately 3,700 square miles, and includes the perimeter lands of Coeur d'Alene Lake, the Coeur d'Alene River subbasin, and the St. Joe/St. Maries rivers subbasin. This area is the aboriginal homeland of the Coeur d'Alene Tribe and is the location of their reservation. Outflow from Coeur d'Alene Lake creates the Spokane River that flows west into Washington State and through Spokane (Figure 3).

From the late 1880s to the early 1980s, the "Silver Valley" was the nation's largest producer of silver, lead, zinc and other metals. The mining and ore-processing methods used to extract this

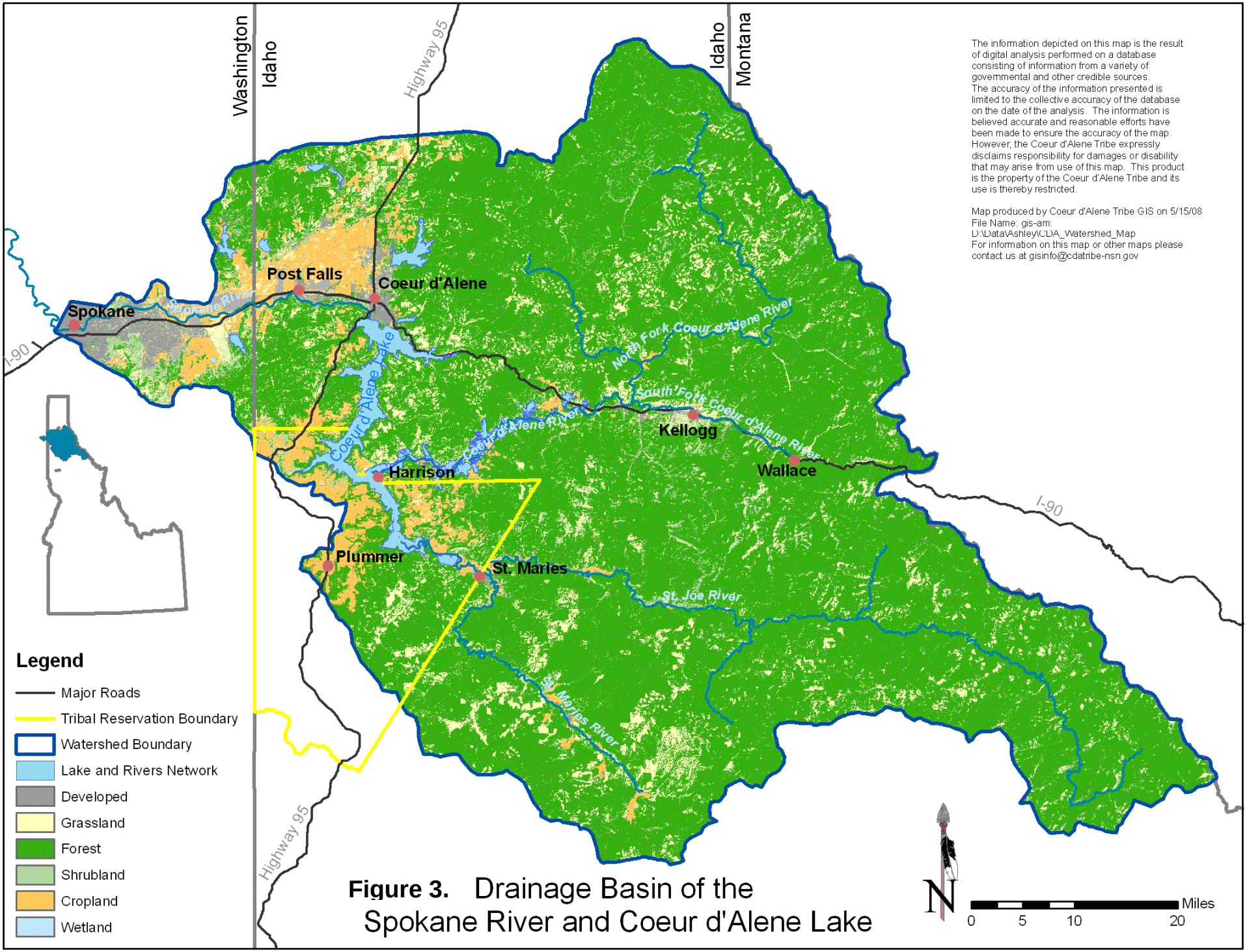


Figure 3. Drainage Basin of the Spokane River and Coeur d'Alene Lake

wealth produced large quantities of waste material containing toxic or environmentally hazardous substances such as cadmium, lead, and zinc. Much of this material was directly discharged to, or washed into the South Fork of the Coeur d'Alene River and its tributaries. The beds, banks and floodplains of the Coeur d'Alene River, Coeur d'Alene Lake, and to a lesser extent the Spokane River, contain vast quantities of metals-contaminated sediments that continue to be transported downstream and dispersed by hydrologic processes and floods in the basin. As much as 83 million tons of particulate and dissolved metals from mining-related activities have been deposited into the lake since the late 19th century (Horowitz et al. 1995, Figure 4). A long-term significant financial commitment will be required to manage metals in place to prevent risk to human health and the environment. If not successful, one alternative could include extensive dredging that may raise concerns regarding environmental impacts and financial cost.

Metals present today in the lake sediments, water, and certain flora and fauna include: mercury, copper, silver, cadmium, arsenic, lead, zinc, antimony, iron, and manganese. Metals also have been transported across Post Falls Dam and down the Spokane River into Washington State in the form of fine-grained sediment and dissolved metals. Transport of mining-contaminated sediment through the Coeur d'Alene Lake/Spokane River Basin is expected to continue for the foreseeable future.

In 1983 the U.S. EPA listed the Bunker Hill Mining and Metallurgical Complex on the National Priorities List (NPL) under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), often referred to as the Superfund process. The Bunker Hill NPL site is in the heart of the Silver Valley and the Coeur d'Alene Lake Basin. EPA and DEQ initially focused their cleanup efforts in a 21-square mile box surrounding Kellogg, and focused on addressing potential human health risks associated with lead, cadmium, zinc, and arsenic as determined in the 1991 ROD, Operable Unit 1 (OU1). Non-populated areas were also addressed in the "box" in the 1992 ROD for OU2. Neither of these RODs addressed mining related metals contamination in Coeur d'Alene Lake.

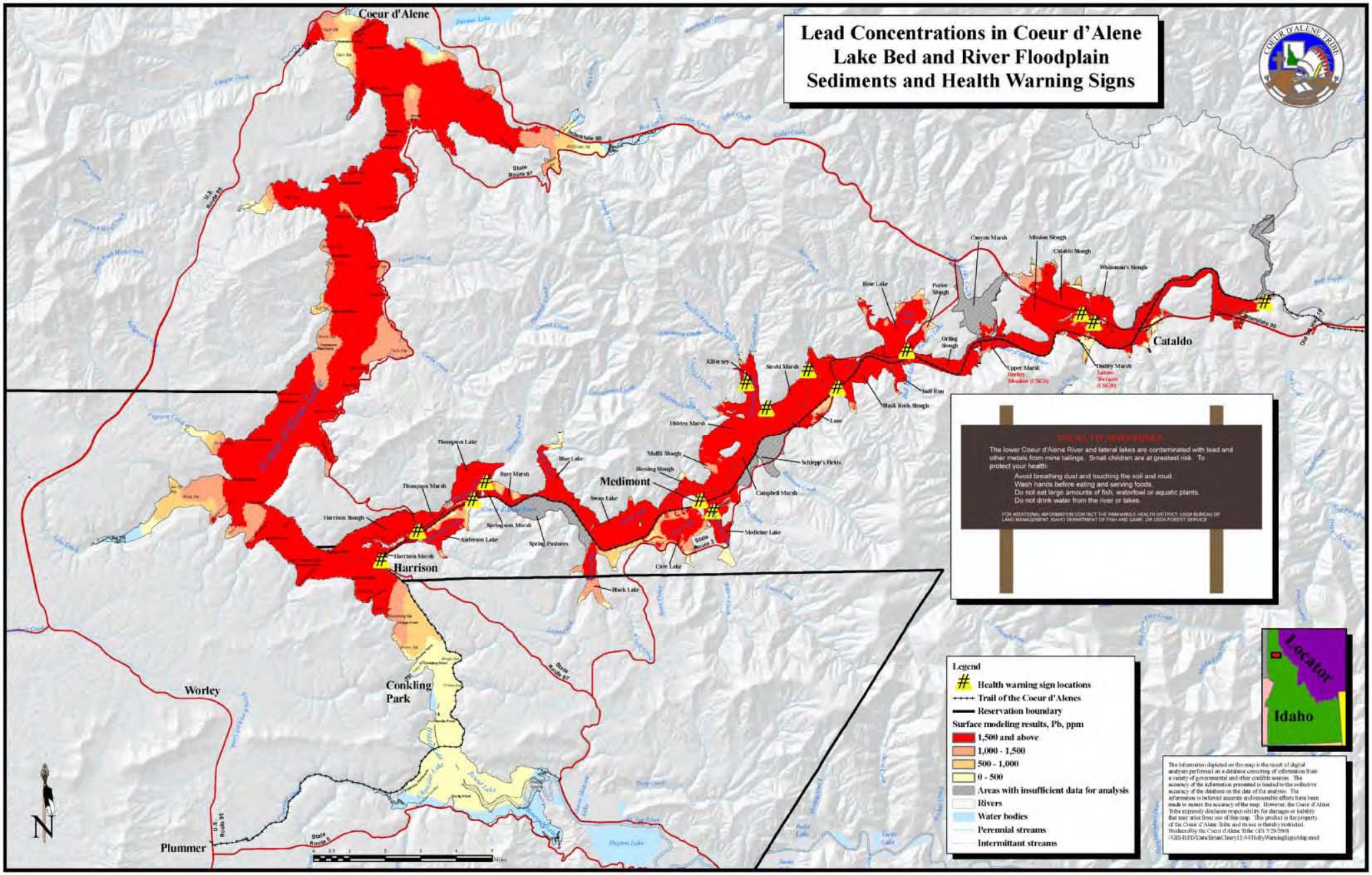


Figure 4. Lead Contamination

EPA expanded its CERCLA focus outside the original Bunker Hill box in 1998 with a Remedial Investigation and Feasibility Study for OU3. This encompassed areas within the Coeur d'Alene Lake Basin, including the lake, and the Spokane River downstream to Upriver Dam in Washington, where hazardous substances have come to be located. EPA issued its Interim ROD for OU3 in September 2002. Although the lake is within the Bunker Hill Superfund Site, EPA did not select remedial actions for the lake in the 2002 Interim ROD. EPA deferred a decision on whether to select remedial actions for the lake pending the development and effective implementation of a revised Lake Management Plan (revision of the 1996 LMP). EPA concluded that an effective LMP created outside of the CERCLA defined process, using separate regulatory authorities, would reduce riverine inputs of nutrients and metals that continue to contribute to contamination of the lake and the Spokane River. This ROD also addressed the possibility of future actions. One effect of EPA's decision was to limit its use of funds from the Superfund created under CERCLA to address mining related water quality conditions in the lake. EPA has commented on lake management in its regular 5-year reviews of ROD implementation progress, most recently in 2005 (EPA, 2005).

During the late 1980s and early 1990s, DEQ, the Tribe, and the United States Geological Survey (USGS) conducted studies of the lake and its surrounding watershed. These studies indicated that overall water quality in the lake was generally good and had improved compared to conditions reported in the mid-1970s by EPA. The improvement in water quality since the mid-1970s made sense, given the improvement in municipal wastewater treatment, continued implementation of the Federal Clean Water Act (CWA), and the reduction in mining activities in the Silver Valley. Remaining concerns were that Water Quality Standards (WQS) for metals were being violated and that dissolved oxygen depletion in the shallow, southern portion of the lake was routinely observed. Following completion of the USGS 1991-1992 water quality study (Woods and Beckwith, 1997), a *Coeur d'Alene Lake Management Plan* was developed by the Clean Lakes Coordinating Council (CLCC), DEQ, the Tribe, and numerous advisory groups to address water quality issues identified in the study. The LMP was completed in 1995 and adopted in 1996 (CLCC et al. 1996). The 1996 LMP relied extensively on existing regulatory authority and institutional arrangements, and on voluntary management actions to achieve its water quality goals. No new funding was provided and secure funding commitments to support

implementation were lacking. There was no mechanism to track or coordinate voluntary efforts, monitor water quality, or evaluate effectiveness to determine and implement necessary adjustments.

There has also been a recent legal and regulatory clarification concerning Coeur d'Alene Lake. The 2001 U.S. Supreme Court decision in *Idaho v. United States* affirmed that the United States, as trustee, and the Coeur d'Alene Tribe, as beneficiary, hold title to the bed and bank of all of the navigable waters lying within current boundaries of the Coeur d'Alene Indian Reservation, which includes portions of Coeur d'Alene Lake and the St. Joe River, and that they are entitled to the exclusive use, occupancy, and right to the quiet enjoyment of those submerged lands. The decision did not address title to the bed and banks of the navigable waters of Coeur d'Alene Lake and the Coeur d'Alene River outside the present Reservation and did not address the bed and banks of the navigable waters claimed by Idaho to be within Heyburn State Park.

The Tribe subsequently promulgated water quality standards under tribal law with respect to all Reservation waters. The Tribe also applied for EPA approval to administer Clean Water Act programs under Sections 303(c) (standards) and 401 (certifications) on all Reservation waters so these Tribal standards could be proposed for Federal approval and administration under the CWA. This process is known as Treatment in the same manner as a State (TAS). In August 2005, the EPA acted on a portion of that application, approving the Tribe to administer these CWA programs on the waters of Coeur d'Alene Lake and the St. Joe River within the present-day Reservation. EPA's approval did not encompass waters with respect to Heyburn State Park. Consistent with the scope of EPA's approval, the Tribe consulted with the State of Idaho and EPA to develop proposed standards for relevant waters, published these proposed standards for public review and comment, and is in the process of preparing responses to public comments before submitting the proposed standards for EPA approval under CWA Section 303(c). In the interim, EPA continues to refer to the water quality standards under tribal law to guide its administration of the CWA Section 303(c) program on all Reservation waters (Figure 5).

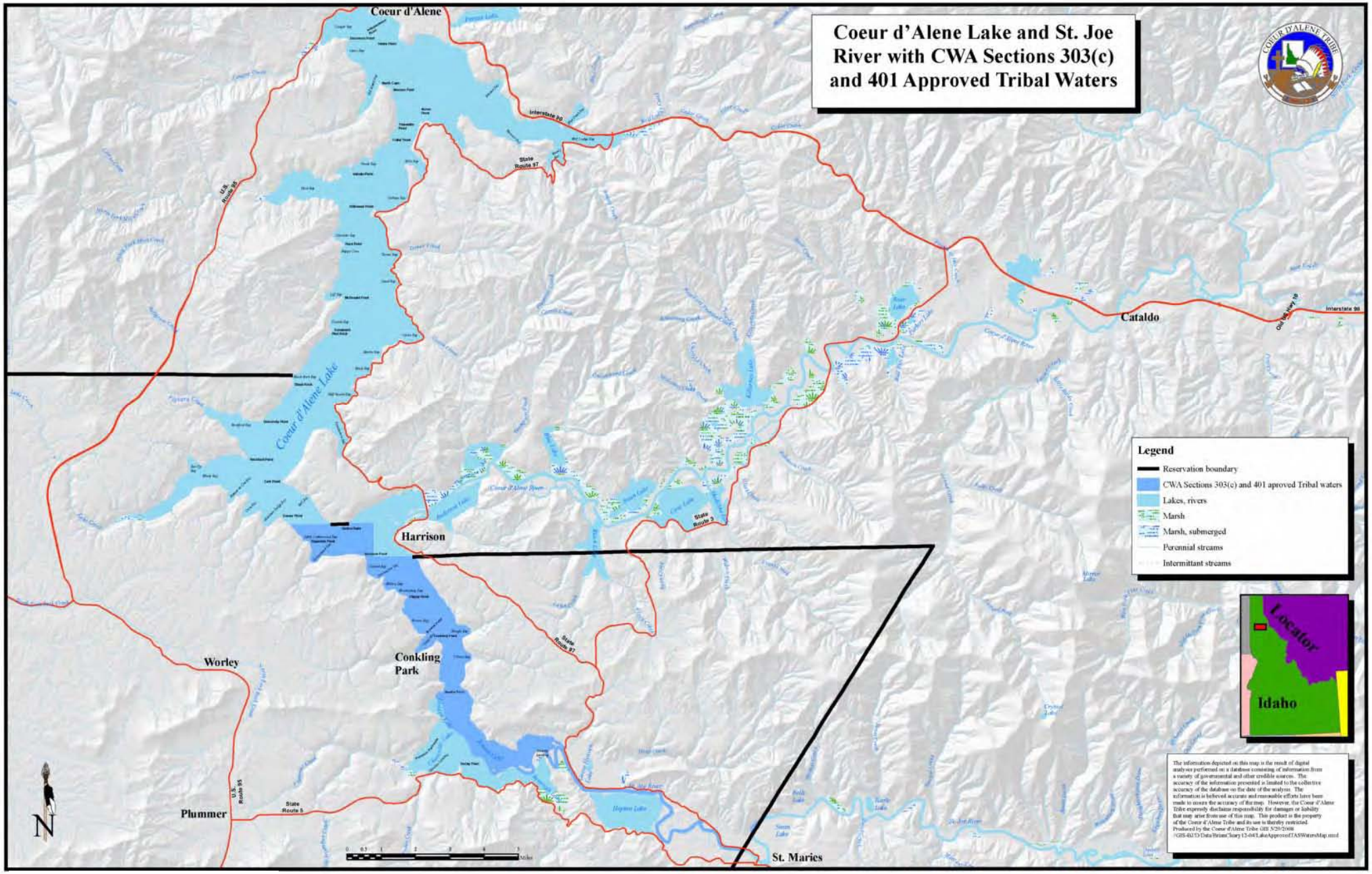


Figure 5. – TAS Waters

During 2002, DEQ and the Tribe, in consultation with government agencies and other stakeholder groups, conducted an in-depth evaluation of the 1996 LMP and its implementation. The evaluation took into account the development of new information and recent legal or regulatory decisions. Local, State, and Federal governmental entities participated in this effort, along with industry and environmental representatives. The result was a draft *Coeur d'Alene Lake Management Plan Addendum* (December, 2002), that offered conclusions and recommendations, but was never formalized.

Efforts to collaboratively develop a revised LMP during 2004 that reflected the advice gathered in the 2002 *Draft Addendum* were unsuccessful. There were disagreements on a number of issues, including, the level of funding for staffing and implementation projects and the reliability of that funding into the future. DEQ prepared its own draft LMP update in 2004 that was never formalized. The Tribe also prepared its own draft LMP in early 2006 that was never formalized. These disagreements and mutual recognition of the importance of effective lake management, led the Tribe, DEQ, and EPA to enter into a formal Alternative Dispute Resolution process (ADR) for the purpose of negotiating an agreed upon LMP.

The first phase of the ADR process was an assessment that occurred during 2006. The assessment included more than 40 interviews and other discussions conducted by an outside mediator, a report-back in June 2006, and a written report and recommendations in January 2007.[1] The report addressed sources of impasse in prior LMP negotiations, ways to avoid future impasses through design of the negotiation process, and ways to effectively engage other governments and stakeholder groups. The report recommended promoting reasonable openness and transparency about the negotiations through briefings and consultation, direct discussions about key interests related to lake management with local stakeholders, and opportunities for nuanced discussion of issues among the Tribe, DEQ, and EPA as the governments having regulatory authority under the Clean Water Act. DEQ, the Tribe, and EPA jointly adopted many of the report's recommendations, modified others, and began negotiations on the LMP in the

[1] The report is entitled "Assessment Report on Prospects for Mediated Negotiation of a Lake Management Plan for Lake Coeur d'Alene," and was prepared by Harty Conflict Consulting & Mediation through a contract with the U.S. Institute for Environmental Conflict Resolution ("Institute"). The report is available to the public on the Institute's web site: www.ecr.gov

spring of 2007 with the assistance of a mediator. The intention was to reach agreement on a draft LMP by using a different approach and avoiding past problems.

DEQ and the Tribe developed a draft outline for the 2008 LMP during the first part of 2007, and along with EPA, reached a technical consensus regarding the current water quality conditions in the lake, addressed in Section 2 and Appendix A. This information was shared with representatives from local counties, the Idaho State Legislature, Washington State, business interests, and environmental representatives in September 2007. During October, 2007, DEQ, the Tribe, and EPA held a series of direct consultations, in Coeur d'Alene, to explore key interests that should be addressed in an LMP. Only after these consultations did the Tribe and DEQ begin to develop a draft LMP, in January 2008.

The 2008 LMP reflects the Tribe and DEQ's long-held position that a collaborative, adaptive, and data-driven approach is needed to manage water quality in Coeur d'Alene Lake. The 2008 LMP attempts to incorporate the substantive conclusions and recommendations made in the 2002 *Draft LMP Addendum*, within the context of the present environmental, institutional, and socioeconomic situation. Furthermore, the 2008 LMP comprehensively identifies the actions and substantial resources likely to be required for successfully managing Coeur d'Alene Lake and the large quantities of mining-associated hazardous substances in its waters and lakebed sediments.

1.3 2008 LMP Goal

The goal of the 2008 LMP is to protect and improve lake water quality by limiting basin-wide nutrient inputs that impair lake water quality conditions, which in turn influence the solubility of mining-related metals contamination contained in lake sediments.

The nutrients of concern are phosphorus and nitrogen. Increased loads of these nutrients into the lake increase algae and rooted aquatic plant growth through a process known as eutrophication. When this organic material decomposes, it consumes oxygen dissolved in the water. Depletion of dissolved oxygen (anoxia) concentrations in lake bottom waters will promote geochemical

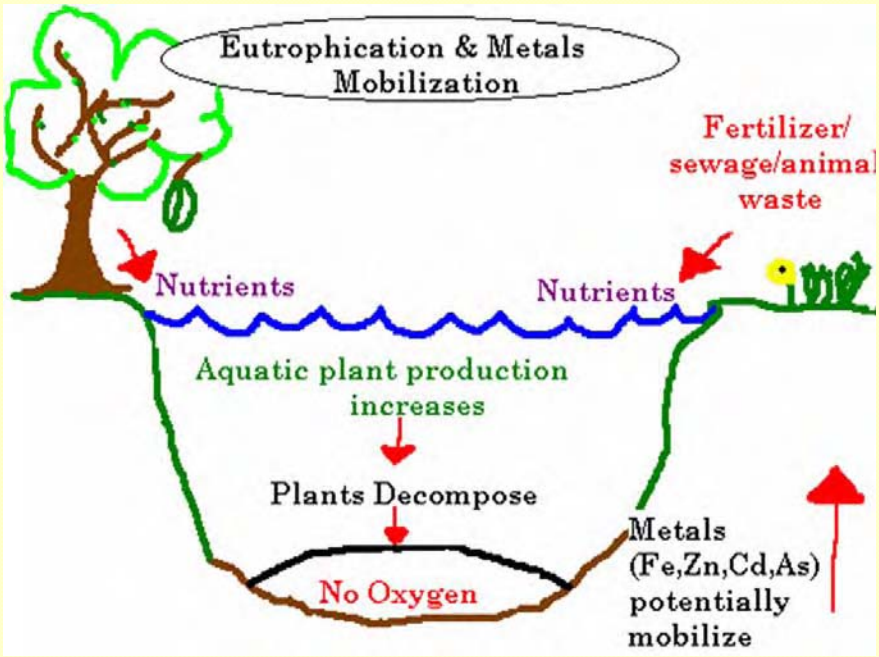


Figure 6. Eutrophication - The natural process by which lakes and ponds become enriched with dissolved nutrients and sediments, resulting in increased growth of algae and rooted aquatic plants and reduced water clarity. Cultural eutrophication is a term for the acceleration of the eutrophication process due to man's land use activities.

processes that release certain mining-related hazardous substances from lakebed sediments. Anoxia will also lead to the release of additional nutrients that stimulate production of algae and rooted aquatic plants that can lead to a cycle that is difficult or impossible to interrupt and that has harmful effects on water quality (Figure 6). Management objectives to achieve this goal are described in Section 3.

1.3.1 Basin-wide Scope

Activities throughout the basin influence contributions of metals, sediments, and nutrients. For this reason it is practical to focus on activities that occur around the lake and in upland areas along tributary streams. An overly narrow focus on lakeside activities would limit the potential for dealing effectively with the key influences on water quality. The scope is intended to follow

natural boundaries, promote integrated solutions, and maximize the use of available resources to benefit water quality.

1.3.2 Lake Management and Partnerships

The Coeur d'Alene Lake Basin is a prime recreational area for Northern Idaho and Eastern Washington, and the lake is its most popular feature. There has been substantial lakeshore development and increased resource use over the past decade, linked to increasing population. As one example, the U.S. Census estimates a 21 percent increase in Kootenai County's population between 2000 and 2006 (Table 1) [2]. This increase in development and population, while signaling a healthy regional economy, brings with it increased challenges for protecting the lake's water quality

Table 1. Demographic Information[2]

Population	1990	2000	% Increase 1990-2000	2006	% Increase 2000-2006
Coeur d'Alene	24,561	34,527	40.5%	41,328	19.8%
Hayden	4,888	9,167	87.4%	12,349	35.6%
Post Falls	7,349	17,333	135%	24,515	41.5%
Kootenai County	69,795	108,685	55.7%	131,507	21%
State of Idaho	1,006,749	1,293,953	28.5%	1,467,465	13.3%
United States	248,765,170	273,643,273	13.1%	299,389,484	9.4%
Idaho was the fifth fastest growing state in the 1990s, and Kootenai County was the third fastest growing county in Idaho. Rapid growth has continued from 2000 to present. **Source: *U.S. Census Bureau***					

[2] U.S. Census Bureau, State and County QuickFacts, Kootenai County, ID. http://quickfacts.census.go/gfd/states/I6/16055.html

State, Tribal, and Federal governments exercise their respective authorities to manage lake water quality. Local, State, Tribal and Federal governments also regulate activities in the basin that can impact water quality in tributaries and the lake. For example, local governments in the basin use zoning ordinances to regulate private land uses that can affect tributary and lake water quality. State, Tribal and Federal resource agency management activities on lands and waters in the basin can also affect tributary and lake water quality.

Effective lake management depends on creation and continuation of effective partnerships across governments. These partnerships must also engage the business community, local residents, advocacy organizations, and even visitors. In short, effective lake management requires a broad-based public and private partnership.

Section 2: State of Lake Water Quality 2008

2.1 Introduction

A key finding of the ADR assessment report was the need for a consistent description of current water quality conditions in the lake from the Tribe, DEQ, and EPA. A lack of consistency in the past has contributed to public misunderstanding about water quality through conflicting views and messages from different agency staff and technical experts (Harty, 2007). This section contains a synthesis of water quality sampling data that is intended to describe the current "State of Lake Water Quality 2008." The Tribe, DEQ, and EPA agree on this technical description of the lake's current water quality and trends that form the basis for the 2008 LMP. A detailed State of Lake Water Quality 2008 appears in Appendix A.

The Coeur d'Alene Lake system is complex and interconnected, with two major rivers and numerous other tributaries flowing in and mixing with lake waters, and then discharging to create the Spokane River. The system is directly influenced by land uses (that are always changing) throughout the Coeur d'Alene Lake Basin (Figure 3). The Tribe and DEQ expect this section of the LMP – State of Lake Water Quality 2008 – will be annually updated and published to promote public understanding of the lake's conditions gained through continued monitoring, studies, and analysis.

2.2 State of Lake Water Quality 2008

Water quality of Coeur d'Alene Lake is highly influenced by two major rivers, the Coeur d'Alene and the St. Joe, that bring in sediments (both rivers), nutrients (both rivers), and metals (Coeur d'Alene River). During years of average water runoff, combined inflow of the two rivers is about 4.3 million acre-feet (e.g., WY06), while the estimated volume of the lake is about 2.3 million acre-feet, or about half of the total river inflow. Therefore, the lake volume is theoretically replaced twice a year from the south to the north.

Water quality data collected during 1991-92 and 2003-2006 has been analyzed with the following key findings:

- *Total phosphorus concentrations* declined throughout the lake based on comparing 1975 data with 1991-92 data. However, total phosphorus concentrations within the southern portion of the lake increased between 1991-92 and 2003-06.
- *Microscopic algae* (phytoplankton) as measured by *chlorophyll a* also declined throughout the lake, based on comparing 1975 with 1991-92. Throughout the lake, *chlorophyll a* concentrations increased between 1991-92 and 2003-06.
- *Water clarity* throughout the lake improved between 1975 and 1991-92. Water clarity has remained the same since then.
- *Dissolved oxygen* approaches zero in deeper (hypolimnetic) waters during summer months in southern waters. This annual pattern has been evident from 1975 to present. Dissolved oxygen in deeper waters of the northern lake generally remains above 6 mg/L during summer months. This annual pattern has remained the same since 1975.
- *Zinc concentrations* within upper waters of the lake declined between 1991-92 and 2003-06. However, zinc concentrations still consistently violate WQS.
- *Lakebed sediments* are highly contaminated with antimony, arsenic, cadmium, zinc, lead, copper, silver, and mercury, in much of the lake.
- *The nuisance aquatic plant, Eurasian milfoil,* has become established within the southern lake shallows and can be found as dense beds within some areas. Shallow bays of northern waters are at risk of invasion by Eurasian milfoil.

The primary environmental concern in Coeur d' Alene Lake is the potential for release of metal contaminants contained in lake sediments into the water column. To prevent this from occurring, oxygen levels must be maintained in bottom waters. Oxygen is controlled by the amount of decomposition of organic matter (plant and animal) that, in turn, is controlled by the amount of nutrients coming into the lake. The basic strategy of the 2008 LMP is to limit basin-wide nutrient inputs to the lake to prevent this chain of negative water quality events.

Based on the data presented above, a change in water quality is occurring. The measured increases in phosphorus concentrations and microscopic algae represent a negative trend. The Tribe and DEQ are concerned about this trend continuing leading to further water quality degradation.

Section 3: 2008 LMP Management Objectives and Strategies

This section describes in detail the five management objectives designed to support the primary 2008 LMP goal, along with rationales for them and strategies to achieve them. The Tribe and DEQ expect that the 2008 LMP goal and management objectives will be the key reference points for the full range of LMP decision making. They are intended to support the adaptive approach to lake management described in Section 5 of the 2008 LMP, including performance actions and milestones to support accountability. Budget information for the objectives and strategies can be found in Section 6.

3.1 2008 LMP Management Objective 1 – Improve Scientific Understanding of Lake Conditions through Monitoring, Modeling, and Special Studies

Rationale

Coeur d'Alene Lake has been the focus of considerable scientific investigation, through routine monitoring and special studies, and an improved understanding of water quality trends is emerging as summarized in Section 2. The complex interactions between the physical lake processes, nutrients, phytoplankton production (microscopic algae growth) and heavy metals require future studies to improve knowledge and the basis for lake management decisions (see Appendix B).

An ongoing science program is needed to ensure that management strategies are effective and efficient. The program will be constantly evaluated in a collaborative, transparent process. This section of the 2008 LMP will be a "living document" with publication of resulting data and analysis. Work plans linked to Objective 1 will be reviewed with suggestions made by scientific staff of governmental agencies, universities, and consulting firms. There are additional monitoring and study efforts identified in the Management Action Tables (MATs) that merit further consideration (Appendix C).

The strategy for achieving Objective 1 has the following four components:

1) Establish water quality "triggers"
2) Perform core routine monitoring: lake and rivers
3) Develop technical tools to support lake management
4) Conduct special studies

Each strategic component is described below.

Strategy: Establish Water Quality Triggers

There are several key water quality variables that need to be tracked in order to measure the long term health of the lake. These include, but are not limited to: levels of zinc, phosphorus, phytoplankton, and dissolved oxygen. The 2008 LMP establishes triggers for each of these variables and others, to build in an "early warning system" for lake health, and then relies on a comprehensive monitoring program to allow enough time for corrective steps to be taken before conditions deteriorate to the point they would be very difficult and expensive to reverse. See Section 5.1 for tables of water quality triggers.

In the event that monitoring data reveals trends that approach a trigger level for one or more constituents, this will prompt a comprehensive review to identify the causes of the trend and guide in developing a corrective management response. Modeling will also be used as a tool to estimate additional nutrient reductions needed to restore water quality to below trigger levels. The MATs will be reviewed to verify implementation status and identify "next steps" for reducing nutrient inputs. Additional management actions will be prioritized, and may include: increasing the implementation of projects, targeting critical sources for reduction, reviewing Best Management Practices (BMP) effectiveness, and reviewing regulatory effectiveness (adequacy of enforcement and of rules). This adaptive management approach using water quality triggers to signal the need for additional actions, followed with ongoing monitoring to determine the lakes response to these actions; will provide for a proactive and measured strategy for protecting water quality.

Strategy: Perform Core Routine Monitoring

The core routine monitoring program has two parts: the lake and rivers. Key activities for each part are discussed below. The locations of monitoring sites for the lake are shown in Figure B1 and for the rivers in Figure B2.

Lake

A long-term core monitoring program is a critical element of an effective LMP for these reasons:

- Provides a record of key water quality variables that would be captured during important, but periodic, flood-flow events
- Provides a long-term annual trend record that would capture the considerable year-to-year variability of water quality data
- Provides a consistent, long-term record of dissolved oxygen profiles, the underlying key variable for a nutrient-based LMP
- Allows evaluation of total phosphorus, chlorophyll *a*, and phytoplankton composition trends and the observed declining trend of zinc concentration in upper waters
- Allows evaluation to determine if the significant higher phosphorus concentrations in southern waters translate to increased phosphorus concentrations and increased phytoplankton production in northern waters as water flows south to north
- Provides validation information for future use of the ELCOM-CAEDYM computer model as a tool for further understanding lake conditions (see Computer Modeling below)
- Allows a data-driven adaptive management approach to the 2008 LMP based on yearly water quality information

In 2007 the Tribe and DEQ began a routine monitoring program, previously conducted by the USGS. This was initiated by development of a Quality Assurance Project Plan (QAPP). The lake monitoring program uses an EPA laboratory for sample analysis of metal concentrations; therefore EPA reviewed and approved the QAPP. If EPA continues to provide laboratory support to the monitoring program, it will review and approve the QAPP annually. The core routine monitoring program for the 2008 LMP is presented in Appendix B. Additional monitoring program details are found within the QAPP. An electronic version of the QAPP is on the DEQ website www.deq.idaho.gov (use the "Find it Fast" menu and click Coeur d'Alene Lake Management).

Rivers

Rivers are significant sources of nutrient input to the lake. The core monitoring program requires sampling stations in key river locations. The sampling stations include existing Basin Environmental Monitoring Plan (BEMP) sites, and additional new stations on the Coeur d'Alene and St. Joe rivers to fill data gaps. Appendix B describes the monitoring program in detail.

Strategy: Develop Technical Tools to Support Lake Management Efforts

Computer Modeling

In addition to reacting to past events, effective lake management requires the ability to predict the effects of future activity and plan actions to reduce water quality impacts. The Tribe and DEQ are working collaboratively to add critical predictive capability through the use of computer modeling. Development of the model (ELCOM-CAEDYM) was supported and funded through the Coeur d'Alene Basin Environmental Improvement Project Commission (BEIPC) from an EPA CWA grant.

In general, the model simulates important processes within the lake system such as:
1) inflow loading of metals/nutrients and river plume flow through the lake, 2) sediment-water interactions, 3) primary production, and 4) organic matter cycling within the water column. In addition, the model can be used to predict dissolved oxygen profiles which can be validated with actual data. Use of the ELCOM-CAEDYM model will greatly enhance understanding of the complex dynamics within the lake system, and has the potential to produce predictive results based on future land use changes within the basin (Appendix B).

Strategy: Conduct Special Studies to Answer Key Questions

In addition to core monitoring described above, special studies to answer key questions that relate directly to the 2008 LMP objectives are needed. These studies will improve knowledge and understanding of internal nutrient cycling, metals release from sediments, foodweb toxicity, septic drainfield impacts, and other factors (Appendix B). This strategy is consistent with the recommendations from the National Research Council of the National Academy of Sciences (NRC/NAS, 2005).

3.2 2008 LMP Management Objective 2 – Establish and Strengthen Partnerships to Maximize Benefits of Actions under Existing Regulatory Frameworks

Rationale

The 2008 LMP relies on LMP partners to use existing regulatory tools and management actions to address nutrient and sediment inputs to Coeur d'Alene Lake. The Management Actions Tables, or MATs, are a critical feature of this approach. The MATs document the diverse

jurisdictions of local, State, Tribal, and Federal agencies, as well as existing programs, BMPs, codes, and regulations that influence water quality. In 2006, the Tribe and DEQ developed a protocol for conducting routine performance audits and conducted an initial audit of the MATs to:

- Determine the extent to which the management actions identified in the 1996 LMP are being implemented
- Evaluate the effectiveness of the management actions
- Identify BMPs that are not being implemented correctly or fully
- Evaluate funding and resources needed to accomplish the management actions
- Assess the commitment to continue the management actions and if needed, recommend/develop new BMPs, management strategies, and/or regulations and standards

The strategy for achieving Objective 2 has the following five components:

1) Use the inventory of existing authorities found in the MATs to coordinate partnerships to implement the 2008 LMP
2) Improve understanding of existing authorities, programs, and activities and their potential to support the 2008 LMP goal and objectives
3) Engage with local, State, Federal and Tribal land managers to influence yearly workplans and support activities that will further the LMP goal
4) Collaboratively implement projects when appropriate
5) Repeat the audit at regular intervals to evaluate progress

Each strategic component is described below.

Strategy: Use the LMP MATs to Coordinate Partnerships

A set of tables identifying management entities and actions affecting lake water quality in the Coeur d'Alene basin was created as part of the 1996 LMP effort. These MATs (Appendix C) were updated and revised through an audit process conducted during 2007 by the Tribe and DEQ using EPA CWA grant funding, available through the BEIPC. The detail provided in the MATs is the primary source of information that will be used to develop and strengthen partnerships to support lake management efforts.

Strategy: Improve Understanding of Authorities

Through the MAT audit process described above, DEQ and the Tribe will improve understanding of the most current authorities of other agencies related to accomplishing the

overall LMP goal. This includes, but is not limited to: applied BMPs, water quality improvement or remediation projects, policy changes within government agencies, revisions of existing rules and regulations, and introduction of new rules and regulations by management agencies. This ongoing process includes, but is not limited to: field audits, phone contacts, in-person meetings, workshops and appearances at commissions and other public venues.

Strategy: Engage with Land Managers to Identify Opportunities in Annual Workplans

The Tribe and DEQ will consult with LMP partners during their respective annual workplan development processes to identify opportunities to support the lake management goal and objectives, along with their other priorities. The MATs will provide a shared point of reference about authorities and programs. This information will be used to identify and prioritize opportunities for DEQ and the Tribe to support activities defined in yearly workplans as they relate to the lake management. Priorities and opportunities may be incorporated in the DEQ/Tribe yearly LMP workplan.

Strategy: Collaborative Projects

In situations where a collaborative effort is appropriate, the Tribe and DEQ will support technical design and funding of LMP partner-projects that are consistent with the 2008 LMP goal.

Strategy: Routine Updates of Management Action Tables

The Tribe and DEQ will routinely evaluate implementation of actions specified in the MATs. The audit process described previously will be conducted every five years.

3.3 2008 LMP Management Objective 3 – Develop and Implement a Nutrient Reduction Action Plan

Rationale

The magnitudes and locations of nutrient sources in the Coeur d' Alene Lake Basin need to be identified. Once identified, priorities for addressing these sources will be developed.

The strategy for achieving Objective 3 has the following three components.

1) Develop, conduct, and publish a basin-wide nutrient source inventory to determine relative contributions
2) Use the basin-wide nutrient source inventory and ongoing monitoring to prioritize site specific projects for implementation in coordination with the management agencies identified in the MATs
3) Incorporate the Total Maximum Daily Load (TMDL) process under the CWA into the nutrient reduction plan

Each strategic component is described below.

Strategy: Basin-wide Nutrient Source Inventory

Development of a basin-wide nutrient source inventory is an essential first step to identifying and prioritizing management decisions for nutrient reduction efforts. This inventory will focus on nutrient and sediment loading at key "nodes" throughout the basin. Samples will be collected during various times of the year to develop an understanding of loadings throughout the basin. There will also be compilation of existing information from other sampling programs, wastewater treatment plants, land-use mapping, and other sources. The product will be a Geographic Information System (GIS) environmental database layer that clearly depicts load distribution throughout the basin. This information will provide the Tribe, DEQ, and LMP partners with data to support future decisions about where to focus nutrient reduction work.

Strategy: Prioritize Projects Based on Inventory

The 2008 LMP recognizes the need to implement projects to reduce nutrient loading in the lake. Decisions on which projects will be implemented will depend upon results of the inventory, monitoring, and coordination with existing programs described in the MATs. Examples of ongoing programs and projects are: upgrading wastewater treatment facilities, enforcing land development and building ordinances, and implementing agricultural BMPs. Other projects and programs will likely emerge from the inventory.

Opportunities for upgrading wastewater treatment and disposal practices in the basin must be explored for communities discharging to the lake or its tributaries such as the Silver Valley, Harrison, Plummer, and St. Maries communities. In addition, wastewater treatment upgrades

may be needed in populated and/or developing bays on the lake or adjacent uplands. Costs for upgrading the wastewater treatment and disposal infrastructure of the basin for the purpose of reducing nutrient inputs to the lake will be large. As an example, in 1991, a sewer system that eliminated near-shore subsurface disposal septic systems was installed in Kidd Island Bay for approximately 350 users, at a cost of approximately $2.6 million (in 2006 dollars).

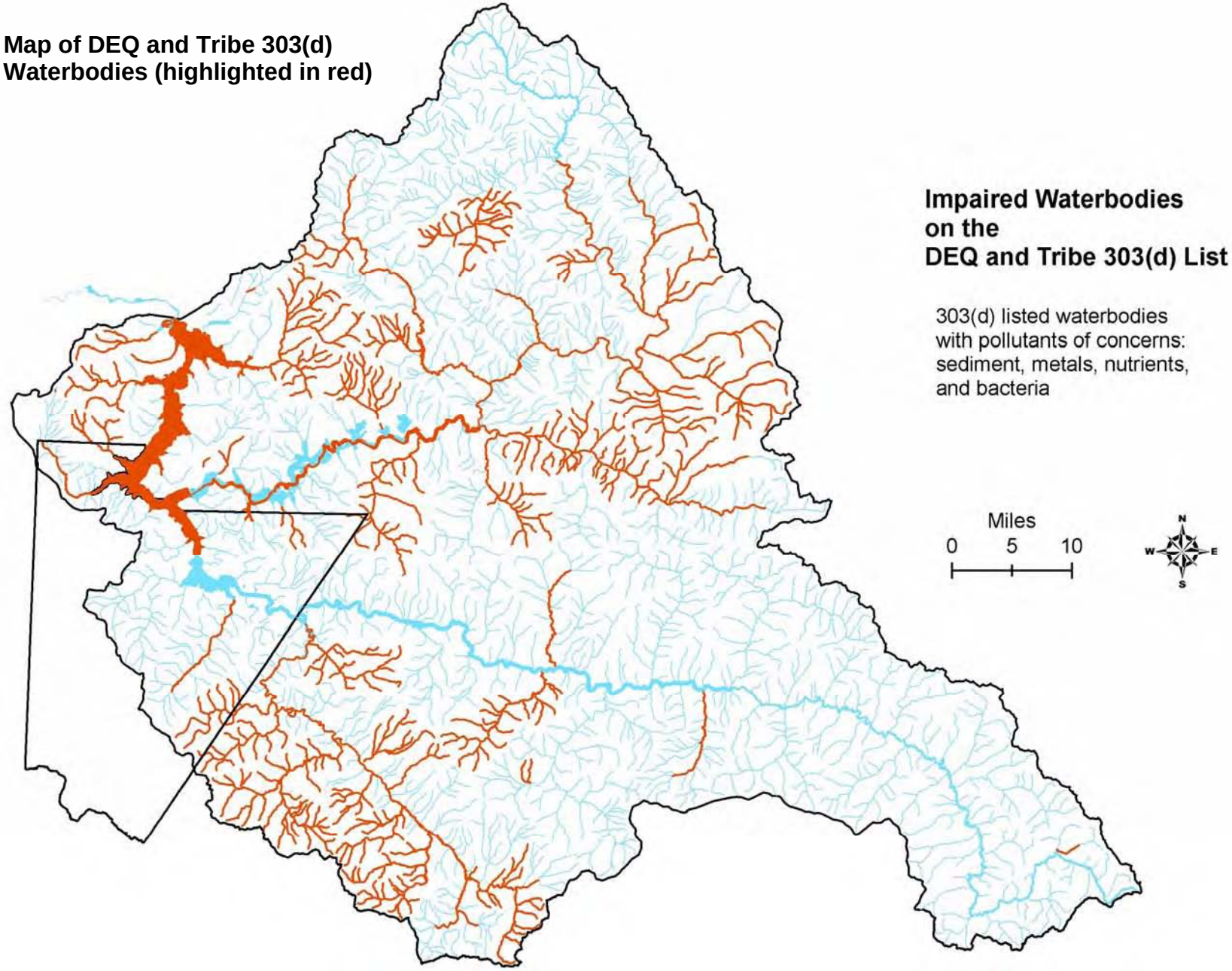
Strategy: Incorporate TMDLs into the nutrient reduction plan

A component of the final 2008 LMP strategy for nutrient reduction involves the Clean Water Act TMDL process for both DEQ and the Tribe. Under CWA section 303(d), DEQ and the Tribe are required to identify waters that are not meeting Water Quality Standards (WQS) or supporting beneficial uses. This process is ongoing. For these impaired waters, a TMDL is prepared for each pollutant. A TMDL is a calculation of the maximum quantity of a pollutant that can be added to a specific water body from all sources, human and natural background, without exceeding WQS. Idaho's 303(d) list of impaired waters and TMDLs must be approved by EPA, and Idaho also must incorporate approved TMDLs into planning processes and water quality management plans. The EPA has developed a list of impaired waters in Indian Country. Several of these streams exist on the Coeur d'Alene Reservation. Figure 7 shows all waters within the Coeur d'Alene Lake Basin that are impaired by metals, sediments, nutrients, or bacteria, and a list of them is found in Appendix D.

Lake Metals TMDL

Any portion of Coeur d'Alene Lake (north of Hidden Lake), within State of Idaho jurisdiction, that exceeds WQS for metals and is included in Idaho's 303(d) list of impaired waters. Any portion of Coeur d'Alene Lake (north of Hidden Lake), within Tribal jurisdictions, that exceeds WQS for metals and is currently not included in EPA's "Indian Country" 303d list. DEQ and EPA completed a metals TMDL for the Coeur d'Alene River subbasin, including Coeur d'Alene Lake, in 2000. The Idaho Supreme Court subsequently ruled that required rule making procedures were not followed in setting the TMDL, making it null and void. State legislation in 2003 clarified that for all other waters in Idaho rule making procedures are not required for TMDLs. The legislation, however, kept the rule making requirement identified by the Idaho Supreme Court in place for a metals TMDL for the Coeur d'Alene River subbasin. At this time

Figure 7. Map of DEQ and Tribe 303(d) Impaired Waterbodies (highlighted in red)



there is no metals TMDL for the lake, for either State or Tribal areas. EPA has issued new point source discharge permits for the Coeur and Hecla mines that have significantly reduced the amount of metals they can discharge. The EPA is also implementing the ROD for OU3, as described in Section 1, to reduce incoming metals to the lake. This ROD also includes reference to an LMP to address issues related to metals in the lake and lakebed sediments. The Tribe and DEQ are not proposing a TMDL for metals, as part of the 2008 LMP, at this time.

Lake Nutrient TMDL

The State of Idaho has a narrative standard for nutrients applicable to those surface waters of Coeur d'Alene Lake not within the present-day Reservation. The Tribe has a similar proposed narrative nutrient standard for approved Reservation waters (i.e., Coeur d'Alene Lake and the St. Joe River within the present Reservation, not including waters of Heyburn State Park). These narrative standards are not currently exceeded by surface water nutrient conditions in Coeur d'Alene Lake. The lake is currently not identified as an impaired water body under CWA Section 303(d) with respect to nutrients. A TMDL to address lake nutrient conditions is not being developed at this time. This status could change because dissolved oxygen conditions in the southern lake do not meet the applicable proposed Tribal standards. The State of Idaho and the Tribe therefore share common concerns regarding dissolved oxygen concentrations throughout the lake and mutual interests in developing agreed-upon actions in the LMP to address those concerns, as outlined in Section 5 of the LMP (performance actions and milestones).

3.4 2008 LMP Management Objective 4 – Increase Public Awareness of Lake Conditions and Causes

Rationale

There is general public appreciation in the basin about the importance of maintaining good lake water quality. There is limited understanding of key components of water quality, and how lake water quality is affected by human activities such as construction, septic tank maintenance, and fertilizing lawns. Some members of the community are well versed in water quality issues,

either from professional experience, participation in business or environmental organizations, or personal interest. A significant portion of the public does not fully understand lake health and human impacts on water quality. The 2008 LMP must build a shared public understanding of water quality and a commitment to its protection on a daily basis. This public understanding and commitment are essential to build support for funding and implementing lake management activities.

Specific components of this overall strategy include these four items:

1) Establish a lake stewardship center
2) Develop and maintain a science and resource library
3) Develop and implement an education and outreach services plan
4) Coordinate with schools

Strategy: Lake Stewardship Center

Establishment of a lake stewardship center will create a focal point for community lake protection and a resource base for increasing awareness and understanding of lake conditions and actions that can be taken to protect water quality. Since the lake is the "heart" of the community, locating a lake stewardship center in Coeur d'Alene will provide easy access to basin residents and visitors alike. This center will be a symbol of the partnerships needed and the community commitment of support to meet water quality protection goals. The center will be staffed with support from DEQ and the Tribe. A variety of science and resource materials will be housed and maintained for public use. Education and outreach services will be developed and offered in various media, targeting different audiences: general public, lake users, lakeshore property owners, civic groups, associations, government agencies, businesses and schools.

There are many options for a lake stewardship center location. Negotiations for space donations, especially along the river educational corridor, will be pursued. North Idaho College, North Idaho Museum, Coeur d'Alene Chamber of Commerce, the Coeur d'Alene Library and other strategically located and compatible area businesses are all possibilities.

Strategy: Science and Resource Library

There is a considerable body of knowledge contained in published documents on the water quality of Coeur d'Alene Lake. A library of documents such as: project completion reports,

technical guidance, monitoring reports, standard operating procedures and quality assurance project plans, will be compiled and maintained at the lake stewardship center. Currently, large quantities of data and scientific documents exist with the Tribe, DEQ and EPA. There are also publicly accessible electronic databases (i.e., STORET) that will be made computer accessible at the lake stewardship center.

A wealth of resource materials already exist that can increase awareness of lake water quality and provide tools for protection. The center will compile and maintain resource documents for public use such as: agency rules and regulations, local ordinances, workshop opportunities, demonstration project information, field trip and tour schedules, and other relevant information. This library will be made available to the public in electronic and hard copy form, and housed in the lake stewardship center.

Information on “lake friendly” products, activity specific BMPs and training programs for erosion and sediment control practices will also be made available. The center will also serve as a resource for developing and implementing a Lake*A*Syst program with materials specific for Coeur d’Alene Lake. This is a program targeted to individual landowners focusing on practices they can use to reduce water quality impacts from activities on their property. It has been a very successful program for area lakes, such as Priest and Pend Oreille.

Strategy: Education and Outreach Services

Staff of the lake stewardship center will develop an annual education and outreach plan that will outline the services available to the community to increase awareness and understanding of lake water quality and forces that influence it. Staff will coordinate with other partners to identify the appropriate media, materials and topics for targeted audiences such as: citizens, civic groups, associations, schools, and businesses.

Strategy: Coordination with Schools

It is important for people of all ages to understand what they can do to become lake stewards. The school system is the logical "delivery system" to spread this message, throughout the community. Staff of the stewardship center will work with primary, secondary and post secondary schools to develop classroom presentations that heighten student observation skills to

better understand that lake water quality affects their quality of life and that they can have a direct personal impact on water quality.

3.5 2008 LMP Management Objective 5 – Establish Funding Mechanisms to Support the LMP Goal, Objectives and Strategies

Rationale

The importance of this objective cannot be over-emphasized. The 2008 LMP goal of protecting lake water quality can only be achieved through reliable funding in amounts sufficient to carry out strategies designed to achieve the 2008 LMP goal and objectives. The basic approach of relying on existing legal authorities and programs described in the MATs to achieve the 2008 LMP goal requires financial support for these existing programs. A lack of reliable funding in the past for MATs programs has been a significant obstacle to effective collaborative lake management. The 2008 LMP attempts to find a balance between funding needs and appreciation for the challenges associated with securing that funding. Section 6 of this document provides details for the 2008 LMP budget and schedule. The Tribe and DEQ consider LMP partners and the broader public essential to securing necessary funding from all sources, public and private.

The four elements of a funding strategy are:

1) Identify core needs
2) Prioritize projects based on a tiered approach
3) Identify funding sources and secure commitments
4) Demonstrate fiscal accountability

These strategic components are described below.

Strategy: Identify Core Needs

The 2008 LMP recognizes the importance of setting priorities to accommodate the challenges posed by funding limits. The Tribe and DEQ have identified the following core needs for funding:

- Conduct core water quality monitoring, Objective 1
- Develop a basin-wide nutrient source inventory, Objective 3
- Use MATs to coordinate and evaluate existing programs with LMP partners, Objective 2

- Educate the community and increase awareness of lake conditions, Objective 4
- Utilize research and data to increase scientific understanding, Objective 1

Strategy: Prioritize Projects Based on a Tiered Approach

Costs for focused nutrient reduction projects based on the planned basin-wide nutrient inventory (e.g., municipal sewer upgrades, lakeside/shallow bay sewer development, or TMDL implementation) will be significant. Obtaining project funding incorporates the vital relationship between community values and regional understanding of the importance of lake water quality. A collaborative approach will be used to develop yearly workplans and secure funding.

Strategy: Identify Funding Sources and Secure Commitments

The funding strategy consists of such mechanisms as:

- Annual budget requests and appropriations from Federal agencies, State, Tribal and local governments
- Annual congressional budget requests and appropriations
- Local business community matching funds for cooperative projects
- Other fundraising initiatives such as foundations, endowments and special grant opportunities

Cultivating this funding pool will depend, in part, on the political acknowledgement of the importance and need for implementing the 2008 LMP. Advocacy of all basin partners will be necessary to garner political support. Commitment of partners to continue to prioritize and pursue funding for their respective LMP implementation activities, in coordination with the overall 2008 LMP implementation effort, is essential.

Strategy: Demonstrate Fiscal Accountability

The Tribe and DEQ are committed to a principle of accountability for the 2008 LMP spending. In practice, this will require attention to diverse sets of standards consistent with different funding sources, both public and private. The Tribe and DEQ intend to use generally accepted procurement and accounting protocols as part of this commitment to accountability, and to present accounting details in each year's annual LMP report. It is expected that this information will be available to LMP partners and the general public.

Section 4: Administrative Structures for Lake Management

Achieving the objectives outlined in Section 3 through existing authorities and administrative structures will require significant coordination and cooperation among the Tribe, DEQ, EPA, and other LMP partners. This section describes the primary existing administrative structures for lake management within DEQ, the Tribe, and EPA, along with a summary of legal authorities under the CWA and State and Tribal laws. The proposed approach for the 2008 LMP coordination involves creation of a collaborative implementation team, also described below. The overall coordination strategy for key LMP partners is summarized under External Coordination, with the understanding that detailed coordination plans for each LMP partner will be necessary. Appendix E presents a summary table of the jurisdictions and authorities to manage programs and activities related to water quality in the Coeur d'Alene Lake Basin.

4.1 DEQ Structure

DEQ is the designated Idaho agency for implementing parts of the Federal Clean Water Act, including adoption of the State WQS. Idaho Code §39-3601 *et seq.* assigns DEQ the responsibility to implement WQS to maintain and achieve designated beneficial uses of streams, lakes and other surface waters. The legislative purpose of §39-3601 *et seq.* is to "enhance and preserve the quality and value of the surface water resources of the State of Idaho." Administrative Rules of the DEQ to fulfill the intent of this Idaho Code are Water Quality Standards, IDAPA 58.01.02.

The Coeur d'Alene Regional Office of DEQ, Water Quality Section, has the local responsibility (in the five county Panhandle area) for implementing the WQS. In the 2005 Idaho legislative session, a new full-time DEQ position was approved to serve as a Coeur d'Alene Lake water quality manager, assigned to the regional office. A primary duty of this position has been to work with the Tribe in developing the 2008 LMP. With finalization and approval of the 2008 LMP, duties of this DEQ position will shift to implementing the 2008 LMP. Initially, a major emphasis will be to seek funding and develop partnerships with governmental agencies, and business and community groups, to actively implement high priority actions and concepts of the 2008 LMP.

The DEQ office performs other functions to support the implementation of the 2008 LMP. These include: 1) receive and respond to water quality complaints, 2) issue water quality certifications for Federal permits under Section 401 of the CWA, 3) review selected permits under the Idaho Joint Application for Permits (Idaho Department of Lands, Idaho Department of Water Resources, and Army Corps of Engineers), 4) review engineering plans and specifications for water and wastewater systems, 5) issue permits for wastewater reuse systems, 6) perform hydro-geological analysis of groundwater characteristics and potential contamination, and 7) administer rules for protecting groundwater quality.

In regard to TMDL processes for lands and activities outside of Tribal reservation boundaries, DEQ is tasked with preparing subbasin assessments and TMDL determinations and facilitating the process of TMDL implementation planning. This is done in partnership with other State agencies, the land owners/land managers of a particular watershed, and a Watershed Advisory Group (WAG), required by State law.

4.2 Coeur d'Alene Tribe Lake Management and Natural Resources Departments

The Coeur d' Alene Tribe, by Tribal Council resolution, established a Lake Management Department to implement parts of the Federal Clean Water Act, including adoption of Tribal WQS, among other actions to protect and enhance water quality on the Reservation.

The Lake Management Department staff is located in Plummer and Coeur d' Alene Idaho. Programs within the Department that conduct LMP activities include: Lake Improvement, Recreation Management, Water Resources Management, and Hazardous Waste Management. In addition the Tribe also has a Natural Resources Department with various programs that conduct LMP activities. These Programs include: Fisheries, Pesticides, Forestry, and Wildlife.

Currently, existing staff from these various programs have been tasked with developing the 2008 LMP. The Lake Management Department performs the following functions to support the implementation of the 2008 LMP. These include, but may not be limited to: 1) receive and respond to water quality complaints, 2) issue quality certifications for Federal permits under

Section 401 of the CWA, 3) review selected permits under the Idaho Joint Application for Permits (Idaho Department of Lands, Idaho Department of Water Resources, and Army Corps of Engineers), 4) develop and enforce encroachment standards, 5) regulate dredge and fill activities, 6) perform hydro-geological analysis of groundwater characteristics and potential contamination, and 7) implement wellhead protection activities.

In regard to TMDL processes for waters within the Tribal reservation boundaries, the Tribe is tasked with preparing subbasin assessments and TMDL determinations and facilitating the process of TMDL implementation planning. This is done in partnership with State agencies, the land owners/land managers of a particular watershed, and watershed advisory groups.

4.3 EPA Water Quality Programs

Passage of the Federal Water Pollution Control Act in 1971 (commonly known as the Clean Water Act) nationally codified the authority of states and tribes to establish WQS. The Act and implementing regulations also standardize the approach to WQS development. Under the act, the authority to establish WQS is retained by states and approved tribes; EPA must review and approve the WQS. If EPA disapproves a WQS and a state or tribe does not revise it, EPA promulgates a standard. States and authorized tribes must review their WQS every three years and submit them to EPA for review. Idaho has approved WQS. The Coeur d'Alene Tribe's WQS are undergoing final revisions and will soon be submitted to EPA for approval.

Sections 208 and 303 of the Federal CWA provide the authority to states for development of Water Quality Management (WQM) plans. Regulations for implementing these provisions are found in the Code of Federal Regulations (CFR) 40 Part 130.6. CWA Section 319 provides grant opportunities to states and tribes to implement efforts to address nonpoint source pollution. The EPA Region 10 office is located in Seattle, Washington. This office houses many administrative, technical and policy staff that in part, work on Coeur d'Alene basin issues (primarily in implementing remedial actions under CERCLA, and overseeing water quality actions under the CWA). Public outreach staff, in Seattle, develops quarterly Basin Bulletin

newsletters and other educational information. As a means to provide more local support for basin-wide issues, the EPA established a field office in Coeur d'Alene.

4.4 Implementation Team

The Tribe and DEQ plan to use their respective staff and internal support, and then add staff as funding becomes available to create a collaborative implementation team to fully implement the 2008 LMP. This team would include:

- 2008 LMP Coordinators (one from DEQ and one from the Tribe). These positions will be supervisory and responsible for executing the 2008 LMP, with an emphasis on development of yearly work plans and funding proposals, and coordination of management actions in the MATs.
- Outreach Specialists (one Full Time Equivalent staff (FTE) each from the Tribe and DEQ). These positions will staff the lake stewardship center and develop and implement annual education and outreach plans.
- Limnologists (one FTE each from the Tribe and DEQ). These positions will implement the monitoring plan, conduct lake modeling, and analyze/synthesize data and develop report information, and conduct the nutrient basin-wide inventory.
- Water Quality Technicians (two FTEs) These positions will support limnological work described above.
- Office Administrative Assistants (two FTEs) These positions will provide general administrative support for LMP activities.

4.5 External Coordination

The implementation team will be responsible for coordinating their activities with those of many other agencies, cities, municipalities, and public and private stakeholders that currently conduct activities affecting water quality in the Coeur d'Alene basin. Through close coordination of basin-wide activities with all parties, the implementation team can better understand program objectives, identify funding commitments, and abilities to share costs or leverage additional funds. This coordination will reduce duplication of effort and increase education of the public and other stakeholders. DEQ and Tribal staff will routinely communicate and coordinate (by telephone, email, and personal meetings) to establish effective and efficient project implementation plans, provide updates on information collected during BMP audits, establish priorities, analyze and interpret data, and conduct public education and outreach.

The Tribe and DEQ will utilize the coordination efforts listed above to encourage implementation. As coordination, funding, and education increase, it is expected that the level of commitment to conduct these activities will increase, resulting in improvements in water quality. Adaptive management will be employed over the life of the 2008 LMP as a means to be flexible, given the many issues to address and many possible solutions. A list of key forums and LMP partners for coordination includes the following:

4.5.1 Basin Environmental Improvement Project Commission (BEIPC)

The BEIPC was established under Idaho law. Its primary purpose as described in the Memorandum of Agreement (MOA) among DEQ, the Tribe, Washington State Department of Ecology, Benewah, Kootenai, Shoshone counties, and the Federal government (currently represented by EPA) was to implement the 2002 ROD for OU3. The BEIPC may also undertake other activities to improve water quality. The Basin Commission Board (the Board), the Technical Leadership Group (TLG), and the Citizens Coordinating Council (CCC), collectively the BEIPC, represent a wide range of regulatory, land management and public stakeholders. The Tribe and DEQ believe the BEIPC can provide beneficial resources and forums to facilitate the 2008 LMP implementation. The two LMP Coordinators will provide regular updates on work plans and project activities. The BEIPC is a logical forum for informational discussion and updates on activities of various basin-wide municipalities, counties, road and other specific-purpose districts, the Panhandle Health District, and other State and Federal agencies to support broad coordination.

4.5.2 Washington State

Washington State has a vital interest in all activities that affect water quality in the Spokane - Coeur d'Alene River Basin. Currently, Washington is developing a dissolved oxygen TMDL for the Spokane River. In addition, Washington State WQS for metals are violated at the border of Idaho and Washington. Given these concerns and the connection between state waters, sustained communication and coordination with the State of Washington – primarily the Washington Department of Ecology (WDOE), is critical. This coordination will be accomplished directly with the WDOE, and may also occur within the forums of the BEIPC. DEQ and the Tribe also

will continue to participate in the TMDL process, the Post Falls Dam Avista relicensing process, and all other forums intended to resolve interstate water quality issues.

4.5.3 Local governments

The local governments of Shoshone, Kootenai, Benewah, and Latah counties, and their respective cities, have enacted land use ordinances to manage upland development and other human activities in the Coeur d'Alene Lake Basin (Appendix E). These local governments play a crucial role in regulating activities on private lands that directly relates to sediment and nutrient inputs to tributaries and lakes. DEQ and the Tribe will encourage and support the counties and cities efforts to enforce all their regulations aimed at managing pollution in the basin. The Tribe and DEQ also will routinely meet with the counties, either separately or together, to address issues related to water quality, and will engage with county commissioners in the BEIPC forum.

4.5.4 Other state and federal agencies

State and federal agencies other than DEQ and EPA have a role in management of public lands and activities that affect water quality (see Appendix E). Direct, agency-specific coordination will occur in order to share and understand program goals and objectives, yearly work plans, funding strategies, monitoring/study plans, and specific projects being conducted to implement actions that affect basin-wide water quality. These agencies also participate in various BEIPC forums which provide an opportunity for collaborative coordination.

4.5.5 Other tribes

Downstream tribes have aboriginal rights to natural resources affected by the water quality flowing out of Coeur d'Alene Lake. Because the outlet of the lake flows into the Spokane River that ultimately drains into the Columbia River, all tribes that rely on these waters and the natural resources that pertain to the waters have a stake in the effectiveness of the 2008 LMP. The Tribe and DEQ will work with other tribes in the region (Colville, Spokane, Kalispel, Kootenai, and Yakama) to foster awareness of upstream issues and seek downstream support for LMP goal and objectives. The Coeur d'Alene Tribe is a member of the Upper Columbia United Tribes and will use this forum to provide information to other tribes and seek support for upstream issues.

4.5.6 Business community

Coeur d'Alene Lake is the economic engine that drives the local and regional economy. The business community has a vital interest in the implementation of a successful LMP that protects and enhances water quality throughout the basin. The Tribe and DEQ envision the business community as a key partner in lake management. The business community has provided valuable feedback during development of the 2008 LMP, and will have a key role in future public outreach to promote lake protection and water quality awareness. The Tribe and DEQ appreciate the importance of building understanding with the business community about lake management activities, and also in ensuring that key interests of the business community are addressed as part of an adaptive management approach. Coordination is planned through business organizations such as the chambers of commerce, associations, and individual businesses.

4.5.7 Environmental and conservation organizations

Non-governmental organizations are uniquely positioned to articulate environmental and conservation interests and to assist in broad public education. The Kootenai Environmental Alliance, the Lands Council, the Center for Justice, the Nature Conservancy, Ducks Unlimited, the Sierra Club, and others, have been vocal proponents of environmental protection for many years. The Tribe and DEQ are committed to fostering partnerships with these groups to achieve the shared goal of lake protection.

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Section 5: Methods, Performance Actions, and Milestones

Method: Adaptive Management Strategy

The goal of the LMP is to protect and improve lake water quality by limiting basin-wide nutrient inputs that impair lake water quality conditions, which in turn influence the solubility of mining-related metals contamination contained in lake sediments.

The overall strategy embodied in the 2008 LMP to accomplish this goal is adaptive management. The adaptive management approach encompasses both environmental effects and/or consequences of ongoing and planned environmental remediation efforts. At its core, this approach relies on monitoring to establish lake conditions and track changes over time, modeling to predict possible future scenarios if key factors change, implementation of actions to reduce nutrients, and finally, more monitoring to determine lake response relative to the overall goal. Monitoring will guide decisions about the need for additional implementation actions on a repeating annual cycle. This process is consistent with that outlined by the National Academy of Sciences (NRC/NAS, 2005) as follows:

"Adaptive management is not synonymous with 'trial and error.' Adaptive management is a six-step process for defining and implementing management policies for environmental resources under conditions of high uncertainty concerning the outcome of management actions. A well-structured adaptive management plan contains the following interactive steps:

1. Assessing the problem
2. Designing a management plan
3. Implementing the plan
4. Monitoring
5. Evaluating results obtained from monitoring
6. Adjusting the management plan in response to the monitoring results."

Performance Actions and Milestones

Performance actions lead to milestones that gauge success for each of the 2008 LMP strategies implemented, as part of the long-term, multi-tiered, adaptive management approach, and are the basis of the 2008 LMP. Performance actions are what the LMP partners set-out to accomplish, and the milestones are how-to determine success in achieving these actions. The actions and

milestones described below correspond with the Management Objectives and Strategies described more fully in Section 3.

5.1 Objective 1 – Improve Scientific Understanding of Lake Conditions through Monitoring, Modeling, and Special Studies

These *four strategic components* identified in Section 3.1 support this objective:

1) Establish water quality triggers (Tables 2 through 7)
2) Perform core routine monitoring: lake and rivers
3) Develop technical tools to support lake management
4) Conduct special studies

Performance actions for this strategy are:

- Manage lake water quality with respect to action trigger levels for all monitored water quality variables
- Conduct core routine monitoring to build the data record for tracking water quality conditions and trends and for use in verifying and improving model performance
- Carry out additional monitoring and special studies in response to specific needs
- Use the ELCOM-CAEDYM model as an analytical and predictive tool
- Summarize monitoring data and analysis through annual reports and presentations to technical and other forums

Milestones for this strategy include:

- Adjust management activities based on action triggers
- Complete each annual core routine monitoring program
- Publish annual “state of lake water quality” updates described in Section 2 (including modeling results)
- Use special study results to guide management actions

Table 2. Water Quality Triggers for Station C1: SE of Tubbs Hill – Northern Pool, North End at 40 meters

Variables	CY91-92 Condition[a]	WY04-06 Condition[a]	Idaho WQ Standards Criteria (IDAPA 58.01.02)	Desired Condition	Trigger Condition
Total phosphorus 1 m – 30 m depth[b]	2.7 µg/L geomean[c]	5.0 µg/L geomean	nutrient narrative (200.05)	no greater than WY04-06 condition	8.0 µg/L annual geomean[d]
Dissolved oxygen in hypolimnion	minimum >6.0 mg/L	minimum >6.0 mg/L	hypolimnion exempt (250.02.a.iii)	minimum >6.0 mg/L	minimum <6.0 mg/L
Chlorophyll *a* in photic zone	0.46 µg/L (0.92 µg/L)[e] geomean 1.3 µg/L max (1.7 µg/L max)[e]	1.57 µg/L geomean 3.3 µg/L max	nutrient narrative(200.05)	no greater than WY04-06 condition	3.0 µg/L annual geomean[f] 5.0 µg/L max
Blue-green algae (cyanobacteria) blooms	blue-greens minor component	not measured	nutrient narrative (200.05)	blue-greens minor component	blue-greens are dominant algal group with seasonal blooms
Water clarity Secchi depth July – October	8.3 m geomean	9.4 m geomean	none	no less than CY91-92 condition	clarity trigger may reflect chlorophyll *a* trigger
Dissolved zinc 1 m ≈ 39 m[g] (1 m off bottom)	only total zinc measured	62 µg/L geomean 33-91 range	36 µg/L CCC[h] (210.02 & 210.03)	meet Idaho WQS	already consistently exceeds WQS
Dissolved lead 1 m ≈ 39 m (1 m off bottom)	only total lead measured	0.12 µg/L geomean 0.05-0.88 rng	0.54 µg/L CCC (210.02 & 210.03)	meet Idaho WQS	when WQS are exceeded
Diss. cadmium 1 m ≈ 39 m (1 m off bottom)	only total cadmium measured	0.23 µg/L geomean 0.15-0.52 rng	0.25 µg/L CCC (210.02 & 210.03)	meet Idaho WQS	already occasionally exceeds WQS

a = CY91-92 - USGS baseline study, annual sampling from January 1991 – December 1992.
WY04-06 - USGS study, annual sampling from October 2003 – August 2006.

b = Data combined for composite photic zone samples and discrete samples at 20 m and 30 m.

c = Geometric mean - used by USGS to summarize data in the CY91-92 studies. A geometric mean dampens the effect of a few very high or very low sample results as compared to an arithmetic mean.

d = A consistent annual trend of 8 µg/L geometric mean for total phosphorus would be a statistically significant upward departure from the CY91-92 data set.

e = Chlorophyll *a* analysis methods changed from CY91-92 to WY04-06. Thus, the USGS did a paired study of chlorophyll *a* samples using the two analytical methods and derived a statistical relationship that adjusts the original chlorophyll *a* values for CY91-92 (first listed value) to values comparable to the WY04-06 data (values in parenthesis).

Footnotes for Table 2, cont.

f = Based on a transitioning between the current oligotrophic condition to a meso-oligotrophic condition. An annual geometric mean of 3 µg/L chlorophyll *a* would be a doubling of the mean from the WY04-06 data set.

g = Data combined for composite photic zone samples and discrete samples at 20 m, 30 m, and 1 m off bottom.

h = CCC is Criterion Continuous Concentration – 4 day average concentration that ensures adequate protection of sensitive species of aquatic organisms from chronic toxicity. The CCC is not to be exceeded more than once every 3 years. The CCC was calculated with a total hardness of 25 mg/L as $CaCO_3$.

Table 3. Water Quality Triggers for Station C4: NE of University Point – Northern Pool, South End at 40 meters

Variables	CY91-92 Condition[a]	WY04-06 Condition[a]	Idaho WQ Standards Criteria (IDAPA 58.01.02)	Desired Condition	Trigger Condition
Total phosphorus 1 m – 30 m depth[b]	3.8 µg/L geomean[c]	6.2 µg/L geomean	nutrient narrative (200.05)	no greater than WY04-06 condition	8.0 µg/L annual geomean[d]
Dissolved oxygen in hypolimnion	minimum >6.0 mg/L	minimum >6.0 mg/L	hypolimnion exempt (250.02.a.iii)	minimum >6.0 mg/L	minimum <6.0 mg/L
Chlorophyll *a* in photic zone	0.48 µg/L (0.94 µg/L)[e] geomean 1.5 µg/L max (1.8 µg/L max)[e]	1.55 µg/L geomean 3.1 µg/L max	nutrient narrative (200.05)	no greater than WY04-06 condition	3.0 µg/L annual geomean[f] 5.0 µg/L max
Blue-green algae (cyanobacteria) blooms	blue-greens minor component	not measured	nutrient narrative (200.05)	blue-greens minor component	blue-greens are dominant algal group with seasonal blooms
Water clarity Secchi depth July – October	7.7 m geomean	8.6 m geomean	none	no less than CY91-92 condition	clarity trigger may reflect chlorophyll *a* trigger
Dissolved zinc 1 m ≈ 39 m[g] (1 m off bottom)	only total zinc measured	68 µg/L geomean 36-104 range	36 µg/L CCC[h] (210.02 & 210.03)	meet Idaho WQS	already consistently exceeds WQS
Dissolved lead 1 m ≈ 39 m (1 m off bottom)	only total lead measured	0.27 µg/L geomean 0.05-2.76 rng	0.54 µg/L CCC (210.02 & 210.03)	meet Idaho WQS	already occasionally exceeds WQS
Diss. cadmium 1 m ≈ 39 m (1 m off bottom)	only total cadmium measured	0.26 µg/L geomean 0.16-0.43 rng	0.25 µg/L CCC (210.02 & 210.03)	meet Idaho WQS	already frequently exceeds WQS

For footnotes a – h, see for Table 2 for Station C1.

Table 4. Water Quality Triggers for Shallow Bays of Northern Pool – Shoreline to ≈ 20 meters

Variables	Summer 91-92 and July – Oct 95-02[a]	WY04-06 Condition[b]	Idaho WQ Standards Criteria (IDAPA 58.01.02)	Desired Condition	Trigger Condition
Nearshore periphyton & aquatic plants[c]	periphyton production in bays - 1992	not measured	nutrient narrative (200.05)	to be determined by nearshore LMP studies	to be determined by nearshore LMP studies
Eurasian milfoil	not present	not present	none	not present	present
Total phosphorus water column	5.7 µg/L geomean 1991 - 2002	data not yet available	nutrient narrative (200.05)	no greater than current condition	9.0 µg/L annual geomean[d]
Dissolved oxygen to near bottom	minimum >6.0 mg/L 1991 - 2002	data not yet available	min. >6.0 mg/L bottom 20% of depth exempt (250.02.a.iii)	minimum >6.0 mg/L	minimum <6.0 mg/L
Chlorophyll *a* in photic zone	0.40 µg/L (0.90 µg/L)[e] geomean 1.7 µg/L max (2.0 µg/L max)[e] 1991 - 1992	data not yet available	nutrient narrative (200.05)	no greater than current condition	3.0 µg/L annual geomean[f] 5.0 µg/L max
Water clarity Secchi depth 10 m and deeper July – Oct.	8.1 m geomean 1991 - 2002	data not yet available	none	no less than current condition	clarity trigger may reflect chlorophyll *a* trigger
Blue-green algae (cyanobacteria) blooms	not measured	not measured	nutrient narrative (200.05)	blue-greens - minor component	blue-greens are dominant algal group with season blooms
Coliform bacteria	not measured	not measured	126 *E. coli*/100 ml geomean of 5 samples/30 days (251.01.c[g])	meet Idaho WQS	when WQS are exceeded
Dissolved zinc water column	58 µg/L geomean 28-272 range 1995 - 2002	data not yet available	36 µg/L CCC (210.02 & 210.03)	meet Idaho WQS	already consistently exceeds WQS
Dissolved lead water column	samples <det. limit of 3 µg/L 1995 - 2002	data not yet available	0.54 µg/L CCC (210.02 & 210.03)	meet Idaho WQS	when WQS are exceeded
Diss. cadmium water column	samples <det. limit 0.5 µg/L 1995 - 2002	data not yet available	0.25 µg/L CCC (210.02 & 210.03)	meet Idaho Standards	when WQS are exceeded

Footnotes for Table 4

a = These data are from USGS sampling in summer months for 1991-92 baseline study, and DEQ sampling for July – Oct., 1995–2002.

b = WY04-06 – these data are from USGS study with annual sampling from October 2003 – August 2006.

c = Periphyton is attached algae growing on natural and artificial substrates.

d = Based on a numerical total phosphorus target established for the nutrient TMDL of near shore waters of Pend Oreille Lake, Idaho (Tetra Tech, 2002).

e = Chlorophyll *a* analysis methods changed from CY91-92 to WY04-06. Thus, the USGS did a paired study of chlorophyll *a* samples using the two analytical methods and derived a statistical relationship that adjusts the original chlorophyll *a* values for CY91-92 (first listed value) to values comparable to the WY04-06 data (values in parenthesis).

f = Based on a transitioning between the current oligotrophic condition to a meso-oligotrophic condition. An annual geometric mean of 3 µg/L chlorophyll *a* would be a doubling of the mean from the WY04-06 data set.

g = For areas that are specified as public swimming beaches, the criteria is 235 *E. coli*/100 ml for a single sample (251.01.a).

Table 5. Water Quality Triggers for Station C5: NE of Blue Point – Southern Pelagic Site South of Harrison.

Parameter	CY91-92 Condition[b]	WY04-06 Condition[b]	Coeur d'Alene Tribe WQ Standards Criteria[c]	Desired Condition	Trigger Condition
Total Phosphorus (euphotic zone)[d]	6.1 µg/L geomean[e]	11.2 µg/L geomean	Narrative[c]	no greater than CY91-92 condition	8.0 µg/L annual geomean
Total Phosphorus (1 m off bottom)	6.1 µg/L geomean	15.6 µg/L geomean	Narrative	no greater than CY91-92 condition	8.0 µg/L annual geomean
Dissolved Oxygen in hypolimnion	minimum 2.8 mg/L	minimum 2.5 mg/L	minimum >8.0 mg/L	minimum >8.0 mg/L	minimum <8.0 mg/L
Chlorophyll *a* in photic zone	0.68 µg/L (1.13 µg/L)[f] geomean 1.9 µg/L (2.21 µg/L d)[f] max	1.56 µg/L geomean 5.3 µg/L max	Narrative	no greater than CY91-92 adjusted condition[f]	3.0 µg/L annual geomean 5.0 µg/L max
Blue-green algae (cyanobacteria) blooms	blue-greens minor component	not measured	Narrative	blue-greens minor component	blue-greens are dominant algal group with seasonal blooms
Water Clarity Secchi depth July – October	5.2 m geomean	5.6 m geomean	Narrative	no less than WY04-06 condition	clarity trigger may reflect chlorophyll *a* trigger
Dissolved zinc (euphotic zone)	only total zinc measured	17.0 µg/L geomean 1.4-60.0 range	26-37 µg/L CCC[g]	meet CDA Tribe WQS	already exceeds WQS
Dissolved zinc (1 m off bottom)	only total zinc measured	40.0 µg/L geomean 4.2-83.0 range	27-37 µg/L CCC	meet CDA Tribe WQS	already exceeds WQS
Dissolved lead (euphotic zone)	only total lead measured	0.15 µg/L geomean 0.05-0.7 range	0.39-0.56 µg/L CCC	meet CDA Tribe WQS	already exceeds WQS
Dissolved lead (1 m off bottom)	only total lead measured	0.18 µg/L geomean 0.05-1.2 range	0.45-0.55 µg/L CCC	meet CDA Tribe WQS	already exceeds WQS
Diss. cadmium (euphotic zone)	only total cadmium measured	0.08 µg/L geomean 0.02-0.20 range	0.073-0.096 µg/L CCC	meet CDA Tribe WQS	when WQS are exceeded
Diss. cadmium (1 m off bottom)	only total cadmium measured	0.15 µg/L geomean 0.04-0.40 range	0.073-0.095 µg/L CCC	meet CDA Tribe WQS	when WQS are exceeded

For footnotes b – g, see Table 6 for Station C6. Footnote 'a' in Table 6 does not apply to Station C5

Table 6. Water quality triggers for Station C6: Chatcolet Lake – Southern Pelagic Site[a]

Variable	CY91-92 Condition[b]	WY04-06 Condition[b]	Coeur d'Alene Tribe WQStandards Criteria[c]	Idaho WQStandards Criteria (IDAPA 58.01.02)	Desired Condition	Trigger Condition
Total phosphorus (euphotic zone)[d]	9.0 µg/L geomean[e]	18.6 µg/L geomean	Narrative[c]	nutrient narrative (200.05)	no greater than CY91-92 condition	9.0 µg/L annual geomean
Total phosphorus (1 m off bottom)	15.8 µg/L geomean	32.4 µg/L geomean	Narrative	nutrient narrative (200.05)	no greater than CY91-92 condition	9.0 µg/L annual geomean
Dissolved oxygen in hypolimnion	minimum 0.0 mg/L	minimum 0.2 mg/L	minimum >8.0 mg/L	minimum >6.0 mg/L – bottom 20% of depth exempt (250.02.a.iii)	meet applicable WQS	when applicable WQS is exceeded
Chlorophyll *a* in photic zone	0.70 µg/L (1.22 µg/L)[f] geomean 2.9 µg/L (3.13 µg/L)[f] max	2.57 µg/L geomean (17.9 µg/L) max	Narrative	nutrient narrative (200.05)	no greater than CY91-92 adjusted condition[f]	3.0 µg/L annual geomean 5.0 µg/L max
Blue-green algae (cyanobacteria) blooms	blue-greens minor component	not measured	Narrative	nutrient narrative (200.05)	blue-greens minor component	blue-greens are dominant algal group with seasonal blooms
Eurasian milfoil	Unknown	present	None	none	not present	present
Water clarity Secchi depth July – October	3.1 m geomean	2.5 m geomean	Narrative	none	no less than CY91-92 condition	clarity trigger may reflect chlorophyll *a* trigger
Dissolved zinc (euphotic zone)	only total zinc measured	1.55 µg/L geomean 0.4-8.0 range	26-37 µg/L CCC[g]	36 µg/L CCC (210.02 & 210.03)	meet applicable WQS	when applicable WQS is exceeded
Dissolved zinc (1 m off bottom)	only total zinc measured	1.97 µg/L geomean 0.4-30.6 range	27-37 µg/L CCC	36 µg/L CCC (210.02 & 210.03)	meet applicable WQS	when applicable WQS is exceeded

Table 6. cont.

Variable	CY91-92 Condition[b]	WY04-06 Condition[b]	Coeur d'Alene Tribe WQ Standards Criteria[c]	Idaho WQ Standards Criteria (IDAPA 58.01.02)	Desired Condition	Trigger Condition
Dissolved lead (euphotic zone)	only total lead measured	0.08 µg/L geomean 0.04-0.23 range	0.39-0.56 µg/L CCC	0.54 µg/L CCC (210.02 & 210.03)	meet applicable WQS	when applicable WQS is exceeded
Dissolved lead (1 m off bottom)	only total lead measured	0.09 µg/L geomean 0.04-0.50 range	0.45-0.55 µg/L CCC	0.54 µg/L CCC (210.02 & 210.03)	meet applicable WQS	when applicable WQS is exceeded
Diss. cadmium (euphotic zone)	only total cadmium measured	0.04 µg/L geomean 0.04-0.15 range	0.073-0.096 µg/L CCC	0.25 µg/L CCC (210.02 & 210.03)	meet applicable WQS	when applicable WQS is exceeded
Diss. cadmium (1 m off bottom)	only total cadmium measured	0.04 µg/L geomean 0.04-0.06 range	0.073-0.095 µg/L CCC	0.25 µg/L CCC (210.02 & 210.03)	meet applicable WQS	when applicable WQS is exceeded

a = DEQ and the Tribe do not agree on the applicable WQS at this station. DEQ and the Tribe recognize that water quality conditions at this station are reasonably representative of water quality in the adjoining nearby TAS area. The listed "desired conditions" for this station therefore reflect the Tribe's WQS that are applicable to the TAS waters for which this station is representative. The "trigger conditions" for this station are the applicable WQS of both the Tribe and the State; the Tribe's WQS as applicable to the TAS area and, as to this station, the State and Tribe each apply their respective WQS.

b = CY91-92 - USGS baseline study, annual sampling from January 1991 – December 1992.
WY04-06 - USGS study, annual sampling from October 2003 – August 2006.

c = Coeur d'Alene Tribe, 2005. Water Quality Standards for Approved Surface Waters of the Coeur d'Alene Tribe. Prepared for the United States Environmental Protection Agency (Region 10). Pages 32.

d = Euphotic zone composite from surface to depth of 1% incident light (PAR).

e = Geometric mean - used by USGS to summarize data in the CY91-92 studies.

f = Chlorophyll *a* analysis methods changed from CY91-92 to WY04-06. Thus, the USGS did a paired study of chlorophyll *a* samples using the two analytical methods and derived a statistical relationship that adjusts the chlorophyll *a* value for the CY91-92 to make the values comparable to the WY04-06 data.

g = CCC is Criterion Continuous Concentration. Toxicity is dependent upon total hardness which ranged from 17.6-25.8 (mg/l) throughout the study periods.

5.2 Objective 2 – Establish and Strengthen Partnerships to Maximize Benefits of Actions under Existing Regulatory Frameworks

These *five strategic components* identified in Section 3.2 support this objective:

1) Use MATs to coordinate partnerships to implement the 2008 LMP
2) Improve understanding of authorities
3) Engage with land managers to identify opportunities in annual workplans
4) Collaborate to implement projects when appropriate
5) Evaluate MAT actions routinely and repeat the audit at 5-year intervals

Performance actions for this strategy are:

- Review and update MATs as necessary
- Meet with LMP partners to promote understanding of authorities and consult on work plans
- Integrate the 2008 LMP goal, objectives, and strategies in annual work plans of LMP partners

Milestones for this strategy are:

- Number of LMP partner activities funded and implemented
- Number of projects funded and implemented
- Quarterly reports delivered to partners and the public
- Annual update of MATs completed
- 5-year audit of MATs completed

5.3 Objective 3 – Develop and Implement a Nutrient Reduction Action Plan

These *three strategic components* identified in Section 3.3 support this objective:

1) Develop a basin-wide nutrient source inventory
2) Prioritize projects based on inventory
3) Incorporate TMDLs into the nutrient reduction plan

Performance Actions for this strategy are:

- Conduct a basin-wide inventory
- Identify and implement additional nutrient reduction projects
- Coordinate and implement MATs activities

- Complete and implement TMDLs
- Assess beneficial uses of TMDL waters

Milestones for this strategy are:

- A basin-wide nutrient inventory funded, designed and conducted during 2009-2011
- Data analyzed and environmental database with GIS maps of nutrient loading developed
- Additional projects for nutrient reduction such as wastewater treatment upgrades, septic system upgrades, lakeside embayment sewer system development, agricultural lands restorations, riparian/stream-side restoration, improvement and maintenance of road systems, among others; identified
- Results of inventory shared with LMP partners and broader public
- Meetings conducted with LMP partners to track MATs activities and effectiveness
- WAGs established for TMDL development and implementation of sediment and nutrient reduction
- Beneficial use reconnaissance activities conducted

5.4 Objective 4 – Increase Community Awareness of Lake Conditions

These *four strategic components,* identified in Section 3, support this objective:

1) Establish a lake stewardship center
2) Develop and maintain a science and resource library
3) Develop an education and outreach services plan
4) Coordinate local school interaction

Performance Actions for this strategy are:

- Fund and establish a lake stewardship center
- Conduct meetings and other activities to educate the public
- Conduct surveys to assess public understanding of lake water quality
- Make a science and resource library available for public use
- Develop a Lake*A*Syst program
- Promote incorporation of LMP information into school curriculums

Milestones for this strategy are:

- A lake stewardship center is established
- A detailed public information plan is developed
- Information to support public understanding is developed

- A science and resource library with electronic bibliography is established
- Information has been adopted into school curriculums

5.5 Objective 5 – Establish Funding Mechanisms to Support the 2008 LMP Goals, Objectives and Strategies

These *four strategic components* identified in Section 3.5 support this objective:

1) Identify core needs
2) Prioritize projects based on tiered approach
3) Identify funding sources and secure commitments
4) Demonstrate fiscal accountability

Performance Actions for this strategy are:

- Seek firm funding commitments for core needs from public and private sources
- Develop annual and 5-year plans
- Prioritize projects and their costs that meet management action goals
- Seek firm funding commitments for priority projects
- Establish protocols for maintaining fiscal accountability

Milestones for this strategy are:

- A funding document that identifies potential funding sources, both public and private, is developed
- Core needs funding is obtained
- Project priorities are identified
- Funding for prioritized projects is obtained
- Annual and 5-year implementation plans to support budget requests are completed
- An integrated process for fiscal accountability (funding requests, approvals and status) is created
- Create and maintain a database to track funding documentation and project completion status
- Report on expenditures as required by individual funding sources

Section 6: Budgets and Scheduling

The Tribe and DEQ have agreed on the following general concepts that serve as a basic framework for the cost estimates and schedules. These general concepts are as follows:

- *Costs are Yearly and Long-term*: As long as hazardous substances are likely to remain in the bottom sediments of Coeur d'Alene Lake there will be the need to actively manage nutrients. To do so will require yearly and long-term funding.

- *Core Funding*: DEQ and the Tribe will pursue long-term secure funding to successfully implement the 2008 LMP. The costs to fund core needs have been identified. These costs must be funded annually. Initial funding success will determine subsequent needs and efforts.

- *5-year Funding Horizons*: As a means of understanding and presenting funding needs over time, the Tribe and DEQ plan to develop 5-year work plans.

- *Funding Needs Will Vary from Year to Year/Except for Core Funding*: Core activities are those that need to be implemented to maintain the basic tasks essential for the 2008 LMP to be credible. These activities will be yearly. Other items needed to be funded are numerous and will be scheduled over the life of the LMP as the plan is fully implemented. These work elements will be prioritized and scheduled as deemed appropriate by LMP Coordinators. Once priorities are established, funding will be sought to implement work elements outlined in 5-year work plans.

Two different approaches to budgets and schedules have been developed. One relies on full DEQ in-house staffing (Table 7). The second is a combination of DEQ staffing and DEQ contracts (Table 8). Both approaches include full staffing by the Tribe. Details of these two approaches are found in Appendix F.

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Table 7. Budget Summary & Schedule for the 2008 LMP for Fully Staffed Approach

I. CORE 2008 LMP PROGRAM	Year 1	Year 2	Year 3	Year 4	Year 5	Comments
1. LMP Nutrient Management & Coordination						
DEQ LMP subtotal	130,500	134,825	141,466	148,940	161,262	Existing DEQ LMP Coordinator FTE (1) New admin FTE (1) for DEQ tasks below:
Tribe LMP subtotal	130,500	134,825	141,466	148,940	161,262	
Total:	**261,000**	**269,650**	**282,933**	**297,879**	**322,523**	
2. Routine Monitoring (annual and periodic)						
DEQ subtotal	213,000	232,675	243,554	254,957	266,910	New DEQ scientific FTEs (2)
Tribe subtotal	213,000	232,675	243,554	254,957	266,910	*Note: Years 2 - 4, staff conduct both routine monitoring & nutrient inventory*
Shared (modeling/GIS) subtotal	125,000	130,750	136,788	143,127	149,783	
Total:	**551,000**	**596,100**	**623,895**	**653,040**	**683,603**	
3. Initial Basin-wide Nutrient Inventory (3 years) - Staff from Core Routine Program						
DEQ subtotal	16,500	27,325	28,191	29,101	20,056	Same FTEs as I.2 "Routine Monitoring"
Tribe subtotal	16,500	27,325	28,191	29,101	20,056	
Shared subtotal	0	20,000	20,000	20,000	0	
Total:	**33,000**	**74,650**	**76,383**	**78,202**	**40,112**	
4. Education & Outreach Center						
DEQ subtotal	102,000	107,100	112,455	118,078	123,982	New DEQ outreach FTE (1)
Tribe subtotal	102,000	107,100	112,455	118,078	123,982	
Shared subtotal	145,000	114,500	119,225	126,186	131,396	
Total:	**349,000**	**328,700**	**344,135**	**362,342**	**379,359**	
CORE Total:	***1,194,000***	***1,269,100***	***1,327,345***	***1,391,463***	***1,425,596***	

Table 7 cont.

II. 2ND TIER STUDIES, PROJECTS AND PROGRAMS	Year 1	Year 2	Year 3	Year 4	Year 5	Comments
1. Special Studies (including Contractual)						
Total:	**6,000**	**161,000**	**42,000**	**107,000**	**147,000**	
2. TMDL Implementation Planning & Oversight						
DEQ subtotal	120,500	126,425	132,646	139,179	146,037	Existing DEQ TMDL Coordinator FTE (1)
Tribe subtotal	120,500	126,425	132,646	139,179	146,037	
Total:	**241,000**	**252,850**	**265,293**	**278,357**	**292,075**	
TIER II, 1 - 2 Total:	***247,000***	***413,850***	***307,293***	***385,357***	***439,075***	
3. TMDL and other Nutrient Reduction Projects						
Total:	**2,000,000**	**2,000,000**	**2,000,000**	**2,000,000**	**2,000,000**	
GRAND TOTAL (Tiers I & II)	**3,441,000**	**3,682,950**	**3,634,638**	**3,776,820**	**3,864,671**	
4 & 5 & 6. Upgrades to Wastewater Treatment						
Upstream total		22,128,000				
Embayments		0				
Downstream total		29,000,000				
Total:		**51,128,000**				
8. Increased Funding/Staffing for MATs Shortfalls						
Total:						

Table 8. Budget Summary & Schedule for the 2008 LMP Partial Contract Approach

I. CORE 2008 LMP PROGRAM	Year 1	Year 2	Year 3	Year 4	Year 5	Comments
1. LMP Nutrient Management & Coordination						
DEQ LMP subtotal	130,500	134,825	141,466	148,940	161,262	Existing DEQ LMP Coordinator FTE (1) Existing Admin FTE (1) for DEQ tasks below
Tribe LMP subtotal	130,500	134,825	141,466	148,940	161,262	
Total:	**261,000**	**269,650**	**282,933**	**297,879**	**322,523**	
2. Routine Monitoring (annual and periodic)						
DEQ subtotal	358,500	382,950	401,663	421,298	441,901	DEQ contract
Tribe subtotal	213,000	232,675	243,554	254,957	266,910	*Note: Years 2 - 4, DEQ contract staff and Tribe conduct both routine monitoring & nutrient inventory*
Shared (modeling/GIS) subtotal	125,000	130,750	136,788	143,127	149,783	
Total:	**696,500**	**746,375**	**782,004**	**819,381**	**858,594**	
3. Initial Basin-wide Nutrient Inventory (3 years) - Staff from Core Routine Program						
DEQ subtotal	0	8,000	8,000	8,000	0	DEQ contract
Tribe subtotal	16,500	27,325	28,191	29,101	20,056	
Shared subtotal	0	20,000	20,000	20,000	0	
Total:	**16,500**	**55,325**	**56,191**	**57,101**	**20,056**	
4. Education & Outreach Center						
DEQ subtotal	75,000	78,750	82,688	86,822	91,163	DEQ contract
Tribe subtotal	102,000	107,100	112,455	118,078	123,982	
Shared subtotal	145,000	114,500	119,225	126,186	131,396	
Total:	**322,000**	**300,350**	**314,368**	**331,086**	**346,540**	
CORE Total:	***1,296,000***	***1,371,700***	***1,435,495***	***1,505,447***	***1,547,713***	

Table 8 cont.

II. 2ND TIER STUDIES, PROJECTS AND PROGRAMS	Year 1	Year 2	Year 3	Year 4	Year 5	Comments
1. Special Studies (including Contractual)						
Total:	**6,000**	**161,000**	**42,000**	**107,000**	**147,000**	
2. TMDL Implementation Planning & Oversight						
DEQ subtotal	120,500	126,425	132,646	139,179	146,037	Existing DEQ TMDL Coordinator FTE (1)
Tribe subtotal	120,500	126,425	132,646	139,179	146,037	
Total:	**241,000**	**252,850**	**265,293**	**278,357**	**292,075**	
TIER II, 1 - 2 Total:	***247,000***	***413,850***	***307,293***	***385,357***	***439,075***	
3. TMDL and other Nutrient Reduction Projects						
Total:	**2,000,000**	**2,000,000**	**2,000,000**	**2,000,000**	**2,000,000**	
GRAND TOTAL (Tiers I & II)	**3,543,000**	**3,785,550**	**3,742,788**	**3,890,804**	**3,986,788**	
4 & 5 & 6. Upgrades to Wastewater Treatment						
Upstream total		22,128,000				
Lake embayment total		0				
Downstream total		29,000,000				
Total:		**51,128,000**				
8. Increased Funding/Staffing for MATs Shortfalls						
Total:						

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Appendix A – State of Lake Water Quality

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Appendix A. State of Lake Water Quality - 2008

A.1 Introduction

A key finding through the Phase 1 LMP Assessment of the ADR process was that among the Coeur d'Alene Lake community, there was not a clear understanding of the current water quality conditions within the lake, and at times there were conflicting views and messages from different agency staff and technical experts on the lake condition (Harty, 2007). As part of the ADR process to prepare for drafting a collaborative LMP, a "State of the Lake - 2007" presentation with handout materials was prepared containing an agreed upon summary of limnological conditions within the lake. The presentation and materials were given to community stakeholder groups during briefing and input sessions prior to drafting the 2008 LMP. This Appendix is essentially an expanded version of the outline format and information contained within the "State of the Lake" presentation.

It is the intent of the Tribe and DEQ to frequently update and publish increased understanding of lake conditions gained through continued monitoring, studies, and analysis. Two examples of recent work that will greatly expand understanding of lake conditions are described below.

The scientific report of USGS studies from 2003 – 2006 (see Section A.2) has not yet been published in final form (under peer review). While data summaries of USGS monitoring are used in this 2008 LMP Appendix (raw data for some sampling stations is available by download from the USGS web site), the "State of the Lake" is not complete without the final USGS report, and thus subject to change. For example, there is no information yet on nitrogen and phosphorus annual load estimates into the lake comparing the recent study with the initial 1991-92 baseline study, and the final report will have a statistical analysis of shallow bay sampling versus deep water sampling.

The second example of work is the recently completed development of an ELCOM-CAEDYM computer model specific for Coeur d'Alene Lake by staff of the University of Western Australia – Centre for Water Research and the USGS (Dallimore *et al*. 2007 and Hipsey *et al*. 2007, see also Appendix B). In September 2007, the Centre provided training to staff of DEQ, the Tribe, and USGS on the science behind the computer model, including: hydrodynamics of river flow through the lake, biological interactions and metabolism, lake thermodynamics, water chemistry, and geochemistry of metal containing compounds. There was also introductory training on model setup, data parameters, data input, and conducting model runs. As DEQ and Tribal scientists learn to conduct computer runs, input newly obtained data, and use field data for computer run validation, it is anticipated that the level of understanding of lake conditions and responses to basin nutrient loads will increase.

A.2 Previous Monitoring and Research Efforts

Coeur d'Alene Lake has received considerable monitoring and research efforts. Previous lake studies include those listed in Table A1, beginning with EPA monitoring visits to the lake in 1975 under the National Eutrophication Survey. An important and comprehensive effort was the USGS baseline study conducted in calendar years 1991 and 1992 (CY91-92). Data from this

Table A1. Monitoring and research studies conducted in Coeur d'Alene Lake since 1975 (this is not a complete list). See References for full citations.

1975:
EPA National Eutrophication Survey – 3 sampling visits, April, July, & September
(U.S. EPA, 1977)

1987:
USGS sampling trips
(Woods, 1989)

1989:
USGS extensive sampling of metal concentrations in lakebed sediments
(Horowitz *et al*. 1993, 1995)

1991 and 1992:
USGS baseline study of limnological conditions
(Woods and Beckwith, 1997)

1994:
USGS bioassays of dissolved zinc inhibition of phytoplankton
(Woods and Beckwith, 1997)

1995 – 2002:
DEQ monitoring of northern pool open waters and bays: summer – fall only
(unpublished data)

1998 - 2001:
USGS study of benthic flux of metals and nutrients from sediments
(Kuwabara *et al*., 2000 and Kuwabara *et al*, 2003)

August 2001, June 2004, June 2005:
USGS – research of zinc effects on phytoplankton productivity
(Kuwabara, *et al*., 2006)

October 2003 – August 2006:
USGS & Coeur d'Alene Tribe – further baseline studies of limnological conditions
(under review)

2004 – 2006:
USGS, University of Western Australia – Centre for Water Research, and Coeur d'Alene Tribe – development of ELCOM-CAEDYM computer model specific for Coeur d'Alene Lake
(Dallimore *et al*., 2007 and Hipsey *et al*, 2007)

March 2003 – ongoing:
EPA - Basin Environmental Monitoring Program including two inflow river stations and one lake outflow station
(U.S. EPA, 2004a)

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effort was utilized in the development of the initial, 1996 LMP. A subsequent baseline study was conducted by the USGS, Tribe, and others, from October 2003 – August 2006 (WY04-06).

A.3 Morphometric Characteristics

Table A2 presents some basic physical and hydrological data for Coeur d'Alene Lake. Of importance to observed conditions within the lake and Spokane River (lake outflow), is the fact that a very large watershed (2.4 million acres) drains into the lake with the combined annual inflow volume from two major rivers and numerous tributaries average approximately twice the lake volume. On a theoretical basis, lake volume is replaced on the average of twice a year (flushing rate, or the inverse, hydraulic residence time). This is a very rapid flow-through, or replacement time, for a large lake.

Table A2. Morphometric data for Coeur d'Alene Lake at full-pool elevation of 2128 ft (Woods and Beckwith, 1997)

Surface area =	31,875 acres
Lake volume =	2.3 million ac-ft
Max depth =	64 m
Mean depth =	22 m
Mean hydraulic residence =	0.5 years
Watershed area =	2.4 million acres
Shoreline length =	150 miles

A.4 Multiple Lake Zones and Two Major Rivers

The Coeur d'Alene Lake system is complex and interconnected with two major rivers and numerous tributaries flowing in and mixing with lake waters, and then discharging to create the Spokane River. However, when evaluating trends of water quality data, and ecological conditions, the lake can be viewed as multiple lake zones influenced by two major rivers (see Figure A1).

Mid-center northern pool within deep waters. This zone extends from the lake outlet eastward toward Wolf Lodge Bay and southward to just north of the mouth of the Coeur d'Alene River, with water depths ranging from 20 – 60 m. This area is represented by USGS sampling sites #1 (SE of Tubbs Hill), #3 (W of Driftwood Point), and #4 (NE of University Point). These sites were monitored in USGS baseline studies of CY91-92 and WY04-06, and by DEQ in 1995 – 2002. Wolf Lodge Bay as represented by USGS site #2 was sampled in CY91-92, but not in WY04-06.

Numerous shallow bays from shoreline to 20 m depth. This zone includes multiple areas which typically have tributary streams flowing into them such as Carlin Creek into Carlin Bay and Fighting Creek into Rockford Bay. There have been sampling sites within many of the bays since 1991, but not of the sample size, consistency, and frequency of the referenced USGS sites listed above.

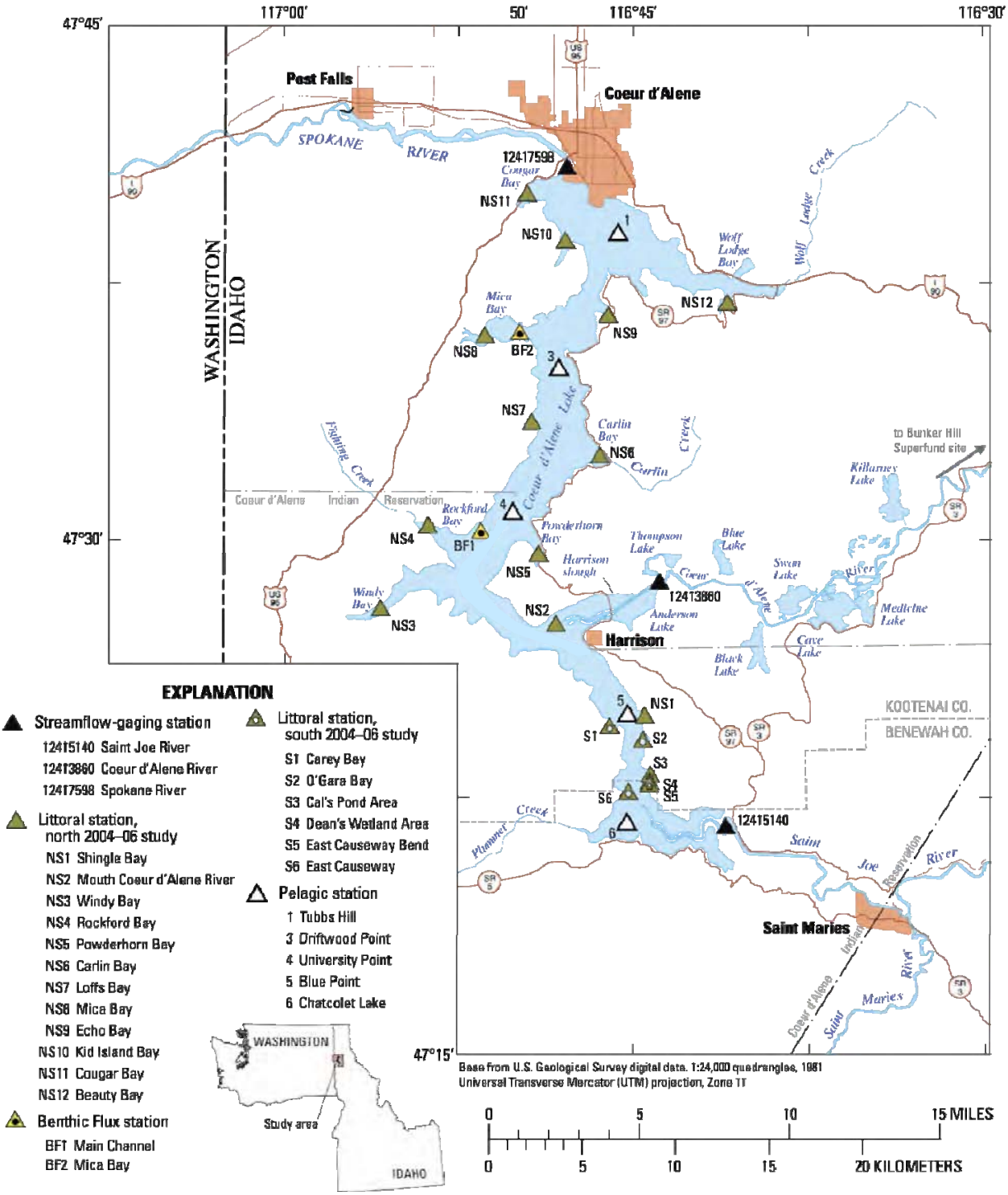

Figure A1. Map of USGS and Coeur d'Alene Tribe sampling sites in Coeur d'Alene Lake for the period of October 2003 – August 2006 (under review).

Transitional zone between southern and northern pool waters. This zone includes the area between the mouth of the Coeur d'Alene River south to approximately Conkling Point where water depths range from 10 – 20 m. This zone is represented by USGS site #5, a site that was monitored in both baseline studies.

Southern shallow waters, 10 m and less. This zone extends southward from Conkling Point and includes the inflow channel and lateral lakes along the lower St. Joe River. This zone is represented by USGS site #6 (Chatcolet Lake), and was monitored in both baseline studies.

Major inflowing rivers, the Coeur d'Alene and St. Joe. Annual water volume into the lake is slightly greater for the St. Joe River than the Coeur d'Alene River. Annual combined inflow of these two rivers account for approximately 90% of the total inflow to the lake, (Woods and Beckwith, 1997). Water quality conditions of these two major rivers play a major role on observed lake conditions.

A.5 Hydrodynamics into and within Coeur d'Alene Lake

Flow and current patterns within the lake are created by: two major rivers and tributary streams, currents generated by wind events, and thermodynamics. Flow and current patterns are extremely variable and complex throughout a year and between years. It is anticipated that with future utilization of the hydrodynamic component of the ELCOM-CAEDYM model, an increased understanding of these hydrodynamics will emerge.

Monitoring during WY04-06 studies was under conditions where flows from the two rivers were below historic norms in WY04 and WY05, and above normal flow for WY06. In WY06, combined inflow of the two rivers was around 4.3 million acre-feet, while the estimated volume of the lake is around 2.3 million acre-feet, or about one-half of the total river inflow (Figure A2).

A.6 Riverine Flow of Metals, Suspended Sediment, and Nutrients

Annually, the Coeur d'Alene River continues to carry elevated concentrations of both dissolved and particulate forms of potentially toxic metals into the lake (Figure A3 for zinc). The St. Joe River carries low concentrations of trace metal compounds into the southern lake, but total phosphorus (TP) concentrations, on the average, are higher within the St. Joe River (Figure A4), and it delivers a greater annual phosphorus load than the Coeur d'Alene River.

A portion of the annual particulate and dissolved metal load, as well as a portion of the phosphorus load that flows into the lake eventually ends up in lakebed sediments. A portion is carried north and exits out the Spokane River. Overall, the lake is a net sink for cadmium, lead, zinc, and phosphorus loads (more comes in than goes out).

Coeur d'Alene Lake conditions change in response to high river and stream flows. There can be significant rain-on-snow events occurring any time from December through March, and high flows during spring peak runoff, which typically occurs from late March through mid-June (see Figure A2 for WY06). Suspended sediment (measured as Total Suspended Sediment, TSS) from

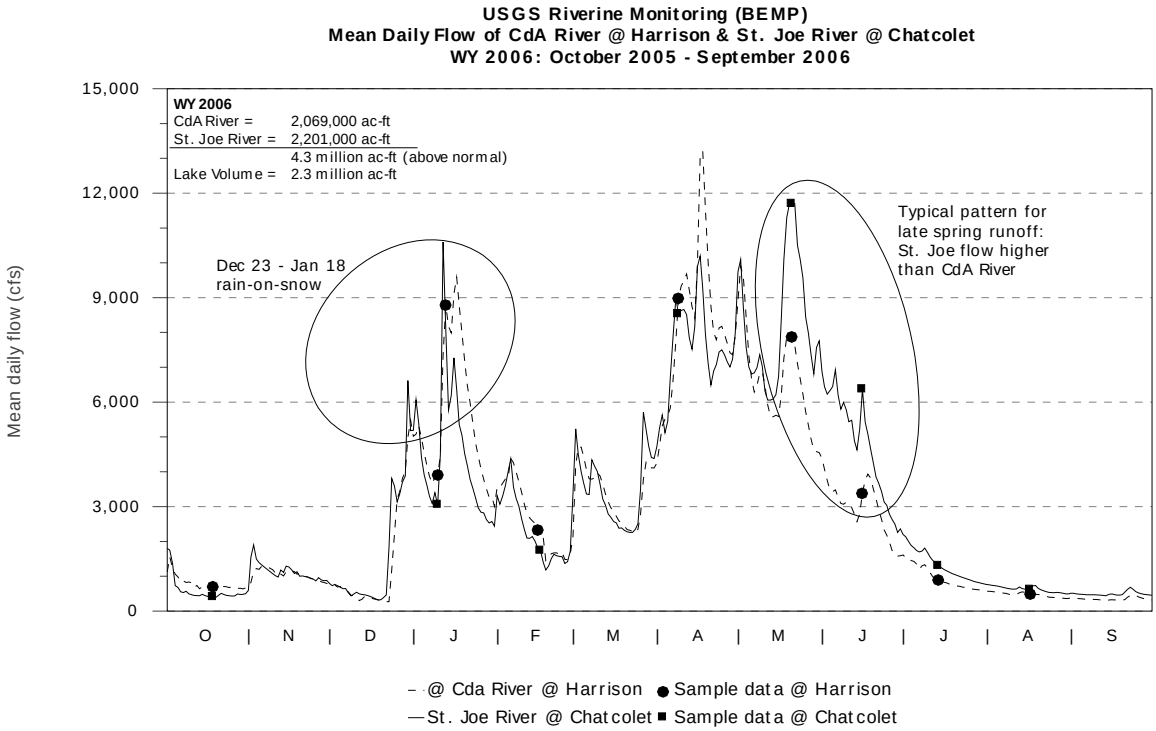

Figure A2. Hydrograph of Coeur d'Alene River and St. Joe River mean daily flows (cfs) for Water Year 2006 (Brennan *et al*., 2007)

the rivers and streams can be high during these periods. Figure A4 shows an association of high flows, TSS spikes, and TP spikes within the two rivers. Spikes in TP concentrations can be recorded within the lake corresponding to the high flow input plumes (most of the high TP values in the box plots of Figure A9). During these periods water clarity typically declines throughout the lake.

Lake trends in total lead and zinc can be traced to inflow trends from the Coeur d'Alene River. For example, the high values of the total lead box plot (Figure A7) are associated with high flow periods. Trends in metal concentrations are complicated to track because of the influence of the St. Joe River moving northward, a river source with low metal concentrations.

A.7 Trace Elements in Lakebed Sediments

Within the northern pool, and south to about Conkling Point, lakebed sediments are highly contaminated in antimony, arsenic, cadmium, copper, lead, mercury, silver, and zinc (Table A3, Woods and Beckwith, 1997). Sediments in southern waters are much lower in metal concentrations and are considered less influenced by metal inflows from the Coeur d'Alene River. Southern waters, however, are not completely isolated from metal-laden inflows from the Coeur d'Alene River, or from wind-driven circulation of contaminated bed sediments from more northern parts of the lake.

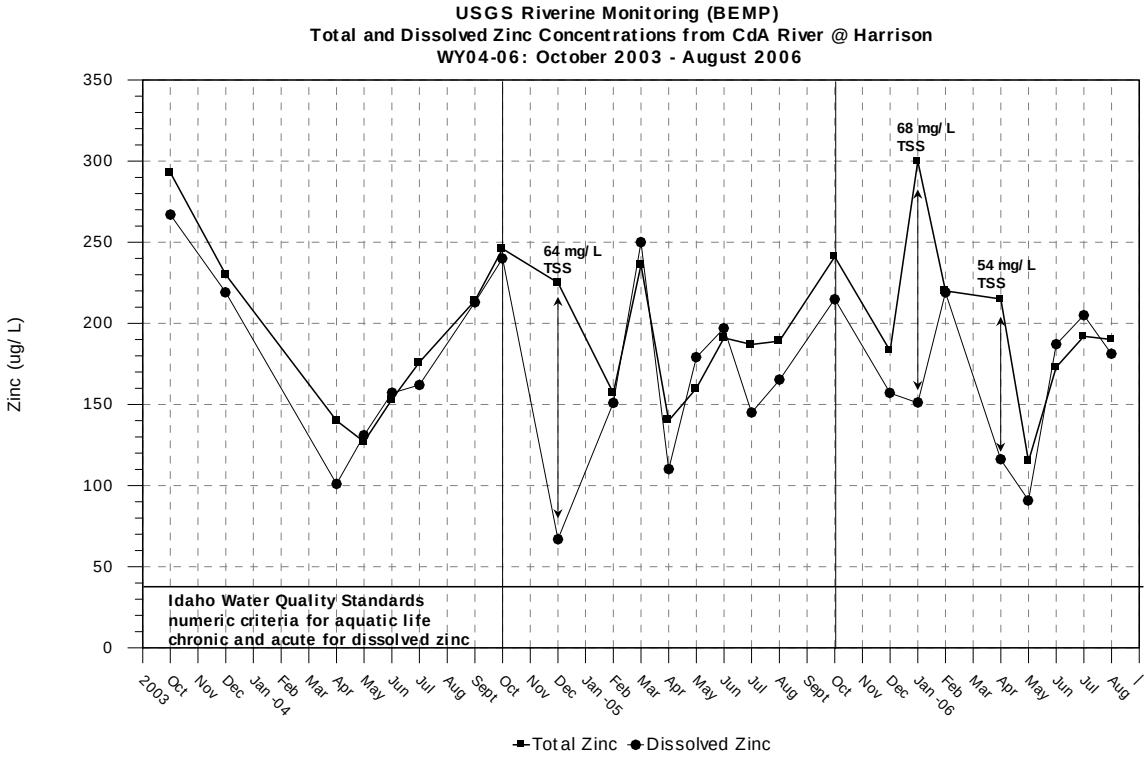

Figure A3. Total and dissolved zinc near the mouth of the Coeur d'Alene River for Water Years 2004 – 2006 as measured by USGS (Brennan *et al*. 2005, Brennan *et al*. 2006, Brennan *et al*. 2007).

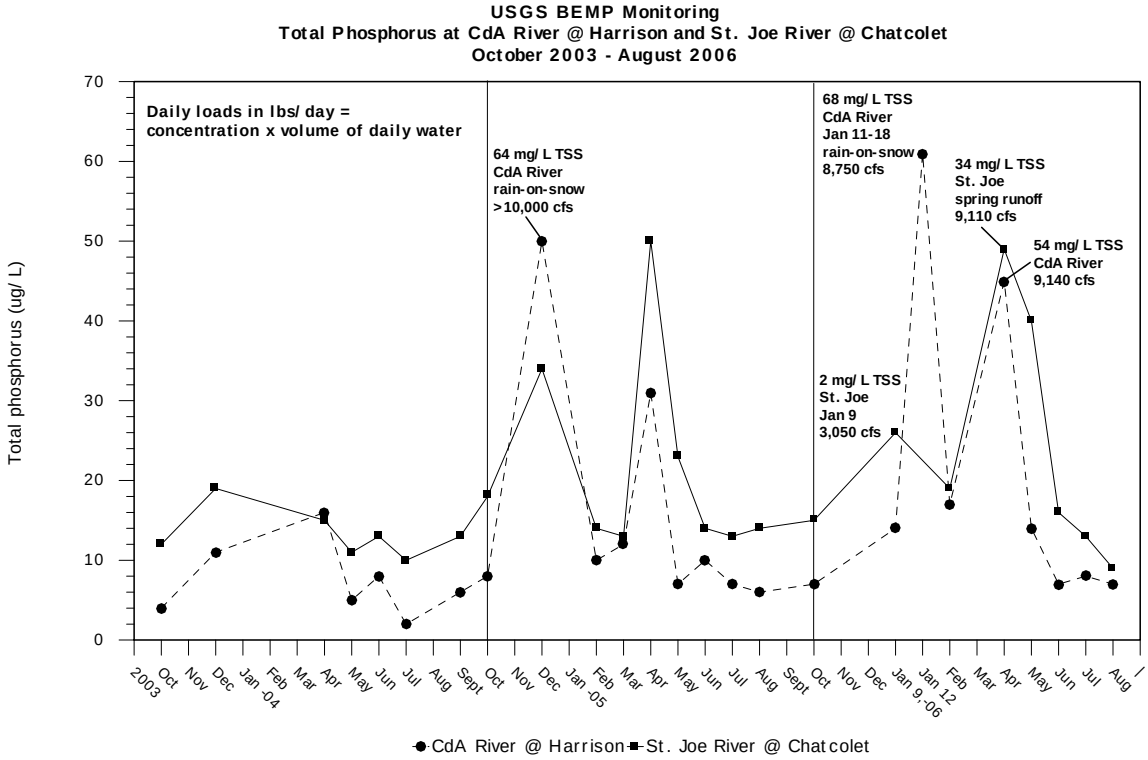

Figure A4. Total phosphorus near the mouths of the Coeur d'Alene River (dashed line) and St. Joe River (solid line) for Water Years 2004 – 2006 as measured by USGS with TP peaks associated with high flow and high TSS events (Brennan *et al*. 2005, Brennan *et al*. 2006, Brennan *et al*. 2007).

Table A3. Statistical summary of selected trace elements in surficial and subsurface lakebed sediments in enriched and unenriched areas, Coeur d'Alene Lake (Horowitz *et al*. 1993, 1995 and Woods and Beckwith, 1997).

[mg/kg, milligrams per kilogram; S, surfical sample; C, subsurface core sample]

Trace Element	Sample Type	Concentration for enriched area (mg/kg)				Median for unenriched areas[1]
		Minimum	Maximum	Mean	Median	
Arsenic	S	2.4	660	151	120	4.7
	C	3.5	845	103	30	12
Cadmium	S	<0.5	157	62	56	2.8
	C	<0.1	137	25	26	0.3
Copper	S	9	215	72	70	25
	C	20	650	91	60	30
Lead	S	14	7,700	1,900	1,800	24
	C	12	27,500	3,200	1,250	33
Mercury	S	0.02	4.9	1.8	1.6	0.05
	C	<0.01	9.9	1.9	0.95	0.06
Zinc	S	63	9,100	3,600	3,500	110
	C	59	14,000	2,400	2,100	118

[1]Unenriched area median concentration for sample type S based on 17 samples from southern area of Coeur d'Alene Lake and lower reach of St. Joe River. Unenriched area median concentration type C based on 189 sample aliquots from cores beneath enriched area.

High concentrations of trace metals within lakebed sediments can be toxic to benthic invertebrates. Studies are ongoing on food web effects from metals within sediments and the concern of human fish consumption and toxicity to migratory birds.

Studies have been conducted on metal-containing compounds within lakebed sediments and sediment pore waters, and on the release of dissolved metals from the sediments into adjacent lake waters (e.g., Kuwabara *et al*., 2000 and Kuwabara *et al*., 2003). This process is termed benthic flux and includes precipitation of solid phase metal compounds back to the sediments.

Benthic flux mechanisms are very complex, variable among the specific metal elements, and not completely understood at this time. It appears that metal containing compounds within and on top of the sediments do release dissolved metals that migrate to the water column immediately above the sediments (Kuwabara *et al*., 2000 and Kuwabara *et al*., 2003). It is uncertain as to what degree high concentrations of both total and dissolved metals near the sediments migrate upward within hypolimnion waters during stratification, or become transferred to upper waters during fall lake turnover. The role of hypolimnetic dissolved oxygen levels during stratification in relation to particulate and dissolved metals in lakebed sediments is discussed in Section A.11.

A.8 Graphical Presentation of Data

For discussions of lake water quality presented in the remainder of this Appendix, there is a series of box plots; they are often used to depict data comparisons between CY91-92 and WY04-06 studies. These box plots were developed from raw data down-loaded from the USGS web site. A diagram of box plots statistics used in this report as computed by SYSTAT software, is shown as Figure A5. One change has been made in this Appendix regarding standard box plot metrics; the geometric mean of data sets is used instead of the median. The geometric mean (average of the logarithmic values of a data set, converted back to a base 10 number), dampens the effect of very high or low values in small sample size data sets compared to calculation of the arithmetic mean. In the CY91-92 data set of limnological variables, USGS used geometric means to assign trophic state to Coeur d'Alene Lake sampling stations (Woods and Beckwith, 1997). The measures and milestone tables of the 2008 LMP (see Section 5.1) also assigns geometric means to limnological variables for desired and trigger conditions.

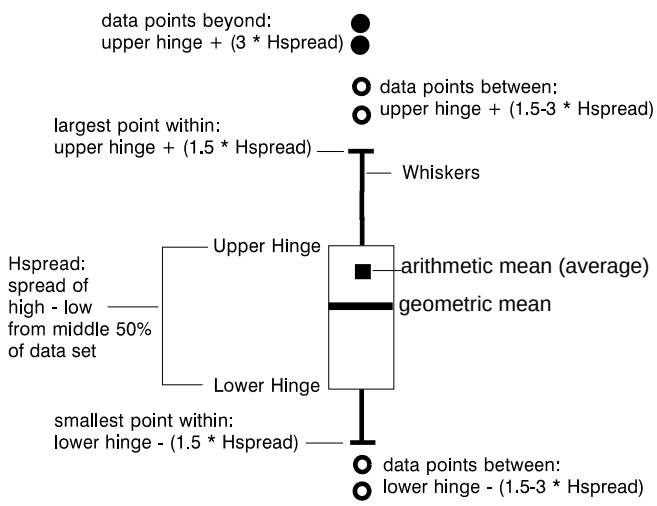

Figure A5. Definitions of box plot statistics used for data presentations within this report.

A.9 Trace Metals within the Lake Water Column

Based on the USGS - WY04-06 data set, concentrations of dissolved zinc within northern pool waters (sites #1, #3, and #4) consistently violate the Idaho Water Quality Standards (WQS) numeric criteria for aquatic life (IDAPA 58.01.02.210, Figure A6 for photic zone samples). Dissolved metals in the WQS are functionally, free ions and chemical compounds which pass through a 0.45 micron filter. The WQS chronic criteria (CCC) and acute criteria (CMC) for dissolved zinc are both 36 µg/L based on an adjustment to 25 mg/L total hardness as $CaCO_3$. The zinc CCC criteria at site #5 (Tribal WQS, 26 – 37 µg/L) is frequently exceeded. For dissolved lead, the CCC criteria is occasionally exceeded within the northern pool and at site #5 (Figure A7). Dissolved cadmium occasionally exceeds the State WQS CCC criteria (0.25 µg/L) at sites #1 and #3, and frequently exceeds the criteria at site #4. The Tribal WQS cadmium criteria (0.073 – 0.096 µg/L) is frequently exceeded at site #5. Dissolved metals criteria are not exceeded at site #6.

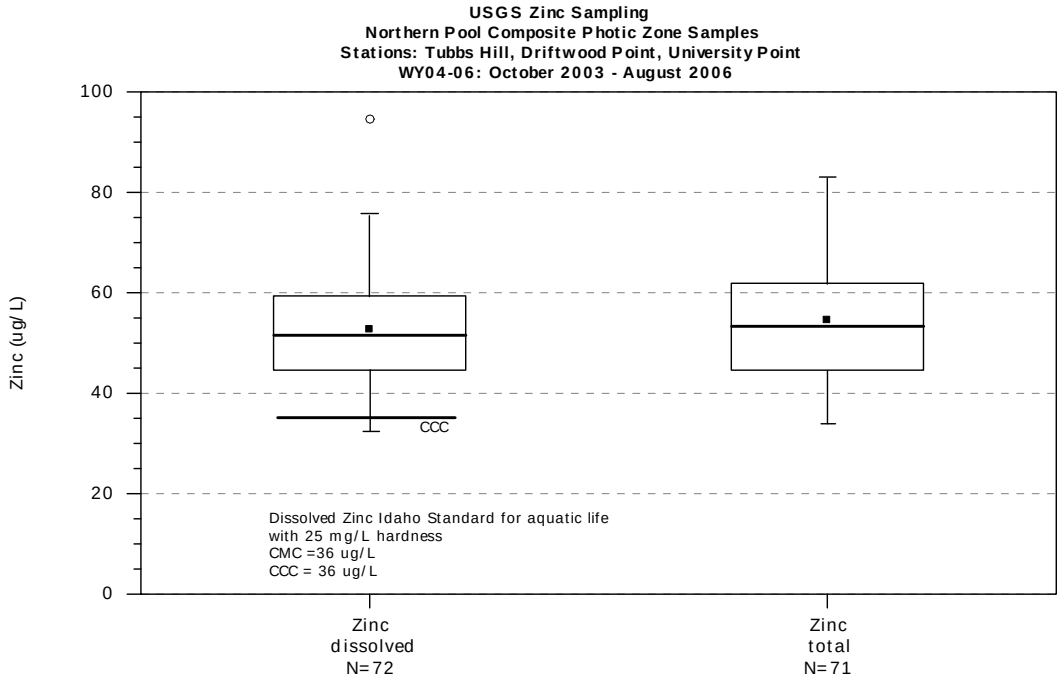

Figure A6. USGS photic zone samples for zinc, data for three northern pool stations combined, WY04-06 study.

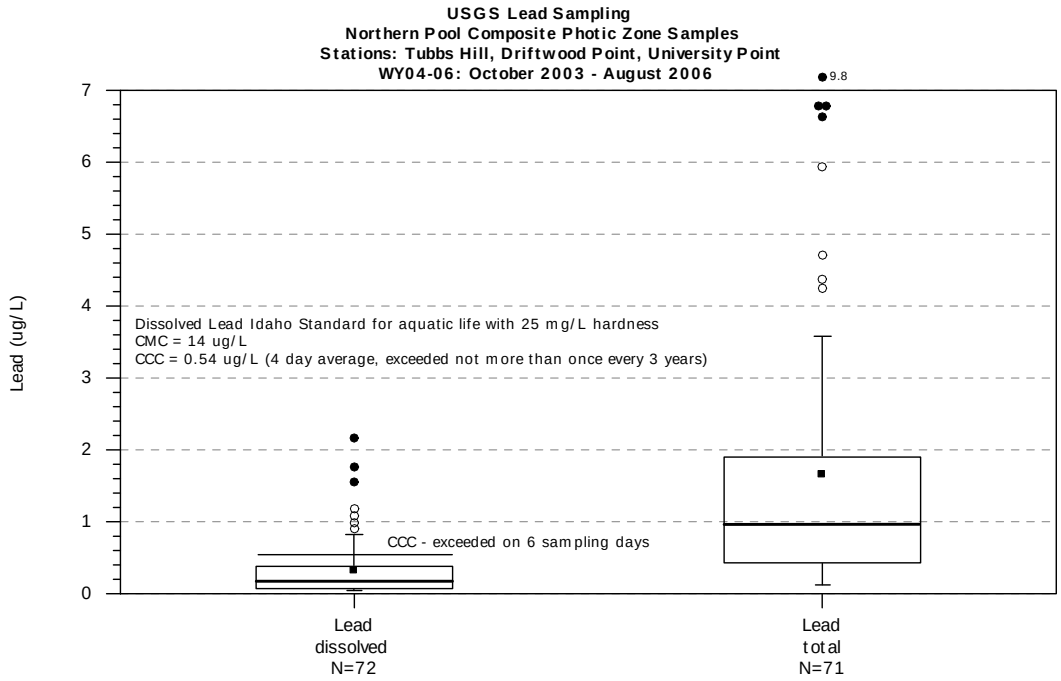

Figure A7. USGS photic zone samples for lead, data for three northern pool stations combined, WY04-06 study.

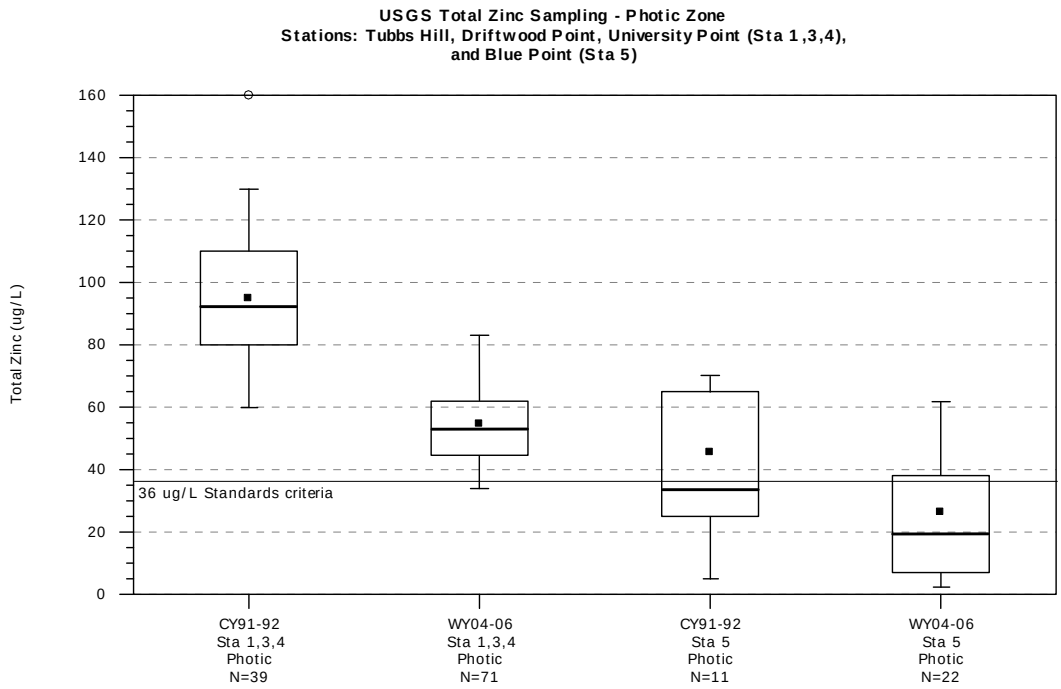

Figure A8. USGS photic zone samples for total zinc; data for three northern pool stations combined, and data for station Blue Point (Station #5). Data is compared between study periods CY91-92 and WY04-06.

Total zinc concentrations (dissolved plus particulate) within photic zone samples (composite samples from the lake surface down to the depth of 1% of incident surface light), when combined for northern pool USGS sampling sites #1, #3, and #4, show a significant decline from CY91-92 data compared to WY04-06 (Figure A8). Dissolved zinc was not measured in CY91-92, but total and dissolved zinc were nearly the same in concentration in WY04-06 data. Geometric mean total zinc in CY91-92 was 92 µg/L (n=39 samples) compared to a geometric mean of 53 µg/L in the latter study (n=72 samples).

The reasons for an apparent zinc decline within photic zone samples between the two baseline studies are subject to further analysis.

Zinc concentrations at USGS site #5 (NE of Conkling Point), fluctuate widely from low concentrations to a maximum of 70 µg/L (Figure A8). This fluctuation is due to a mixed influence of Coeur d'Alene River plumes flowing south, and a St. Joe River plume (with low metal concentrations) flowing north. Dissolved zinc at site #5 often violates WQS criteria (Tribal WQS). Dissolved zinc at site #6 (Chatcolet Lake) does not violate WQS criteria.

Zinc data in the lake is difficult to analyze because of fluctuating trends among seasons, and with depth. Zinc depth profiles were taken by USGS in 1999, and then routinely sampled in WY04-06. Samples were from: the photic zone (a composite sample), 20 m and 30 m (12 m at site #5), 1 m off the bottom, and occasionally a few centimeters off the bottom. Zinc concentrations vary

significantly between depths during summer through fall stratification, as zinc exhibits a pronounced declining trend within photic zone samples from about May through October. This likely represents a sinking of particulate bound zinc from upper waters.

Dissolved zinc is of importance not only from exceedance of WQS, but also because zinc-ion activity can limit, or inhibit phytoplankton productivity within the lake. The mechanism of zinc inhibition to aquatic primary producers is reported as a disruption of phosphate assimilation and phosphate intracellular utilization (Kuwabara *et al*., 2006). Zinc-ion inhibition results in lower chlorophyll *a* concentrations than what might be expected or predicted within Coeur d'Alene Lake. It appears that diatoms, a major phytoplankton component of the lake, have a greater tolerance to zinc-ion activity than other phytoplankton forms (Kuwabara *et al*., 2006).

A.10 Nutrient Concentrations, Phytoplankton, and Water Clarity

Limnological investigations typically categorize a lake with a "trophic state" using in-lake indicator conditions of: total phosphorus, chlorophyll *a* (as measured by phytoplankton biomass), water clarity, and at times nitrogen. An "oligotrophic" lake is generally: low in nutrient concentrations (phosphorus and nitrogen), low in phytoplankton productivity with minor blue-green algae populations, and high in water clarity during summer through fall months. A "eutrophic lake" is generally: high in nutrients, high in phytoplankton productivity, often includes blooms of nuisance blue-green algae, and is low in water clarity. Table A4 presents the trophic state classification used for CY91-92 Coeur d'Alene Lake studies (Woods and Beckwith, 1997). This table may be used to compare data presented for the lake.

Table A4. Trophic-state classification based on open-boundary values for four limnological variables (as published in Woods and Beckwith, 1997).

Limnological variable[a]		**Oligotrophic**	**Mesotrophic**	**Eutrophic**
Total phosphorus (µg/L)	geometric mean gm ± 1 SD	8.0 4.8 – 13.3	26.7 14.5-49.0	84.4 48.0 – 189.0
Total nitrogen (µg/L)	geometric mean gm ± 1 SD	661 371 – 1,180	753 485 – 1,170	1,875 861 – 4,081
Chlorophyll *a* (µg/L)	geometric mean gm ± 1 SD	1.7 0.8 – 3.4	4.7 3.0 – 7.4	14.3 6.7 – 31.0
Secchi-disc transparency (m)	geometric mean gm ± 1 SD	9.9 5.9 – 16.5	4.2 2.4 – 7.4	2.4 1.5 – 4.0

a = annual geometric mean values and standard deviations

A.10.1 Nutrients

Total phosphorus (TP) concentrations of photic zone samples for northern pool sites combined, during CY91-92, had a geometric mean of 3.3 µg/L; a concentration depicting an oligotrophic condition. For WY04-06 sampling, TP was slightly higher with a geometric mean of 5.8 µg/L (Figure A9).

At site #5, geometric mean TP increased between the study periods from 6.1 µg/L in CY91-92 to 11.2 µg/L in WY04-06.

At site #6 there is a substantial and statistically significant shift to higher TP concentrations between study periods with a TP geometric mean of 9.0 µg/L in CY91-92 versus 18.6 µg/L in WY04-06. Reasons for this increase need to be explored.

During major winter rain-on-snow events, or during the rising limb of spring run-off, total phosphorus concentrations within the lake can show significant increases. This is due to material brought in by high river and stream flows, and possibly by rising lake waters inundating shorelines that have been dry during winter months. TP in northern pool sites can measure between 15 – 25 µg/L during these periods, and at sites #5 and #6, TP can reach 30 – 45 µg/L.

Total nitrogen data for CY91-92 studies is considered as a low, oligotrophic condition with geometric means lake-wide mostly less than 300 µg/L TN, and maximum values less than 1,000 µg/L (refer to Table A4). Nitrogen data for the WY04-06 study is still in the process of being evaluated for comparison with the CY91-92 study period. Nitrogen compounds play important roles within the lake. This can include: 1) a subsurface source of dissolved inorganic nitrogen from drainfield wastewater (containing ammonia and nitrate), where flow into nearshore areas can fuel growth of rooted aquatic plants, and 2) the nutrient role for phytoplankton growth and assemblage composition, as algae respond within a seasonal range of in-lake Nitrogen:Phosphorus ratios. The existing N:P ratio can dictate whether it is phosphorus or nitrogen that is the nutrient limiting phytoplankton growth.

A.10.2 Phytoplankton

Phytoplankton biomass is commonly assessed by measuring chlorophyll *a* concentrations within algae retained on a water filter. Analytical methods by the USGS national laboratory to determine chlorophyll *a* were different between study periods CY91-92 (high-performance liquid chromatography, HPLC), and WY04-06 (chromatographic-fluorometric, C-F). This change in analytical methods presents some difficulties for comparisons between the two study periods. USGS paired-sampling, with samples analyzed by the two methods, resulted in a regression equation converting CY91-92 HPLC values to C-F values (C-F = 0.45801 + 0.92047 * HPLC, $r^2 = 0.59$). Adjustment to C-F values averaged around 0.4 µg/L higher than the HPLC data set. The data analysis in following paragraphs and Figure A10 has made and utilized the C-F conversion of CY91-92 data for comparison with the WY04-06 data set.

In CY91-92, chlorophyll *a* values at all lake sites within the photic zone were very low. At northern pool sites the range of values was narrow with the geometric mean and arithmetic mean around 0.9 µg/L (Figure A10). At sites #5 and #6 the data had slightly higher values, with geometric and arithmetic means ranging from 1.1 – 1.3 µg/L.

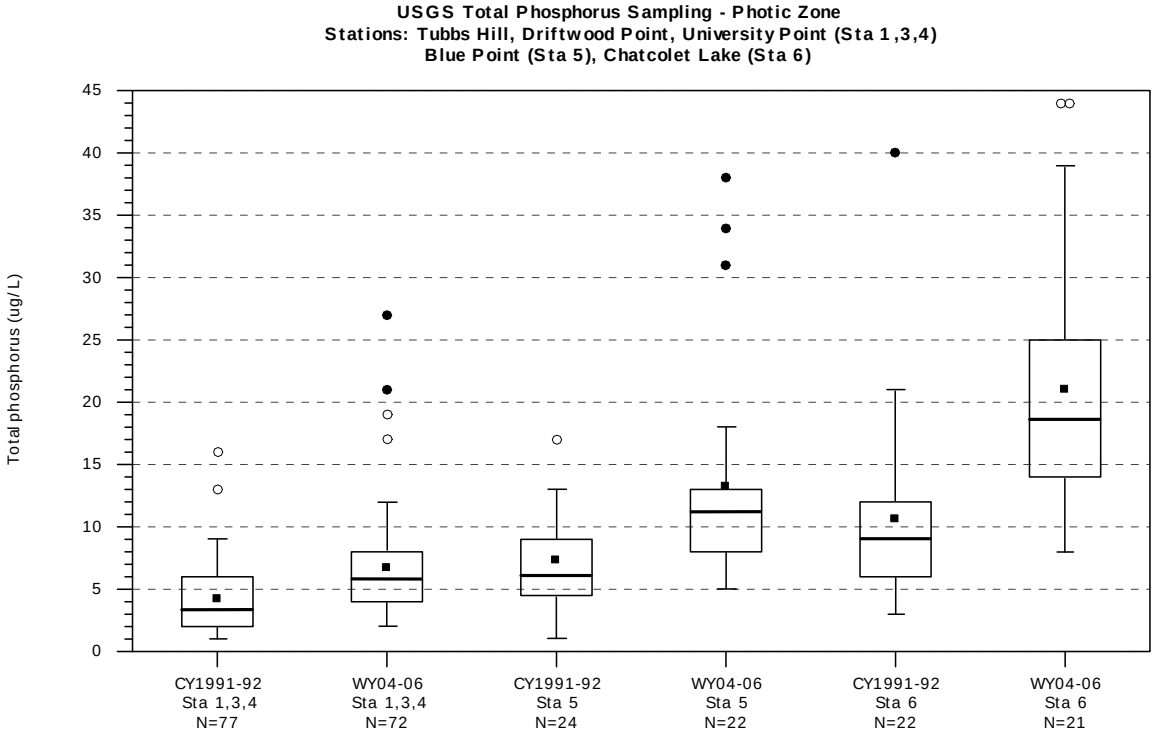

Figure A9. USGS photic zone samples for total phosphorus: data for three northern pool stations is combined, and also data for stations at Blue Point and Chatcolet Lake. Data is compared between study periods CY91-92 and WY04-06.

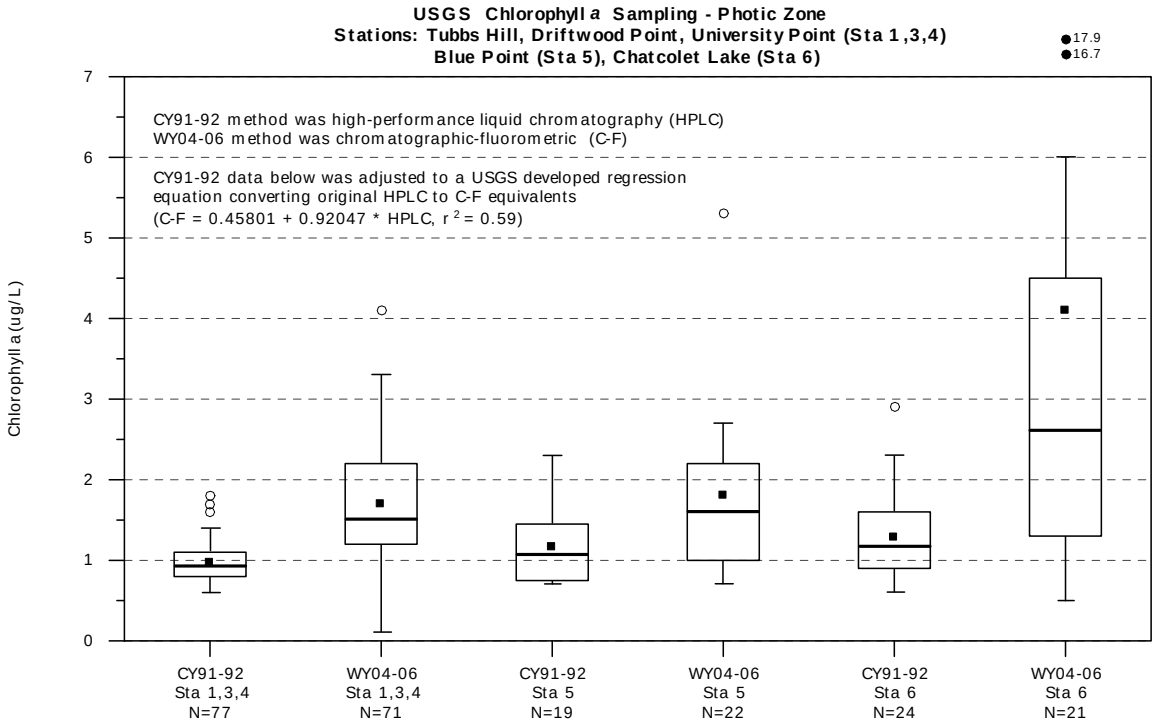

Figure A10. USGS photic zone samples for chlorophyll *a*: data for three northern pool stations is combined, and also data at stations Blue Point and Chatcolet Lake. Data is compared between study periods CY91-92 and WY04-06.

In WY04-06, chlorophyll *a* concentrations throughout the lake were greater. At northern pool sites and site #5, the geometric means were around 1.5 μg/L (about 50% higher than the CY91-92 concentrations). At site #6 there was a wide spread of reported chlorophyll *a* values, with a geometric mean of 2.9 μg/L and an arithmetic mean of 4.1 μg/L (around 3 times greater than CY91-92). Spikes in chlorophyll *a* at site #6 have been from late summer through fall compared to spring peaks at northern pool sites.

Reasons associated for the increase in chlorophyll *a* between study periods are not clear, and will be the subject of further analysis.

There can be a significant subsurface peak of chlorophyll *a* during summer months, commonly found within the cooler waters of the thermocline (metalimnion). This peak is called chlorophyll metalimnetic maxima, a common occurrence in lakes.

Samples for phytoplankton identification and enumeration were taken during the USGS study period of CY91-92. Diatoms were the predominant algal group throughout the seasons at all sites. The Cyanophyta (blue-green algae, now called cyanobacteria) were incidental or absent at sites 1 – 5. At site #6, blue-green species constituted at least 10% of the phytoplankton density (expressed as cells/ml or colonies/ml) during summer months of 1991 and 1992. The blue-green alga of dominance was *Anabaena flos-aquae*, a common blue-green species in smaller, mesotrophic lakes of northern Idaho.

Samples for phytoplankton identification and enumeration were not part of the routine monitoring during WY04-06. The USGS research project of dissolved zinc effects on phytoplankton (Kuwabara *et al*., 2006) included samples for phytoplankton composition taken in June 2004. Two sites were sampled, one at the outlet of Chatcolet Lake, the other at USGS site #5. Comparing this one set of samples with those taken in CY91-92 showed a couple of contrasts of note, although caution is taken because of different taxonomists. Within these southern waters, the green algae *Chorella minutissima* was a dominant alga in 2004 but was not reported in CY91-92 samples. Five of seven blue-green species identified in 2004 were not recorded in CY91-92.

A.10.3 Water Clarity

Water clarity as measured by the qualitative method of Secchi disc transparency has been measured continuously since 1991 (including July to October, 1995 – 2002, by DEQ). In both USGS baseline study periods, photosynthetically active radiation (light transmission and attenuation) through upper waters was also measured by solar radiation sensor equipment. This method determines the depth underwater at which there is 1% of the light incident on the waters surface, or the theoretical primary producer photic zone.

Water clarity follows a seasonal pattern of being low during significant rain-on-snow events and spring peak flow, and then clearing to reach clarity peaks from July through October. At northern pool sites, minimum clarity ranges around 2 – 4 m Secchi depth (Figure A11), with 1% photic zone depths ranging 5 – 10 m. From mid summer through fall, Secchi depths can range from 9 – 12 m, with 1% photic zone depths ranging 15 – 21 m.

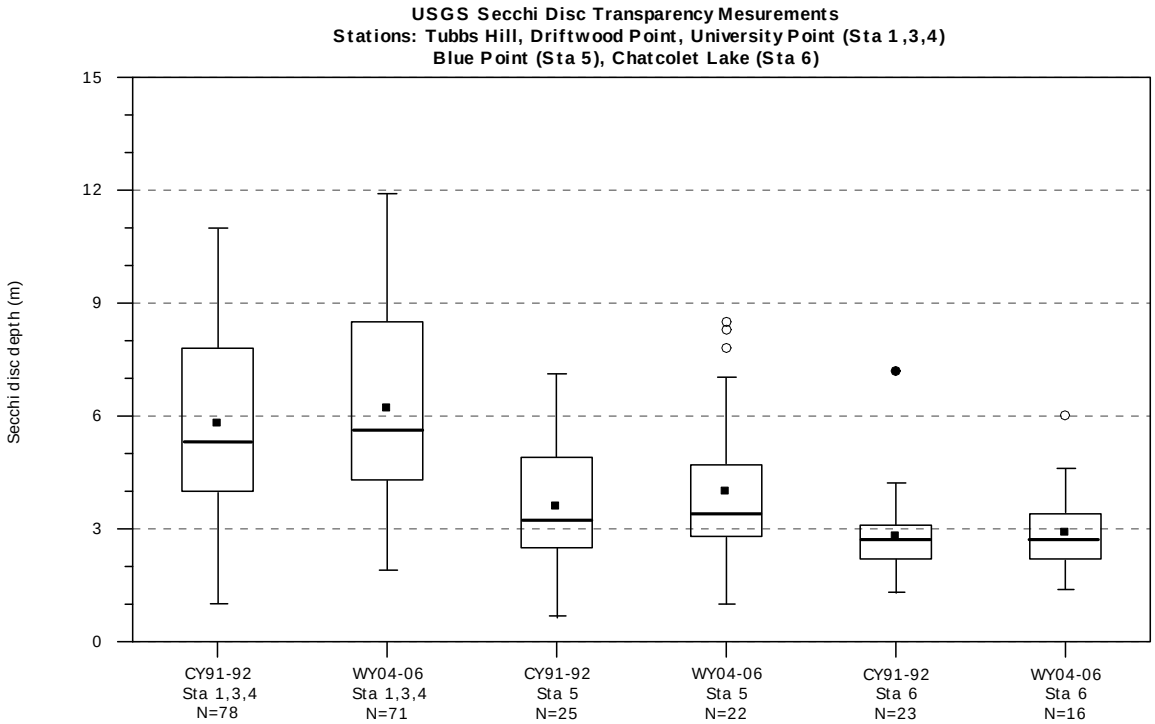

Figure A11. USGS measurements of Secchi disc transparency: data for three northern pool stations combined, and also data for stations Blue Point and Chatcolet Lake. Data is compared between study periods CY91-92 and WY04-06.

At sites #5 and #6, periods of lowest clarity are similar to northern sites, but during periods of improved lake clarity, the southern two sites do not reach the transparency observed in northern sites.

Combining all seasonal data for WY04-06, the geometric mean Secchi disc depth for northern sites was around 6 m, while at site #5 the geometric mean was 3.4 m, and at site #6, 2.7 m. Seasonally combined data show minimal differences at all sites between WY04-06 and CY91-92.

A.11 Dissolved Oxygen

Dissolved oxygen (DO) profiles at northern pool stations, during early summer through late fall stratification, show a hypolimnetic condition of consumed oxygen by bacterial decomposition of organic material and chemical oxidation (Figure A12a with 70% DO saturation in bottom-most waters). During stratification there is minimal DO replenishment from the atmosphere until fall turnover. By October, with the lowest hypolimnetic DO concentrations of the stratified season, percent DO saturation can decline to around 60% (Figure A12b). However, numerous October profiles show that DO concentrations remain above 6 mg/L within the hypolimnion down to near the bottom sediments. Deep water areas of Coeur d'Alene Lake experience fall turnover, or complete mixing of water layers, in November.

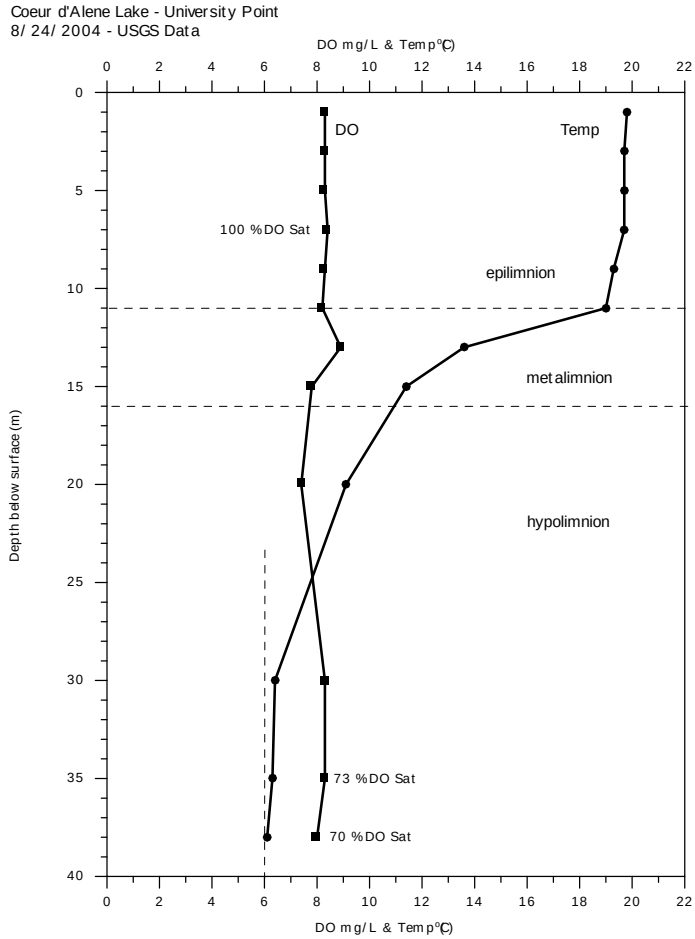

Figure A12a. Dissolved oxygen and water temperature profiles at University Point sampling station (#4) on August 24, 2004.

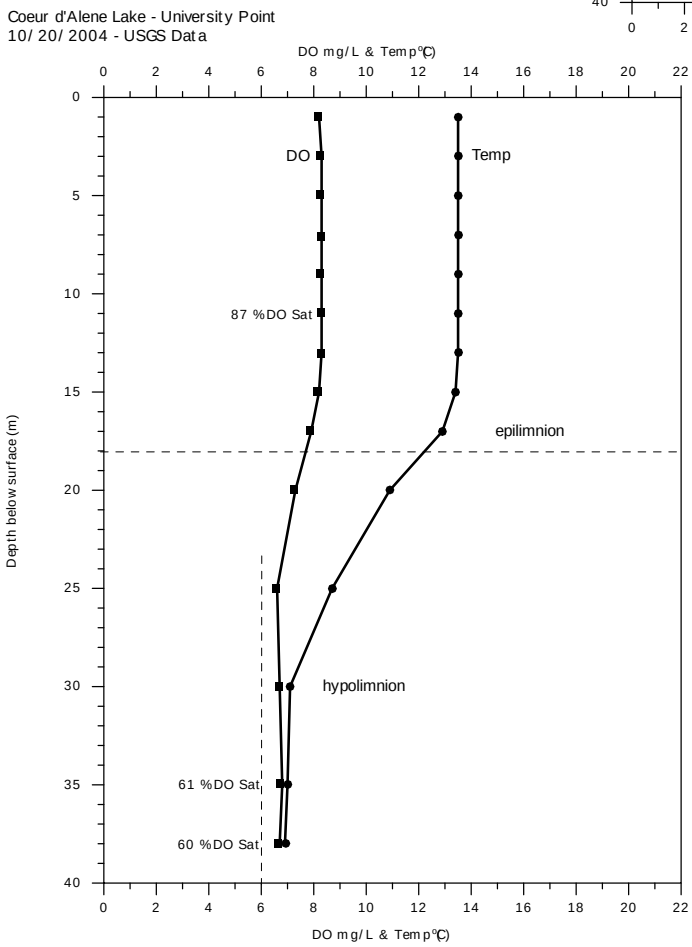

Figure A12b. Dissolved oxygen and water temperature profiles at University Point sampling station (#4) on October 20, 2004.

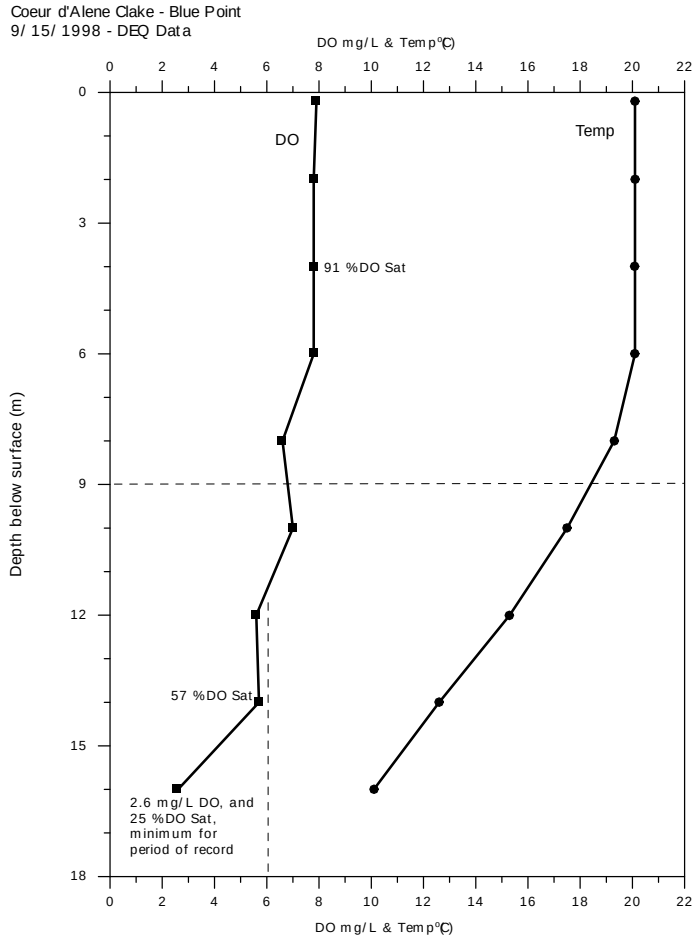

Figure A12c. Dissolved oxygen and water temperature profiles at Blue Point sampling station (#5) on September 15, 1998 (DEQ data).

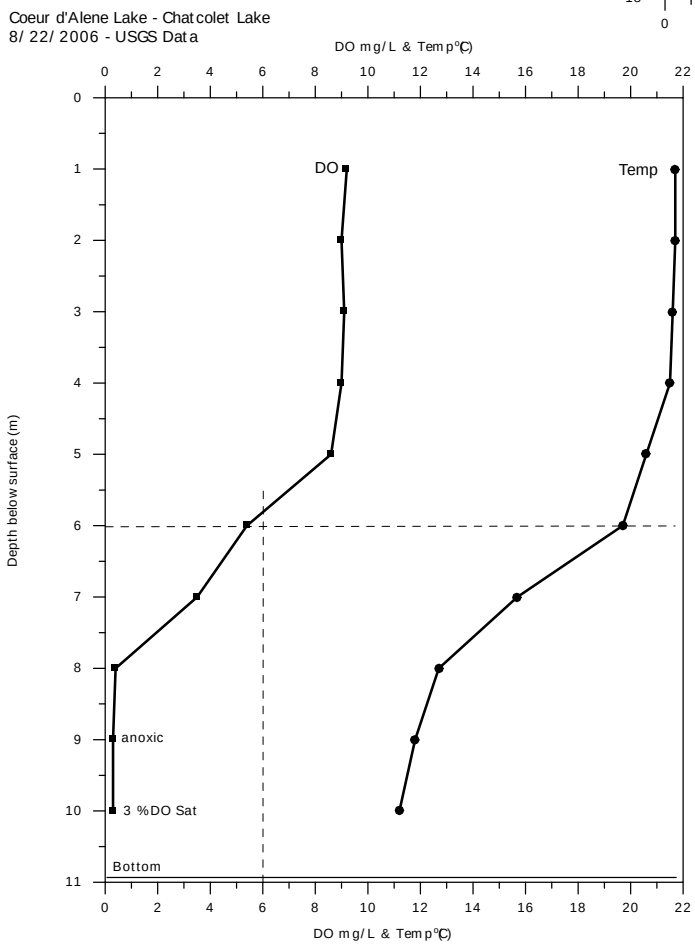

Figure A12d. Dissolved oxygen and water temperature profiles at Chatcolet Lake sampling station (#6) on August 22, 2006.

DO profiles at site #5 (15–17 m station depth), exhibit concentrations below 6 mg/L within the hypolimnion. Some profiles taken in late summer have ranged from 6 - 2.5 mg/L DO within the bottom 3 meters of water (Figure A12c). By late October, temperatures and DO are fairly uniform as fall turnover has occurred in shallower lake areas.

During warm, calm periods, profiles at site #6 (10-11 m station depth) show the development of a thermocline and low DO within the bottom few meters. Several summer profiles have shown DO <1.0 mg/L within the bottom 3 meters (Figure A12d). Samples of phosphorus and nitrogen compounds taken 1 m off the bottom under these anoxic conditions can be quite high, establishing the potential for internal nutrient loading during a wind driven turnover event.

Comparing DO data between CY91-92 and WY04-06, there were no significant differences at any of the sampling sites between study periods.

Current knowledge considers that oxic conditions within the hypolimnion serve to minimize the mobilization of dissolved metals coming from the lakebed sediments. With hypolimnetic anoxic conditions (i.e., DO <1.0 mg/L), changes in redox potential, microbial metabolism, and chemical reactions within lakebed sediments would result in an increase of solubilities for some particulate metal compounds (e.g., ferric oxide complexes) and therefore an increased release rate of dissolved metals (Kuwabara *et al*. 2000, Kuwabara *et al*. 2003, Toevs *et al*. 2006, La Force *et al*. 1999). In lakes without a history of mining related metals input, hypolimnetic anoxia results in significant sediment release of ferrous (Fe^{+2}) and manganous (Mn^{+2}) constituents, along with orthophosphate (PO_4^{-3}).

Excess phosphorus and nitrogen loading into a lake from upland watershed land use activities can fuel aquatic plant growth. In spring through fall, as phytoplankton cells die and sink to the bottom, bacteria decompose this organic material utilizing dissolved oxygen which is not replenished during lake stratification (i.e., hypolimnetic oxygen demand). Also, organic material brought into the lake, both as dissolved organics and particulate organics as a component of suspended sediment, settles to the lake bottom and adds to the dissolved oxygen demand. The goal of the 2008 LMP is aimed at keeping metals in bottom sediments insoluble by maintaining an oxic condition in the hypolimnion, by minimizing both the fueling effect of incoming nutrients on lake plant growth, and minimizing external organic loads.

Another importance of maintaining or improving the currently observed DO profile under stratification is for fisheries management because 6 mg/L DO is about the lower limit of salmonid tolerance. Preventing anoxic lower waters also caps lakebed particulate-bound phosphorus from dissolving and entering lower lake waters (i.e., internal phosphorus loading).

A.12 Eurasian Watermilfoil

Within the southern lake shallows, Eurasian milfoil (*Myriophyllum spicatum*), and/or a hybrid of Eurasian milfoil and a native milfoil species, has become established and can be found in dense beds within some areas. Scientists from the Coeur d'Alene Tribe have performed extensive aquatic plant identification, mapping, and biomass measurements. In 2006 and 2007, initial control treatments were conducted in the densest Eurasian milfoil stands, including: herbicide applications, diver suction removal, diver hand removal, and bottom barriers.

Establishment of dense Eurasian milfoil stands can have significant ecological effects within the lake. These include: crowding out native aquatic rooted plants, and increasing internal nutrient loading by assimilating sediment nutrients (phosphates and nitrogen) through the root system and then releasing these into the water upon senescence (die-back) in the fall.

A.13 EPA Lake Data from 1975

While 1975 data is only three sampling events (at eight lake stations), the resulting data indicate a considerable difference compared to CY91-92 and WY04-06 studies, with 1975 exhibiting a more eutrophic lake condition. EPA classified Coeur d'Alene Lake as mesotrophic based on their sampling, where in CY91-92 USGS classified the lake as oligotrophic.

Total phosphorus measured by laboratory methods has long been a fairly consistent and reliable constituent for analysis. TP data in 1975, within the photic zone and combined over the sampling events for five northern pool stations (n=14 samples), results in a geometric mean of 14 μg/L. This is about triple the average TP concentrations in the CY91-92 and WY04-06 study periods. Data combined for 2 southern stations in 1975 gave a geometric mean of 24 μg/L TP, again higher than observed in later years by USGS.

Chlorophyll *a* analysis in 1975, by EPA, would have had different laboratory methodology and equipment available compared to samples analyzed by the USGS laboratory. Thus, caution is needed for comparisons. Still, the differences are dramatic. With 1975 data combined for five northern pool stations, chlorophyll *a* geometric mean was 8.0 μg/L, and April samples ranged from 18 – 32 μg/L. Again, this compares to a range of geometric means of 0.9 – 1.5 μg/L in USGS studies. Levels of 1975 chlorophyll *a* may have been under a condition of higher dissolved zinc than measured in USGS studies (zinc was not analyzed by EPA).

Secchi disc measurements taken in July and September of 1975 may corroborate a northern pool condition of greater phytoplankton biomass than observed in later studies. Secchi disc measurements at northern pool stations ranged from 2.5 to 5.8 m maximum, at least one-half the average clarity from 1991 on.

As cited in the USGS report from CY91-92 studies (Woods and Beckwith, 1997), examination of phytoplankton data from both a 1971 study and the 1975 EPA sampling, indicated that the presence of Cyanophyta within the lake had declined substantially in the latter years.

Examination of the northern pool dissolved oxygen profiles taken on September 9, 1975, show the minimum hypolimnetic DO level at 7.0 mg/L.

A.14 Conclusions on Current Trophic State

Given conventional limnological parameters of total phosphorus, total nitrogen (CY91-92 data), chlorophyll *a*, water clarity, and dissolved oxygen profiles, the northern pool remains as an oligotrophic water body: low in nutrient concentrations and primary productivity, good summer water clarity, and oxygen levels above 6 mg/L in bottom waters during stratification. However, zinc concentrations within the water column are still high, and there are times when dissolved lead and cadmium exceeds WQS criteria for aquatic life.

WY04-06 data for southern lake waters shows significantly higher values for total phosphorus and chlorophyll *a* compared to CY91-92 data. WY04-06 data trends toward a mesotrophic classification, or moderately productive.

Further water quality investigations may be warranted within shallow bays. The draft USGS report of WY04-06 studies will present water column data from sampling of selected bays, and it appears that overall, there are no statistically significant differences between bay sampling data compared to the nearest open water, deep sampling sites. This is not an uncommon result when attempting to assess bay conditions with water column sampling (for example, in Priest Lake, Rothrock and Mosier, 1997).

Any localized impacts in bay environments could be related to subsurface wastewater treatment systems, runoff from increasing land disturbance through development on the shorelines, or water quality of inflowing tributaries affected by watershed land uses (such as agriculture). Bay studies to assess impacted conditions may have to focus on examining near-shore sedimentation rates, growth patterns of rooted aquatic plants, and growth of attached algae (periphyton) on natural substrates and artificial structures such as pilings. However, these can be difficult and expensive scientific endeavors, in particular, assessment of groundwater percolation into localized near-shore areas that may be impacted by subsurface wastewater. USGS did some periphyton measurements and statistical correlations from selected bays in the CY91-92 studies, and this work could be expanded upon in future investigations.

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Appendix B – Core Routine Monitoring and Special Studies for the Coeur d'Alene LMP

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B.1 Core Routine Monitoring Program

Coeur d'Alene Lake

In June 2007, DEQ and the Tribe began a routine monitoring program within Coeur d'Alene Lake. This program is a continuation of baseline monitoring and studies conducted by the USGS and Tribe from October 2003 through August 2006 (Wood and Beckwith, under review), and an earlier baseline study conducted from January 1991 through December 1992 (Woods and Beckwith, 1997). The 2003 – 2006 studies (Water Years 04–06) were funded by an EPA Clean Water Act grant whose funding ended in 2006. DEQ and the Tribe, as part of the ongoing effort to develop and implement the 2008 LMP, agreed to continue monitoring at key USGS sites with the goal of providing a long-term, annual trend record of key water quality parameters in support of the LMP goal and objectives. Tribal staff samples stations in Tribal jurisdiction waters of the southern lake and lower St. Joe River, and DEQ staff samples northern pool waters within State jurisdiction.

Regional staff of the EPA has participated in this continued monitoring effort. The EPA staff secured agreements and made arrangements for the EPA Manchester Laboratory (in Port Orchard, WA) to receive and analyze samples for concentrations of trace metals, certain minerals, and chlorophyll *a*. DEQ and the Tribe secured laboratory facilities and have funded the analysis of samples for nutrient concentrations and phytoplankton identification/enumeration. The Tribe selected Spokane Tribal Laboratory for their nutrient analysis, DEQ selected SVL Analytical (Kellogg, ID), and both selected TG EcoLogic (an LLC arm of TerraGraphics) for phytoplankton samples.

DEQ and the Tribe jointly prepared a Quality Assurance Project Plan (QAPP) according to EPA guidelines, and submitted the QAPP to EPA for approval. The document was approved in June, 2007 (DEQ and CdA Tribe, 2007). The QAPP was designed to not only address quality assurance/quality control (QA/QC) issues, but to serve as the initial work plan for the 2007 monitoring season. The approved QAPP can be viewed at the DEQ web site, www.deq.idho.gov. In preparation for the 2008 monitoring season, EPA required an amended QAPP, and this document was approved in January 2008.

<u>Sampling Locations and Frequency</u>

DEQ selected two of the USGS reference sites in the deep waters of the northern pool for continued monitoring. These were sampling sites 1, located southeast of Tubbs Hill, and 4, located northeast of University Point (see Figure B1 and Table B1). The Tribe retained USGS site 5, located mid-lake between Browns Point and Shingle Bay (labeled NE of Blue Point by USGS), and site 6 in Chatcolet Lake. The Tribe also added a new site, designated SJ1, on the lower St. Joe River.

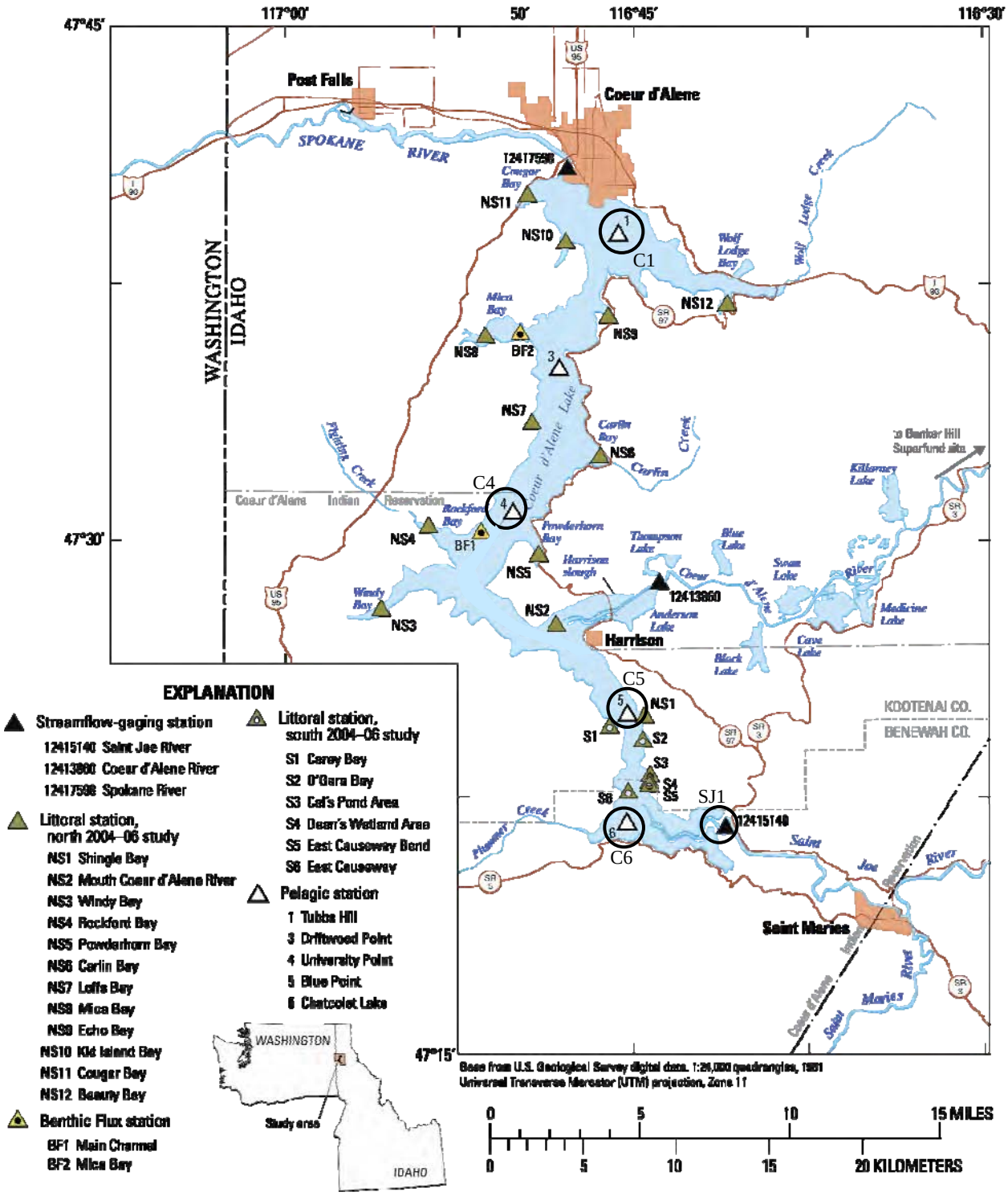


Figure B1. Map showing sampling sites for the 2007 and beyond Coeur d'Alene Lake Monitoring Program (circled); map provided by USGS for WY04-06 sampling program (under review).

Table B1. Sampling locations of the 2007 and beyond Coeur d'Alene Lake Monitoring Program

USGS Site #	USGS site number, location, and approximate depth	Latitude	Longitude
C1	473900116453000 Coeur d'Alene Lake – 1.3 miles southeast of Tubbs Hill near Coeur d'Alene, ID Depth: 40 meters*	47° 39' 00"	116° 45' 30"
C4	473054116500600 Coeur d'Alene Lake – 1.7 miles northeast of University Point near Harrison, ID Depth: 40 meters*	47° 30' 54"	116° 50' 06"
C5	472500116450000 Coeur d'Alene Lake – mid lake between Browns Point and north end of Shingle Bay near Harrison, ID (NE of Blue Point by USGS). Depth: 17 meters*	47° 25' 00"	116° 45' 00"
C6	472120116451000 Chatcolet Lake - 0.4 miles northwest of Rocky Point near Plummer, ID Depth: 11 meters*	47° 21' 20"	116° 45' 10"
SJ1**	Lower St. Joe River - ~100 m upstream of USGS gage 12415140 near Chatcolet, ID Depth: 18 meters*	47° 21' 27"	116° 41' 10"

*At full summer pool, lake surface elevation 2128 feet
**New Tribal sampling site within lower St. Joe River

The schedule of sampling events was established at eight (8) sampling visits per calendar year (Table B2). The timing of sampling visits coincides with specific river flow and lake conditions of interest throughout the year. DEQ and the Tribe coordinate their respective field sampling events so that they both are conducted during the same week. The lake sampling schedule matches fairly closely the USGS sampling scheme at the mouths of the Coeur d'Alene and St. Joe Rivers under the EPA Coeur d'Alene Basin Environmental Monitoring Plan (BEMP, EPA, 2004a). The BEMP began in October 2003 to evaluate the long-term effects of cleanup actions as part of the Bunker Hill Superfund site remediation process.

Field Measurements Taken

At each site, field measurements taken include Secchi disc transparency depth and the 1% light compensation depth of Photosynthetically Active Radiation (PAR, as measured by radiation sensor equipment to identify the theoretical photic zone depth). Field measurements also include depth profiles of water temperature, dissolved oxygen (DO), percent DO saturation, pH, specific conductance, and chlorophyll *a* fluorescence, as measured by Hydrolab® DS5X instrumentation.

Table B2. Annual sampling visits for the Coeur d'Alene Lake Monitoring Program (selection of 8 sampling events below)

Sampling visits	Season	General Schedule	Lake condition
1	winter - early spring	December - March	unstratified; prior to spring peak runoff; potential opportunity to sample during major rain-on-snow lake inflow event.
2	winter - early spring	January - March	unstratified; prior to spring peak runoff; second opportunity to sample during major rain-on-snow lake inflow event, or early spring peak runoff.
3	spring	late March – early June	during spring peak runoff, opportunity to sample strong riverine influences on the lake; spring pulse of diatom growth develops.
4	late spring	mid to late June	onset of stratification, spring pulse of diatom growth; before the onset of strong thermal stratification.
5	summer	mid to late July	strong thermal stratification is established; sample the development of a metalimnetic chlorophyll *a* maxima; for some years, the peak of epilimnetic temperatures and thermocline thickness.
6	summer	mid to late August	for some years, the peak of epilimnetic temperatures and thermocline thickness; declines in dissolved oxygen near bottom may become evident; phytoplankton peaks might start to develop at stations C5 and C6.
7	late summer	mid to late September	phytoplankton growth waning in northern pool, and still-strong thermal stratification in northern pool; DO deficit at C5 may be at maximum for season.
8	fall	mid to late October	within northern pool, thermocline is deep but stratification still persists; DO deficits near bottom are still evident and often exhibit the peak of DO deficit for the season; waters of C5 and C6 have undergone fall turnover, and phytoplankton growth may still be at its peak.
9	early winter	late-November or early December	unstratified (lake has undergone fall turnover); water quality data fairly uniform from top to bottom, and not yet affected by a rain-on-snow event (usually).

Water Samples for Chemical Constituents

Water quality constituents that are sampled and analyzed for are shown in Table B3. Not all constituents are analyzed within every sampling depth zone. Table B3 shows laboratory method and target reporting limits from the three laboratories for the constituent list.

Sampling for water quality constituents will entail using a 2.2 Liter, non-metallic Kemmerer-style sampler. Sample depths and constituents analyzed will be similar to those used for the WY04-06 USGS study. The four anticipated sampled depth zones are:

1. **Photic Zone Composite:** five equally spaced samples from 1.0 m below the surface to the depth where underwater PAR is 1% of the light incident on the surface, composited into a churn splitter.

2. **Zone of Maximum Chlorophyll *a*:** a discrete sample collected at the depth of maximum chlorophyll *a* fluorescence if so determined by the Hydrolab® profile. During stratification, on about four of the yearly sampling visits, there has been observed in both the USGS WY04-06 program, and the first year of the Tribe/DEQ program (2007), a pronounced peak of chlorophyll *a* fluorescence within the metalimnion.

3. **Discrete sampling at 20 m and 30 m for northern pool stations**: USGS sampled at these depths, and a trend of interest was that zinc concentrations vary considerably from upper waters to bottom waters from about April – October.

4. **1 meter above lake bottom:** a discrete sample with sampling depth determined from the Hydrolab® profile.

Coeur d'Alene and St. Joe Rivers

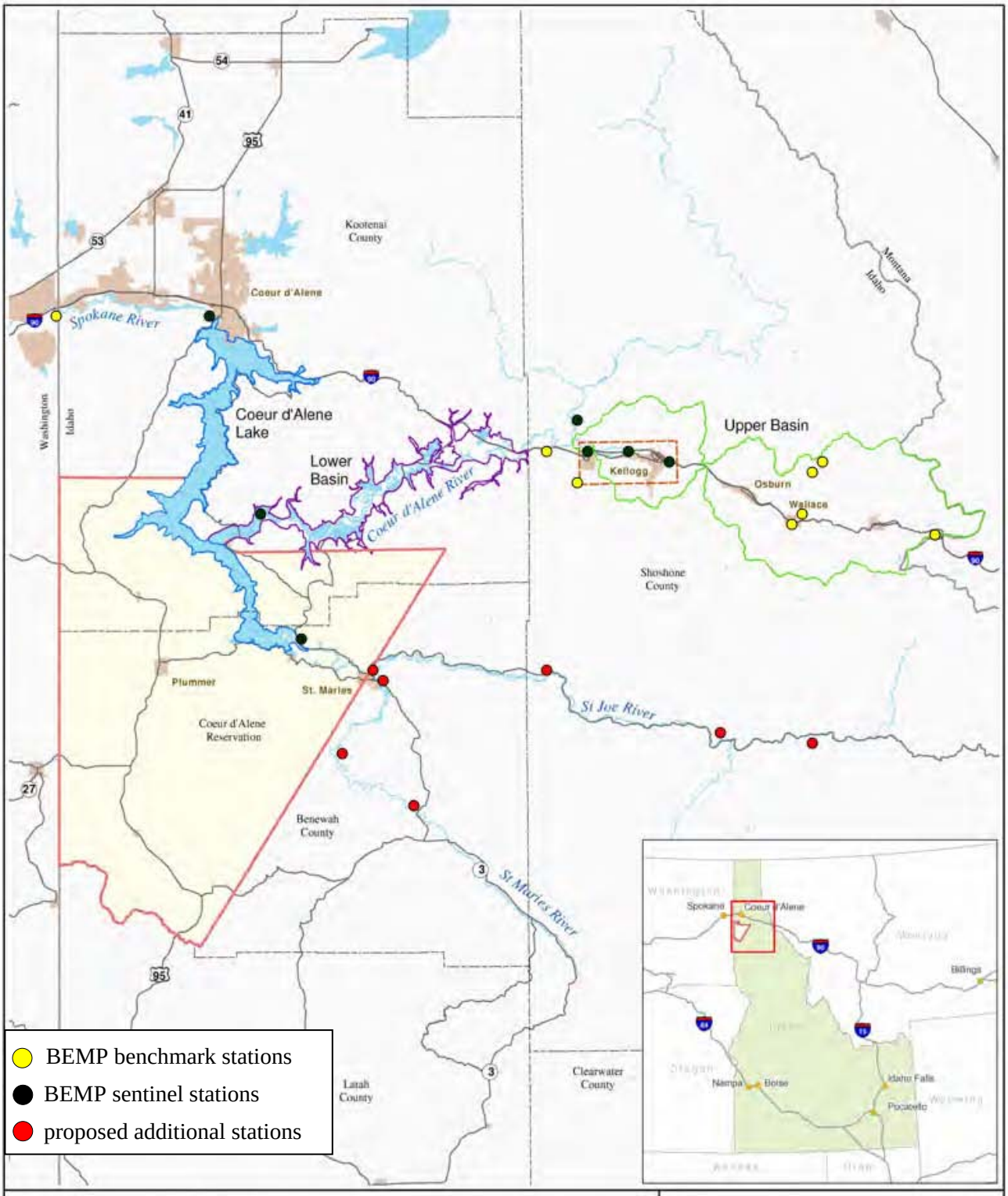
EPA funds the USGS to monitor flow, sediment, mining-associated contaminants, and nutrient transport within the Coeur d'Alene and St. Joe Rivers, and at the lake's outlet to the Spokane River, under the BEMP (EPA, 2004a). The BEMP monitoring network on the Coeur d'Alene River includes four sentinel sites (monitored 7-8 times each year) from Elizabeth Park on the South Fork Coeur d'Alene River to the mouth of Coeur d'Alene River near Harrison (Figure B2). There is one sentinel site on the North Fork Coeur d'Alene River. There is a sentinel site on the St. Joe River near the mouth, and a sentinel station at the lake's outlet. Several of the sentinel sites have continuous flow gauging stations, and some have real-time transmission of data.

DEQ and the Tribe obtain annual BEMP data as an important source of water quality information for concentrations of constituents coming into the lake, and as a comparison to concentrations measured within the lake. Annual phosphorus and nutrient loads (calculated in pounds per day) can be estimated from site data near the mouths of the two rivers. Flow and water quality data from BEMP will continue to be integrated into ELCOM-CAEDYM modeling efforts.

Table B3. Analytical methods and data quality for analytes of the Coeur Lake Monitoring Program (NOTE: target reporting limits are the values used by the EPA Manchester Lab, Spokane Tribal Lab, and SVL Analytical for the 2007 monitoring year).

Analyte	Analytical Method	Target reporting limit	Precision & Accuracy/ completeness
Nutrients	***Spokane Lab / SVL Analytical***	***Spokane / SVL***	
ammonia, dissolved[a]	EPA 350.3 / EPA 350.1	10 µg/L	+/- 25% 95%
nitrite+nitrate, dissolved[a]	EPA 353.2	10 / 15 µg/L	
total nitrogen–	USGS I-2650-03 / SM[b] D-5176	50 µg/L	
total phosphorus	EPA 365.3 / SM 4500-P-E	5 / 2 µg/L	
total dissolved phosphorus[a]	EPA 365.3 / SM 4500-P-E	5 / 2 µg/L	
orthophosphate, dissolved[a]	EPA 365.5 / SM 4500-P-E	2 µg/L	
Total recoverable metals, unfiltered, digested		***EPA Manchester Lab***	
cadmium	EPA 200.8 – ICP-MS	0.13 µg/L	+/- 25% 95%
lead	EPA 200.8 – ICP-MS	0.13 µg/L	
zinc	EPA 200.8 – ICP-SAS	5.0 µg/L	
arsenic	EPA 200.8 – ICP-MS	0.63 µg/L	
iron	EPA 200.8 – ICP-SAS	5.0 µg/L	
manganese	EPA 200.8 – ICP-MS	0.13 µg/L	
Dissolved metals, filterable, undigested[a]		***EPA Manchester Lab***	
cadmium	EPA 200.8 – ICP-MS	0.10 µg/L	+/- 25% 95%
lead	EPA 200.8 – ICP-MS	0.10 µg/L	
zinc	EPA 200.8 – ICP-SAS	5.0 µg/L	
arsenic	EPA 200.8 – ICP-MS	0.20 µg/L	
iron	EPA 200.8 – ICP-SAS	5.0 µg/L	
manganese	EPA 200.8 – ICP-MS	0.10 µg/L	
Minerals		***EPA Manchester Lab***	
total hardness (as $CaCO_3$)	SM 2340B	0.30 mg/L	
calcium, dissolved	EPA 200.7 – ICP-AES - mod. scan	30 ug/L	+/- 25% 95%
magnesium, dissolved	EPA 200.7 – ICP-AES - mod. scan	50 ug/L	
Biological		***EPA Manchester Lab***	
chlorophyll *a*	SM 1002G – fluorometric	1.0 µg/L	+/- 25% 95%
Biological	***TG Eco-Logic***		
phytoplankton	SM 1002 C-F – identification /enumeration with sedimentation and 1500 magnification	n/a	n/a

a = Samples will be field filtered through a 0.45 µm pore size capsule filter for dissolved analysis
b = Standard Methods for the Examination of Water and Wastewater



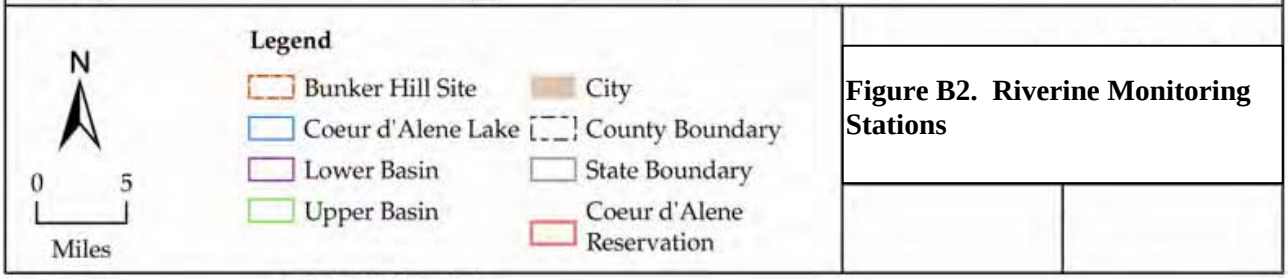


Figure B2. Riverine Monitoring Stations

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DEQ and the Tribe believe that additional riverine monitoring stations are needed within the LMP core monitoring program, or to the BEMP, or to the existing USGS network of sampling sites (Figure B2). Additional riverine sites are needed to better evaluate nutrient source loading, and to conduct the basin-wide nutrient inventory (see Section 3.3). One prevailing example is where the existing monitoring network suggests a general area of moderate to high nutrient loading, but the network is not adequate enough to further pinpoint an area of contribution. This appears to be the case for the southern end of the lake where phosphorus concentrations at lake station C6 (Chatcolet Lake) were significantly higher in WY04-06 studies compared to CY91-92 data. The St. Joe River as measured near its' mouth, can have fairly high nutrient loading. Although the Tribe has added station SJ1 (Table B1), there are still insufficient monitoring stations upstream to partition the nutrient load.

Historically, USGS has maintained flow gauging stations on the St. Joe River system at Red Ives Ranger Station (river mile 103), Calder (mile 43, upstream of the St. Maries River confluence), the St. Maries River at Santa (mile 24.6 on St. Maries), and the reestablished lower St. Joe site (for the BEMP) near Chatcolet (mile 5.4). For the DEQ/Tribe monitoring program, the Tribe added a sampling station near the lower St. Joe USGS gage site. Previous monitoring at this 18 m site, and other deep river sites upstream, has shown summer stratification and periodic dissolved oxygen deficits in lower waters (approaching anoxia). This degree of dissolved oxygen deficit is uncommon for other large rivers in northern Idaho.

In recent years water quality samples at the USGS Calder and St. Maries River sites have not been taken. It might benefit the understanding of nutrient loading sources into the southern lake if at least on a short-term basis, the water sampling program could be reinstituted at Calder, and that a new gauging and sampling site be established near the mouth of the St. Maries River. The St. Maries River watershed includes considerable land in agriculture and grazing use relative to other portions of the St. Joe drainage. Also, it would be beneficial for nutrient load analysis if the St. Maries Wastewater Treatment Plant (WWTP) obtained monthly samples for phosphorus and all nitrogen constituents (ammonia, nitrate, TKN) during periods of discharge to the St. Joe River (see discussion below for the Page WWTP).

In the CY91-92 USGS studies, a considerable phosphorus and nitrogen load to the Coeur d'Alene River was assigned to the Page WWTP which discharges to the South Fork below Smelterville (Woods and Beckwith, 1997). An improved estimation of WWTP nutrient loading to the Coeur d'Alene River can now be made with the combination of the BEMP network, and recent NPDES permit requirements for the Page and Smelterville treatment plants to sample phosphorus and nitrogen constituents monthly. DEQ has begun preliminary load estimations down the Coeur d'Alene River beginning at the Elizabeth Park sampling site based on WY04-06 data. Nutrient load estimates down the river corridor do however incorporate high uncertainty due to the lack of water quality samples from Pine Creek (below Amy Gulch), and Coeur d'Alene River at Cataldo. These two are BEMP benchmark sites, and they are scheduled to be sampled once every 5 years.

One point of interest in evaluating the BEMP data is an apparent phosphorus spike contribution between the Elizabeth Park and Smelterville sampling stations (upstream of the Page and Smelterville WWTPs). Some local residents have suspected (and even sampled) a phosphorus contribution coming from what's called the "Smelterville seeps". This nutrient source will be investigated as part of the LMP nutrient inventory (Section 3.3).

Tributaries

Sampling of selected tributaries, streams flowing directly into the lake or into the two rivers, will be part of the basin-wide nutrient inventory (Section 3.3). Based on inventory results, and also from previously collected data, some tributaries may become part of the long-term core monitoring program.

With the apparent increase of phosphorus concentrations at Chatcolet Lake station C6 between study years CY91-91 and WY04-06, an estimate of nutrient loading from tributaries flowing into the southern lake, and an assessment of the impact of this loading, needs to be developed. The Tribe has conducted sampling on Plummer, Fighting, Benewah, and Lake Creeks. Plummer and Fighting Creeks were monitored in the CY91-92 studies.

Very little sampling data exists for tributaries to northern pool waters. Wolf Lodge and Carlin Creeks were part of the monitoring effort in the CY91-92 studies. From visual observations, many tributaries to the lake exhibit turbid water conditions during rain-on-snow and spring peak flow events. Nutrient and suspended sediment sampling is warranted for northern pool tributaries that are on the §303(d) list of impaired waters and have EPA approved TMDLs (DEQ, 1999). These are Wolf Lodge, Cougar, Kid, and Mica Creeks.

B.2 Technical Tools to Support Lake Management Efforts

Computer Modeling

Researchers from USGS and the Centre for Water Research – University of Western Australia, applied a 3-dimensional hydrodynamic model, Estuary and Lake COmputer Model (ELCOM) to reproduce the hydrological regime in Coeur d'Alene Lake. ELCOM was coupled to the Computational Aquatic Ecosystem Dynamics Model (CAEDYM) to simulate lake processes, such as benthic flux of metal contaminants to/from lakebed sediments, and the interactive effects of dissolved zinc on algal productivity. Final reports of this research have been completed and submitted to EPA and the BEIPC (Dallimore *et al*., 2007 and Hipsey *et al*., 2007).

In general, the ELCOM-CAEDYM model simulates important processes within the lake system such as: 1) inflow loading of metals/nutrients and river plume flow through the lake, 2) sediment-water interactions, 3) primary production, and 4) organic matter cycling within the water column. In addition the model can be used to predict dissolved oxygen profiles which can be validated with actual data. Utilization of the model will greatly enhance understanding of the complex dynamics within the lake system, and has the potential for predictive results based on future land use changes within the lake basin.

Utilization of ELCOM-CAEDYM could result in monitoring efficiencies. If continued validation shows that predicted dissolved oxygen profiles are accurate, this may lessen staff hours needed for field profiling. If metal and nutrient concentrations within the lake can be satisfactorily predicted, this may free staff time from routine sample collection to specific short-term studies for answering unknown, key questions (e.g., pinpointing high nutrient input sources).

Meteorological Stations and In-lake Water Quality Sensors

The ELCOM-CAEDYM model utilizes meteorological information in its calculations. To date, meteorological stations have not been established on the lake (previous data used was from the Coeur d'Alene airport weather station, which does not adequately describe conditions on the lake). The quality of weather data specific to the lake would be greatly enhanced by having meteorological stations installed at the southern and northern end of the lake.

One example of newer technology is the Lake Diagnostic System (LDS), a meteorological station installed on the lake surface by a buoyed platform. The LDS can provide real-time weather data (i.e., continuous collected data transmitted to office receivers). In Idaho, an LDS has been installed in Brownlee Reservoir operated by the U.S. Bureau of Reclamation.

The LDS can also include an array of underwater sensors that measure water temperature and dissolved oxygen at multiple depths. A sampling array of sensors would provide an enhanced data set for the computer model, and could free up staff resource time now used to profile these parameters in the field.

B.3 Special Studies to Answer Key Questions

In addition to the core routine monitoring described in Section B.1, there is value in pursuing special studies to answer key questions that relate directly to the LMP objectives. While nutrient management is the primary LMP focus, this does not preclude an LMP effort to consider and be involved in issues of "whole lake health." This would include the effect of metals concentrations within the lake column that can affect aquatic life. The list of special studies listed below will improve knowledge and understanding of nutrient cycling, metals release from sediments, food web toxicity, and septic drainfield impacts. This is consistent with the recommendations from the National Research Council (NRC/NAS, 2005). At the same time, there are opportunities for research that could support LMP goals.

<u>Synoptic Sampling to Validate/Refine the ELCOM-CAEDYM Model</u>

Validation and refinement of the ELCOM-CAEDYM model will improve the model's predictive ability, making the model a more powerful management tool. Data from the core routine monitoring program may not be sufficient to validate and refine the ELCOM-CAEDYM model to predict lake conditions at temporal and spatial scales needed to make management decisions. Synoptic sampling that is not covered in the core routine monitoring program will provide "snapshots" of conditions from randomly selected sites in Coeur d'Alene Lake following meteorological events (e.g., rain-on-snow, wind storms). This will provide the data to validate the model's ability to predict variables (e.g., temperature, dissolved oxygen, chlorophyll *a*,) at spatial and temporal scales outside the core routine monitoring program.

<u>Southern Lake Shallows – Rooted Aquatic Plants</u>

Tribal scientists have been surveying and mapping rooted aquatic plant communities within southern waters, including collection of data on biomass and nutrient content of submersed plant species. In this effort they have discovered infestations of the invasive species Eurasian

watermilfoil and also a hybrid of Eurasian milfoil with the native northern milfoil. Beginning in 2006, the Tribe applied integrated milfoil control treatments in selected areas of southern waters. It is important that aquatic plant surveying and noxious weed control programs continue.

Northern Bays – Rooted Aquatic Plants

With the discovery of Eurasian milfoil in southern waters, it is important to establish a program of surveillance and mapping of rooted plant communities within bays of the northern pool. There are many areas of northern pool bays that would be susceptible to the establishment of Eurasian milfoil. Some mapping efforts have been performed by the Kootenai County Noxious Weed Department.

Nutrient Cycling by Rooted Aquatic Plants

Studies are needed to investigate the role of rooted aquatic plants in the shallows of the southern lake as nutrient contributors. Internal nutrient cycling and loading occur by rooted plants assimilating sediment nutrients (phosphates and nitrogen) through the root system, and then releasing these into the water upon senescence (die-back) in the fall.

Northern Bays – Water Quality Sampling and Nearshore Studies

In both the CY91-92 and WY04-06 studies, selected bays around Coeur d'Alene Lake were sampled on a rotational basis for water quality parameters. Bay sampling was also conducted by DEQ in the years of 1995 – 2002. Based on preliminary results presented in the draft scientific report from the WY04-06 studies, it appears that overall there were no statistically significant differences between bay water column data compared to the nearest open water, deep sampling sites. As discussed in Appendix A, this is not entirely an unexpected or uncommon result. At this point in time DEQ does not contemplate adding any bay, water column sampling sites to a routine monitoring program. Consideration will be given to periodic sample events within selected bays; a selection process based on evaluation of previously collected data.

Based on information that will be collected during the basin-wide nutrient inventory (Section 3.3), DEQ may conduct nearshore studies that could include: sampling of attached algae on natural and artificial substrates, sampling of nearshore lake sediment pore water, looking for areas of rooted aquatic plants that indicate enrichment by subsurface nitrate, and possibly establishing a few shallow monitoring wells near the shoreline.

Lakebed Sediments – Sediment Coring

Coeur d'Alene Lake is the ultimate sink for mining-contaminated sediments transported from the Silver Valley and lower Coeur d'Alene River. Extensive lakebed sediment sampling, geochemical analysis and radiometric dating of deep cores was conducted in 1989-90 by the USGS (Horowitz *et al*., 1993 and 1995). Repeating such sampling on a periodic basis would permit a comparison between pre- and post- 1990 trace element data. This comparison could be used to determine if any of the completed and/or ongoing Superfund remediation efforts have had a statistically significant effect on sedimentation rates, and sediment-associated metals concentrations.

Benthic Flux of Metals

More investigation, similar to the initial USGS studies on the benthic flux of metals from lakebed sediments (Kuwabara et al., 2000), is needed to improve our understanding. It is still uncertain as to what degree metals become dissolved within lakebed sediments, and then migrate to adjacent lake waters and become distributed through the water column. Also uncertain is the fate of the continuous metals load from the Coeur d'Alene River. What portion of the inflowing metals are incorporated in either particulate organic material (e.g., zinc absorbed by phytoplankton), or particulate inorganic materials (e.g., adsorbed onto ferric oxide compounds), and then eventually sink to the bottom?

Toxic Effects of Metals on Benthic Invertebrates

Some work has been done in this area, but it is uncertain to what degree metals in both dissolved and particulate states within sediments have altered the benthic community from the expected natural population assemblage.

Exposure and Bio-magnification of Metals

Studies to determine exposure and bio-magnification of metals within the aquatic food web of Coeur d'Alene Lake are needed. Analysis of fish tissue samples taken from the lake in 2002 detected lead, mercury, and arsenic at levels that may affect certain people's health. The Idaho Department of Health & Welfare and Coeur d'Alene Tribe issued a public fish consumption advisory in 2003 based on this sampling.

On-site Wastewater Disposal

An up-to-date survey and mapping of subsurface sewage disposal systems around the lake perimeter, including: individual septic tank drainfields, community drainfields, and Large Soil Adsorption Systems is needed. This project utilizes a Panhandle Health District (PHD) database of subsurface wastewater permits, and incorporates the data within GIS software format, including overlays of slope, soils, and underlying geology. A DEQ contract with both PHD and the Tribal GIS department is already in place to produce this updated inventory and mapping in GIS format.

A survey and mapping of subsurface systems would be utilized by DEQ and Tribal staff to calculate an estimated nutrient loading to Coeur d'Alene Lake by subsurface wastewater. This evaluation would include identified "hot spots" of suspected high nutrient loading areas and wastewater impacts to the lake. The subsurface evaluations may then lead DEQ and the Tribe to conduct water quality studies in suspected areas of impact.

Land Use/Land Cover Inventories

Periodic land use/land cover inventories and analysis using current technology (e.g., remote sensing and imagery) are needed. It is important to characterize and quantify nutrient sources as a function of land use/land cover for effective development and implementation of TMDLs at the stream reach, sub-watershed, and watershed levels.

Flooded Shallows and Wetlands

There are shallow areas of the southern lake such as Hepton Lake that were wetlands or historical farmlands, that are now flooded in summer and fall months. This flooding is because of Post Fall Dam operations that maintain a consistent summer pool of 2,128 feet elevation. There is a thought that these flooded areas might be nutrient contributors to the lake. The Tribe will be designing an investigation to explore this possibility in the Hepton Lake area. Also, there are completed and proposed projects that convert agriculture lands back to wetland habitat for waterfowl and other migratory birds. The question has arisen if these newly flooded lands are nutrient contributors. Again, this could be an area of water quality investigations.

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Appendix C – Management Action Tables

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The Management Action Tables (MATs) were first published in the 1996 Coeur d'Alene LMP. These were developed by numerous individuals in the government, business, and private sectors; working within Technical Advisory Groups for broad land use categories such as: forest practices, wastewater, and agriculture. Management action items within the tables are a compilation of current rules, regulations, recommendations, BMPs, and other actions that play a role in water quality management of Coeur d'Alene Lake and its tributaries. A column titled "Lead Group," identified government agencies and other entities who would take the lead for implementing individual action items.

In 2002, there was an effort to update and revise the 1996 MATs by advisory workgroups. Revised tables were published in a draft *Coeur d'Alene Lake Management Plan Addendum*. The 2002 draft LMP was never published as a final document.

In 2006, staff from the Tribe and DEQ began a collaborative project to assess the level of implementation of action items in the tables. The revised 2002 tables were used to develop questionnaires and to conduct personal interviews with representatives of Lead Group entities, listed in the tables.

The draft 2008 tables reflect recommended changes from the 1996 and 2002 versions, based largely on information collected through the interview process. Some action items were deleted because the actions had been fully implemented; other were deleted based on solid reasoning gained from the interviews or in some cases, redundancy across multiple tables. Some action items were reworded based on unclear language or other recommended rewording by those interviewed. Some action items were combined into a single item, again based on redundancy.

In these tables, wording in normal font is retained from the 2002 tables. Wording in *italicized font* indicates changes made for the draft 2008 version. At the end of each general land use table there are comments or a rationale for each recommended item, primarily based on information gained during the interviews.

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Acronyms and Abbreviations used in Management Tables

ACOE	U.S. Army Corps of Engineers
AVISTA	rename of Washington Water & Power
BEIPC	Coeur d'Alene Basin Environmental Improvement Project Commission (formed in 2002)
BSWCD	Benewah Soil & Water Conservation District
BC	Benewah County
BIA	U.S. Bureau of Indian Affairs
BLM	U.S. Bureau of Land Management
BMP	Best Management Practices
CAC	Citizen's Advisory Committee for CBIG
CCC	Citizen's Coordinating Council for BEIPC
CBIG	Coeur d'Alene Basin Interagency Group (1990 - 1996)
CBRP	Coeur d'Alene Basin Restoration Project (1991 - 1996)
CIA	Central Impoundment Area
Cities	Collectively, cities within the Coeur d'Alene Lake Basin: Coeur d'Alene, Pinehurst, Kellogg, Osburn, Wallace, Mullan, Harrison, Plummer, Saint Maries
CLCC	Clean Lakes Coordinating Council
Cons-Part	Agriculture Conservation Partnership comprised of the KSSWCD, BSWCD, NRCS, and the ISCC
Counties	Collectively, counties that are within the Coeur d'Alene Lake Basin; Benewah, Kootenai, and Shoshone
CRBC	Coeur d'Alene River Basin Commission
CWA	Federal Clean Water Act
CWE	IDL's Cumulative Watershed Effects protocol
EPA	U.S. Environmental Protection Agency
Fire Dist.	*Local Fire Districts*
Forest-industry	*Collectively: non-industrial private forest landowners, Industrial Timber companies (e.g., Potlatch, Stimson, Forest Capital, Inland Empire Paper), forest associations such as Associated Logging Contractors and Intermountain Forest Association, contractors, and forest product industries*
FPA	Idaho Forest Practices Act
FSA	USDA Farm Service Agency
Hwy-Dists	Collectively, Highway Districts with jurisdictions within the Coeur d'Alene Lake Basin: Worley, East Side, Plummer-Gateway.
IDEQ	Idaho Department of Environmental Quality
IDFG	Idaho Department of Fish & Game
IDL	Idaho Department of Lands
IDPR	Idaho Department of Parks & Recreation
IDWR	Idaho Department of Water Resources
ILB	Idaho Land Board
INFISH	Inland Native Fish Strategy
INLT	Inland Northwest Land Trust
IPNF	Idaho Panhandle National Forest

ISCC	Idaho Soil Conservation Commission
ITD	Idaho Transportation Department
KC	Kootenai County
KCPW	Kootenai County Parks & Waterways
KMPO	*Kootenai Metropolitan Planning Organization*
KSSWCD	Kootenai-Shoshone Soil & Water Conservation District
Legislature	Idaho State Legislature
LHTAC	*Local Highway Technical Assistance Council*
LSAS	*Large Soil Absorption System*
NAS	*National Academy of Sciences*
NIBCA	North Idaho Building Contractors Association
NPDES	National Pollutant Discharge Elimination System
NRCS	USDA Natural Resource Conservation Service
PAC	Panhandle Area Council
PHD	Panhandle Health District
PLRCD	Panhandle Lakes Resource Conservation and Development
SC	Shoshone County
State	State of Idaho
SAWQP	State Agriculture Water Quality Program (now WQPA)
SPZ	Stream Protection Zone (in FPA)
SWCD	Soil & Water Conservation Districts
TNC	The Nature Conservancy
TMDL	*Total Maximum Daily Load*
Tribe	Coeur d'Alene Tribe
T2 Center	Idaho Technology and Transfer Center
UI - CES	University of Idaho, Cooperative Extension Service
U of I	*University of Idaho*
USDA	United States Department of Agriculture
USFS	U.S. Forest Service
USFWS	U.S. Fish & Wildlife Service
USCG	*U.S. Coast Guard*
USGS	U.S. Geological Survey
WPCA	Water Pollution Control Account
WQPA	Water Quality Program for Agriculture
WDOE	*Washington Department of Ecology*

Table C1. Public Outreach Information and Education (I & E)

Management Actions	Lead Group	Other Participants	Estimated Costs	Funding Sources
Action 1: *Create a centralized public outreach and education center (CDA Lake Basin Education Center). Functions of a center would include the following:* *a) Provide Federal, State, Local, and Tribal regulatory information.* *b) Serve as a liaison and coordinate among government, tribal, businesses, and community entities for promoting water quality protection awareness and education.* *c) Provide a centralized location for information and education materials that are related to water quality protection. Existing and new materials will be housed in this location.* *d) Develop and implement a Coeur d'Alene Lake specific Lake*A*Syst (LAS) program and materials.* *e) Create and maintain a Coeur d'Alene Lake Management Plan (LMP) website.* *f) Conduct workshops, tours, & presentations for the community and area schools on water quality issues.* *g) Assist the conservation partnership with their outreach efforts.* *h) Promote consumer awareness and use of "lake friendly" products.* *i) Promote training programs on erosion & sediment control Best Management Practices (BMPs).* *j) Provide landowners with information on proper maintenance of subsurface sewage systems.*	IDEQ Tribe UI-CES	*All other government, business, and community entities in the CDA Lake basin*		

Table C1. Public Outreach Information and Education (I & E)

Management Actions	Lead Group	Other Participants	Estimated Costs	Funding Sources
k) Develop an educational pamphlet for distribution to boat registrants on reducing impacts caused by boat wakes to riverbanks and lakeshores. *l) Fund and implement a Clean Marina program for marina, boat operators, and the general public.*				

*Note: All items in italics are recommended changes out of 2006-07 audit between IDEQ and Coeur d'Alene Tribe.

Comments and Rationale:

Action 1: *The LMP audit found a lack of understanding of Coeur d'Alene Lake issues and the need to protect water quality. Though several entities throughout the basin each have some form of information and education efforts, there is a need for centralization and coordination.*

Table C2. Forest Practices

Management Actions	Lead Group	Other Participants	Estimated Costs	Funding Sources
Action 1: Continue implementation of Forest Practices Act (FPA) *and Tribal Forest Mgt. Plan* BMPs as related to stream protection zone (SPZ), and make recommendations as needed to FPA as related to SPZ.	IDL Tribe	USFS, BLM, Forest-industry,		
***Action 2*:** *For all lakes in CDA Lake basin, fully implement FPA rule 030.07.a (Lake Protection BMPs) following the St .Joe Supervisory Area guidelines as established in April 2000. Implement Tribal Forest Management Plan within reservation boundaries.*	*IDL* *Tribe*	*USFS, BLM,* *Forest-industry*		
Action 3: Continue to implement pre-operation inspections for proposed timber harvest and related road construction. *Conduct or establish annual audits, at a minimum.*	IDL, Tribe, USFS, BLM, Forest Industry			
Action 4: *Encourage alternatives to culverts where feasible within the* Stream *Channel* Alteration permit process.	IDWR IDL *ACOE*	*Tribe, USFS,* *BLM, Forest-* *industry*		
Action 5: Continue stream channel protection activities. Develop more prescriptive stream-crossing and stream alteration BMPs that provide a high level of water quality protection from road sediments. Promote enforcement of the Stream *Channel Protection* Act within the basin for crossing and alteration proposals.	IDWR IDL *ACOE*	*Tribe, USFS,* *BLM, Forest-* *industry*		
Action 6: Continue logger accreditation and other forestry I & E programs.	*IDL, Tribe* *USFS, BLM,* *Forest-industry* *UI-CES*			
Action 7: Identify, prioritize, and implement restoration projects using currently available technologies.	IDL, Tribe, USFS, BLM, Forest-Industry			

Table C2. Forest Practices

Management Actions	Lead Group	Other Participants	Estimated Costs	Funding Sources
Action 8: Minimize road construction impacts in basin by cooperating on joint access development to forest stands. Streamline process to allow access on previously developed roads.	IDL, Tribe, USFS, BLM, Forest-Industry			
Action 9: Pursue necessary funding to *address* road maintenance needs and management objectives which reduce sediment on forest roads.	IDL, Tribe, USFS, BLM, Forest-Industry			
Action 10: Monitor watershed restoration projects to measure effectiveness of sediment and nutrient reduction. *Projects should include monitoring BMP effectiveness on minimizing sediment and nutrient loading into water bodies.*	IDL, Tribe, USFS, BLM, Forest-Industry	IDEQ		

Comments and Rationale:
Action 1*: Coeur d'Alene Reservation Forest Management Plan 2003-2017 adopted 12/12/02. There have been many significant changes to the 1996 FPA.*

Action 2*: FPA Rule 030.07.a 'Lake Protection BMPs' adopted by St. Joe IDL office. Cataldo and Mica did not indicate whether they abide by this rule.*

Action 3*: A minimum of annual audits is important and a requirement of forest product certifications. All entities stated that timber sale inspections are considered audits.*

Action 4: *2002 MOU between IDWR and IDL has streamlined the Stream Channel Alteration permit process. All entities agree that there is a need to consider alternatives to culverts.*

Action 5*: One of the most important FPA BMPs is road stabilization at road crossing and stream channel protection activities.*

Action 6*: The LEAP program has gained a successful reputation and most if not all lumber mills in North Idaho will only accept timber from certified LEAP participants.*

Action 7*: Restoration projects still necessary however, inadequate funding restrains progress.*

Action 8*: Using the St. Joe watershed as an example, shared access and joint maintenance lessens the need for new roads.*

Management Actions Comments

Action 9: *Insufficient funding and man power cannot keep up with current forest road maintenance needs.*

Action 10: *The LMP audit found overall agreement that monitoring of restoration project success and BMP effectiveness is an important component in forestry activities, however, funding is generally not available for monitoring.*

Table C3. Roads

Management Actions	Lead Group	Other Participants	Estimated Costs	Funding Sources
Action 1**:** *All entities with road responsibilities need to identify and prioritize road related water quality improvement needs, and develop long range plans for correcting existing problems*	ITD, Hwy-Dist, Counties, Cities, *IDL, USFS, BLM, Tribe, KMPO Forest Industry*	*IDWR*		
Action 2: *Road jurisdiction entities need to improve on the control of erosion and sediment during construction and maintenance activities.*	ITD, Hwy-Dist, Counties, Cities, *IDL, USFS, BLM, Tribe, Forest Industry*	*IDWR T2 Center*		
Action 3: Develop and enforce regulations which *incorporate water quality protection strategies into existing road standards, policies, procedures, and decisions.*	ITD, Hwy-Dist, Counties, Cities, *IDL, USFS, BLM, Tribe, Forest Industry*	*IDWR*		
Action 4: *IDL, Counties, and Hwy Districts need to coordinate enforcement of road standards and specifications, and educate landowners when converting FPA roads to subdivision roads and driveways.*	ITD, Hwy-Dist, Counties, Cities, *IDL, USFS, BLM, Tribe, KMPO Forest Industry*	*Fire Districts IDWR*		
Action 5: Prevent sediment from entering road ditches from adjacent properties by adopting and enforcing erosion control and grading ordinances for *all land disturbing* activities.	ITD,Hwy-Dist, Counties, Cities, *IDL,USFS, BLM, Tribe, Forest Industry*	*EPA IDWR*		

Table C3. Roads

Management Actions	Lead Group	Other Participants	Estimated Costs	Funding Sources
Action 6: *Promote training programs on maintenance and construction BMPs, and regulations which can be used to reduce road impacts to water quality. Provide private landowners with education and assistance materials to install road BMPs.*	ITD, Hwy-Dist, Counties, Cities, *IDL, USFS, BLM, Tribe, Forest Industry, LHTAC, DEQ*	*Uof I IDWR*		
Action 7: Encourage ITD and other road jurisdictions to hold public meetings *and post construcion plans* prior to and during construction projects.	ITD, Hwy-Dist, Counties, Cities, *IDL, USFS, BLM, Tribe, Forest Industry*			

Comments and Rationale:

Action 1: *Problem roads that impair water quality remain and need to have a long term plan of prioritization and funding in order to be repaired.*

Action 2: *Observations show that there needs to be continued improvement in erosion and sediment control education and implementation. The Idaho Technology and Transfer Center (T2) through the U of I sets a framework for this improvement.*

Action 3*: Existing regulations are considered to be somewhat insufficient in the protection of water quality and improved enforcement is necessary.*

Action 4: *The LMP audit found this was a commonly stated problem. FPA roads are constructed for low volume capacities and when logging operations are complete these roads are "buttoned up" as per FPA standards with IDL. Some of these FPA roads, however, get converted to private access roads and driveways which do not meet Hwy District standards or specifications. This practice has been identified by FPA advisors as "logging with the intent to build". Currently there are efforts between IDL and the Counties to address this issue.*

Action 5: *Road Supervisors stated that there is a problem with adjacent land disturbances contributing sediment into County road ditches. Many road ditches can discharge directly into surface waters. The T2 Center and Stormwater and Erosion Education Program (SEEP) through PAC, provide education and certification.*

Action 6: *Promote and further support existing training and education programs such as T2 and SEEP.*

Action 7: *During our audit it was stated that public meetings prior to and on occasion during road construction projects are important in order to gain public input.*

Table C4. Development, Erosion, and Stormwater

Management Actions	Lead Group	Other Participants	Estimated Costs	Funding Sources
Action 1: In order to address stormwater run-off, provide information and technical assistance to contractors, utility companies, engineers, design professionals, businesses, recreationists, cities, agencies, property owners and the general public. *Stormwater run-off information and education would be a function of the CDA Lake Basin Education Center. (see Table 1)*	IDEQ Tribe UI – CES *EPA*	*All other stakeholders throughout the basin.*		
Action 2: *Utility* companies *need to* incorporate and implement erosion and sediment control into the siting, installation, and maintenance of utilities.	*Utilities*			
Action 3: Improve enforcement of existing stormwater treatment and erosion control requirements; including maintenance, in the CDA Lake Basin to better prevent phosphorous and sediment loading from grading and development activities. Hire *sufficient* staff to *inspect* and enforce site disturbance and stormwater ordinances.	Counties Cities *EPA*			
Action 4: *Protect, and ensure maintainance of existing riparian vegetative buffer around the entire perimeter of Coeur d'Alene Lake.*	*Counties, Cities, IDPR, Tribe*	*Private property owners*		
Action 5: *Establish performance standards which will minimize the quantity of sediment leaving property boundaries. For example, prohibit increases in sediment export, or if sediment export is allowed, limit it to identified numeric standards. Require stabilization of soil disturbance*	Counties Cities	*EPA* *IDEQ* *Tribe*		
Action 6: *Establish requirements within site disturbance and stormwater ordinances that development projects will result in "no net increase" in phosphorus loading to surface waters. This will include treatment of stormwater, and pollution (e.g.phosphorus) trading where feasible.*	Counties Cities	*EPA* *IDEQ* *Tribe*		

Table C4. Development, Erosion, and Stormwater

Management Actions	Lead Group	Other Participants	Estimated Costs	Funding Sources
Action 7: *Investigate alternatives to Grassed Infiltration Areas (GIAs) for stormwater treatment within the City of Coeur d'Alene.*	*City of Coeur d'Alene*	*PHD, IDEQ, EPA*		
Action 8: *Site disturbance and stormwater ordinances shall not allow exemptions for erosion control during the installation of subsurface sewage disposal systems on slopes greater than 10% and/or less than 500' from surface waters.*	*Counties, Cities*	*PHD*		
Action 9: *Pursue* funding for stormwater and erosion control programs, including stormwater utilities. Implement programs and ordinances throughout the CDA Basin	Counties Cities	IDEQ, Tribe, *EPA*		
Action 10: Conduct periodic audits and *monitoring of* BMP implementation and effectiveness.	Counties Cities	IDEQ, Tribe, EPA		
Action 11: Prohibit burning of construction debris on lakeshores and adjacent to streams and drainageways. Provide information on the effects of burning any debris on the lakeshores and adjacent to streams.	IDEQ, Counties, Cities, Fire Dist.	Tribe		
Action 12*:* Evaluate the level of treatment and stormwater retention needed for roads and highways in the Basin; expand regulation and policies as needed to prevent contaminants from reaching the water.	*All road jurisdictions in the Basin*			

Comments and Rationale:

Action 1: *Public information and education on erosion control and stormwater run-off is needed and would be a major function of a CDA Lake Basin Education Center. Staff of the Center will promote SEEP or other related education programs.*

Action 2: Erosion control techniques need to be in place during the installation of utilities. These might include reseeding of disturbed areas, locating utilities away from streams and drainages, and timing utility projects.

Action 3: *Throughout the CDA Lake Basin, there is insufficient funding and man power for inspection and enforcement of current site disturbance and stormwater ordinances.*

Management Actions Comments

Action 4*: In 2006, IDEQ and the Tribe conducted a shoreline survey for compliance with the Kootenai County Site Disturbance Ordinance 374. It was commonly observed that the 25' buffer zone was disturbed or eliminated in violation of the ordinance. There remains roughly 25% of undisturbed shoreline vegetation and this needs to be protected.*

Action 5: *Numeric performance standards should be included and enforced in site disturbance and stormwater ordinances. For soil disturbance stabilization requirements, an EPA SWPPP, for example, requires stabilization within 7-14 days.*

Action 6: *Some ordinances already state that BMPs must be sufficient to prevent sediment from leaving a site. This is "no net increase" but is not often achieved.* A pollution trading system is designed to offset new phosphorus loads by reducing existing loads. Mitigation actions might include: providing funds for upgrading the Page Wastewater Treatment Plant (to increase its phosphorus removal capabilities); replacing substandard septic systems; removing unpaved roads not in use; or surfacing poorly constructed dirt roads which are eroding into CDA Lake or its tributaries.

Action 7: *As per City of Coeur d'Alene stormwater engineers and staff, GIAs are the only approved BMP over the Rathdrum Prairie-Spokane Valley Aquifer and have been difficult to design and maintain due to an increase in development and run-off. City staff recommend that alternatives need to be explored.*

Action 8: *As per PHD staff, site disturbance for septic tanks and drainage fields are deferred to County ordinances. PHD staff observe that installation of subsurface systems is often exempt fromKootenai County Site Disturbance Ordinance 374, per Section 5.A.7. They observe that when septic tanks are installed as close as 50 feet from the lake, and effluent is pumped to an up-gradient drainfield, erosion control BMPs are exempt. PHD states that subsurface sewage disposal systems should be explicitly cited as needing a permit under the ordinance.*

Action 9*:Additional funding and staff are needed. As per Kootenai County staff, a stormwater utility is not a county concept, refer to city stormwater utilities.*

Action 10: *Audits and monitoring of BMP implenentation and effectiveness are lacking basin wide. This could be a significant cost for agencies.*

Action 11: *The burning of trade and construction waste is prohibited as per IDAPA 58.01.01.600-617. Burning of woody debris along streambanks, riverbanks, and lakeshores needs to be discouraged because burned residue can contribute to the phosphorus load. Burning of debris requires a local fire district permit..*

Action 12: *As an example, Lakes Hwy District has performed an evaluation of stormwater treatment and retention on some roads around Hayden Lake. As a result, the Hwy District obtained a 319 IDEQ grant for a pilot project to treat stormwater run-off before entering Hayden Lake.*

Table C5. Agriculture

Management Actions	Lead Group	Other Participants	Estimated Costs	Funding Sources
Action 1: *Continue to* identify those tributaries which produce high levels of nutrients, sediment, pesticides, and bacteria from agricultural sources.	Cons-Part, IDEQ, Tribe			
Action 2: *Continue to* provide direct technical assistance and provide new and existing cost-share programs to agricultural landowners, including livestock operators, for planning and implementation of BMPs. *Encourage planning and implementation on a watershed scale.*	Cons-Part	Tribe		
Action 3:*Improve* outreach programs directed at agricultural landowners, including livestock operators. The program will utilize personal contact and mass communication tools with the intent of advertising available programs that encourage voluntary planning and implementation of BMPs.	Cons-Part	IDEQ Tribe UI-CES		
Action 4: *Education materials on the environmental benefits and available programs for agricultural BMPs will be a function of the CDA Lake Basin Education Center (See Table 1).*	IDEQ Tribe UI-CES	Cons-Part		
Action 5: Insure the continued implementation of existing cropland management practices, including production of grass seed, through implementation of federal Farm Bill requirements.	NRCS	FSA USDA		
Action 6: Provide planning, implementation, and funding assistance to small acreage farms (i.e. ranchettes or hobby farms) for BMPs.	Cons-Part	UI-CES Tribe		
Action 7: *Continue to* provide engineering surveys and designs for structural BMP implementation.	NRCS	Cons-Part		
Action 8: *Identify funding* to conduct on-farm testing of potential new BMP technologies.	UI-CES Cons-Part	*U of I* *EPA*		
Action 9: *Encourage funding for NRCS to conduct Rapid Watershed Assessments within the CDA Lake Basin.*	*NRCS*	*Cons-Part* *Tribe*		

Table C5. Agriculture

Management Actions	Lead Group	Other Participants	Estimated Costs	Funding Sources
Action 10: *Continue to* provide technical and financial assistance for stream and riverbank stabilization projects in agricultural areas.	*NRCS*, Cons-Part, Tribe	*IDWR*		
Action 11: *Continue* to provide and update databases and GIS coverage of land use activities, including BMP implementation through funded agricultural projects.	Cons-Part Tribe	FSA		
Action 12: *Fund and* implement water quality monitoring to determine collective effectiveness of agricultural BMP installation and maintenance.	Cons-Part IDEQ Tribe			
Action 13: Develop a tax incentive program to encourage agricultural landowners to restore natural vegetation buffers along creeks and drainage ways to minimize runoff from adjacent lands.	Counties	Cons-Part		
Action 14: Implement zoning ordinances that limit the conversion of agricultural land to urban uses.	Counties Cities	Cons-Part		

Comments and Rationale:

Action 1: *The Conservation partnership uses the IDEQ 303(d) list of impaired water bodies as well as the NRCS Stream Visual Assessment Program (SVAP) to identify problem areas and develop TMDLs. Some grant programs such as IDEQ 319 Non-Point Source Pollution program prioritizes requests according to approved TMDLs.*

Action 2: *Current available Farm Bill programs implemented by the NRCS include: Conservation Reserve Program (CRP), Continuous CRP, Wetland Reserve Program (WRP), and Environmental Quality Incentives Program (EQIP). The State agricultural cost-share program implemented by the ISCC is the Water Quality Program for Agriculture (WQPA). As of 2006, the NRCS and ISCC have combined the EQIP and WQPA programs to potentially offer up to 90% cost-share for eligible landowners.*

Action 3: *The LMP audit found eligible landowners awareness of the above cost-share programs has been lacking due to funding and Conservation District staff turn-over.*

Action 4: *The CDA Lake Basin Education Center could assist the Conservation Districts in their outreach programs.*

Table C5. Agriculture

Management Actions Comments

Action 5: *Request that NRCS Area offices provide Farm Bill program project updates as they pertain to nutrient management and Coeur d'Alene Lake (keeping in mind landowner privacy rights).*

Action 6: *The LMP audit found there is an increasing trend of 5-20 acre "hobby farms" and there can be water quality issues on these small acreage farms. If tracts are < 20 acres they do not qualify for Farm Bill or WQPA programs. Districts need additional funding to assist with these small acreage farms.*

Action 7: *Many agricultural BMPs are installed with the help from NRCS engineering and surveying (Federal and Non-Federal).*

Action 8: *Funding and and new ideas are limiting factors for on-farm testing of new BMP technologies. One example of testing new BMP technologies is a riverbank stabilization design on the CDA River which utilizes EQIP dollars and is adjacent to agricultural land.*

Action 9: *Rapid Watershed Assessments (RWA) for the Coeur d'Alene Lake Basin was scheduled for the beginning of 2007. Examination of other RWAs show that this assessment provides valuable watershed information.*

Action 10: *Inventories of stream and riverbanks have identified areas of significant bank erosion adjacent to agricultural lands. Funding is limited for stabilization projects.*

Action 11: *Agricultural databases and GIS coverages can be very helpful in watershed assessments. The NRCS Performance Results System (PRS) is available on the web for public use and it hosts program specific reports and conservation practices information.*

Action 12: *Water quality monitoring is generally lacking in agricultural projects. For example, there were 3 water quality monitoring stations on Lake Creek for several years that monitored turbidity, TSS, and phosphorus to ensure that the agricultural BMPs were working. The stations have not been in use for the last 5 years due to the lack of funding.*

Action 13: *There are no tax incentives for riparian area restoration projects. Counties have not considered a tax break for this purpose. Kootenai County believes they have no taxing authority in this area.*

Action 14*: Shoshone County staff stated that very limited agricultural acreage remains for conversion. Kootenai County staff states that it is a low priority to conserve agricultural land and they question why this is an LMP issue. Benewah County does not having zoning ordinances related to the coversion of agricultural land to urban uses however, staff stated that the County favors agricultural resources.*

Table C6. Wastewater

Management Actions	Lead Group	Other Participants	Estimated Costs	Funding Sources
Action 1: Evaluate impacts *(including inflow and infiltration problems),*conduct a financial evaluation of alternatives, and recommend strategies for reducing phosphorus loads from wastewater treatment plants *that discharge to surface waters in the Coeur d'Alene Basin. Identify* basin wide funding alternatives.	Sewer-Dists IDEQ EPA Tribe	*BEIPC*		
Action 2: *a) Inventory existing individul/subsurface sewage systems and lagoon/land application systems located along tributaries and lakeshore in the CDA basin.* Maintain a data base which can be used to locate and prioritize systems needing attention. b) Identify substandard and failed individual/subsurface sewage systems. c) Prioritize systems for upgrade and/or replacement based on their probable nutrient contribution to the lake.	PHD IDEQ Tribe	*Private landowners*		
***Action 3*:** *Fund studies that evaluate the effect of nutrients in wastewater on water quality, particularly in near shore areas. Studies would include potential impact of wastewater generated by future growth and development. Incorporate the use of IDEQ's Nutrient/Pathogen Evaluation Program.* Where nutrients have been identified as a problem, develop and install alternative sewage systems which are more effective at removing *nutrients* from effluent.	IDEQ *Tribe* *PHD*			

Table C6. Wastewater

Management Actions	Lead Group	Other Participants	Estimated Costs	Funding Sources
Action 4: Encourage replacement of substandard individual/subsurface sewage disposal systems by: a) Allowing nutrient loads for new development to be offset with upgrades to existing offsite substandard indvidual/subsurface sewage systems (i.e. pollution trading). b) Developing cost share and other incentives. c) *Investigate new and alternative technologies for improvement of substandard systems.*	PHD IDEQ Tribe	*Sewer Districts, private landowners*		
Action 5: *Improve compliance with PHD rules regarding the reporting and identification of failed individual/subsurface sewage systems.*	*PHD* *private landowners*			
Action 6*: Improve compliance of reporting and maintenance requirements by homeowner associations connected to Large Soil Absorption Systems (LSAS). IDEQ should periodically inspect LSAS.*	*IDEQ*	*Private landowners*		
Action 7**:** *Improve maintenance of individual/subsurface sewage systems. This would primarily be through an information and education effort by PHD inspectors with private landowners and would be a function of the CDA Lake Basin Education Center. (See Table 1.)*	PHD IDEQ *Tribe*			
Action 8**:** *Ensure that PHD has sufficient funding and staff to adequately inspect the installation of new individual/subsurface sewage systems. Pursue additional funding for PHD staff to periodically inspect existing individual/subsurface sewage disposal systems.*	PHD IDEQ			

Table C6. Wastewater

Management Actions	Lead Group	Other Participants	Estimated Costs	Funding Sources
Action 9: During plan reviews of both new and replacement *individual/subsurface* sewage systems, consider clustering of the systems if it will have less impact on water quality than small, individual systems.	PHD, IDEQ, Counties, Cities,	*Private Landowners*		
Action 10**:** *Evaluate and promote the use of non or low phosphate laundry detergents, other cleaning products and fertilizers in the CDA Lake basin. Audit the compliance of the City of Coeur d'Alene's Phosphorus Laundry Detergent Ban (Ord.. 2267). This could be a function of the CDA Lake Basin Education Center. (See Table 1.)*	Counites Cities			

Comments and Rationale:

Action 1: *Wastewater Water Treatment Plant's (WWTP) contribute a portion of the nutrient loading to Coeurd'Alene Lake. Some evaluations have been started at the SFK CDA River Sewer District and the Plummer Waste Water Treatment and Disposal Facility (WWTDF). Inflow and Infiltration (I & I) of ground water into deteriorating sewer lines is a problem for WWTP's throughout the entire basin. Funding needs to be secured for improvements.*

Action 2: *a) An updated inventory of individual on-site sewage disposal systems is needed in order to evaluate the impact of subsurface wastewater. These systems include: lagoon/land application, individual subsurface disposal, community subsurface (2-10 homes serviced), and Large Soil Absorption Systems (greater than 2,500 gpd). This inventory will help identify 'hot spots' of wastewater impacts to the lake. b) Substandard systems are considered those installed prior to 1971 that are non-compliant by current regulations. A system with surfacing sewage or if sewage is backing up into system are identified as failed systems. c) The inventory as mentioned in Action 2a will in part be used to prioritize systems for upgrade and/or replacement.*

Action 3: *Scientific studies, including inventory information gathered in Action 2, are needed to identify any impacts of wastewater on the lake. There are no current rules governing the recommendations of Action 3 for existing subsurface wastewater system (last sentence in Action item).*

Action 4: *a)Pollution trading concepts will be explored by the LMP team. Replacing substandard individual/subsurface sewage disposal system is voluntary. b) Public Outreach and incentives such as cost-share programs would assist in getting substandard systems upgraded.*

Action 5*: PHD Repair Permit is required for a failed individual/subsurface sewage disposal system. PHD acknowledges that homeowners may not report a failed system due to the cost of an upgrade to current or "best fit" standards.*

Action 6: *IDEQ needs to improve the current audit procedure for required annual LSAS reports and need to conduct periodic field inspections.*

Table C6. Wastewater

Management Actions Comments

Action 7: *It is possible that many homeowners around the lake and tributaries are unaware that periodic pumping of septic tanks is necessary for individual subsurface systems to function properly. PHD recommends that a rule change be made to make maintenance required.*

Action 8*: State rules require that septic system installers have to be liscensed, bonded, and insured, and PHD offers a one day training course for installers. PHD considers inspections for new individual/subsurface sewage disposal systems as adequate. Inspections of existing, substandard, and failed sewage systems are complaint based. Currently there is no rule requiring inspection of these existing systems.Additional funding and staff would be needed for these inspections.*

Action 9: *The LMP audit found clustered or community systems are at times not feasible due to easement issues and the size requirements of communtiy drain fields. LSAS and Community systems have monitoring, reporting, and O&M requirements which would come from established homeowner associations that jointly maintain the systems. PHD encouragess clustering of lake cabins with a centralized LSAS where feasible. Advantages of clustered systems are the above listed requirements and the requirement of 2 separate drain fields for the purpose of alternating and resting of drain fields. Kootenai County states that they do not play a role in the clustering of systems.*

Action 10: *There is very little promotion of using low or non phosphate detergents and fertilizers throughout the basin. The Operators of the WWTP's that were interviewed showed interest in learning more about the benefits and were unaware that the City of Coeur d'Alene has a Phosphorus Ban Ordinance dated 1990.*

Table C7. Rivers, Bays, and Southern Shallows

Management Actions	Lead Group	Other Participants	Estimated Costs	Funding Sources
***Action 1*:** *Control bank erosion & bottom scour on the St. Joe and Coeur d'Alene Rivers, and lakeshores by expanding and enforcing no-wake zones and speed of boats and improve signage for these zones.*	Counties Tribe IDPR	*Boaters*		
Action 2: Develop an informational pamphlet for distribution to boat registrants educating them on the impacts caused by boat wakes to riverbanks and lakeshores. *This could be a function of the CDA Lake Basin Education Center (see Table 1).*	Tribe IDPR Counties	BEIPC		
Action 3: *Continue* to inventory rapidly and moderately eroding banks along reaches of the Cd'A and St Joe rivers.	Cons-Part Tribe IDEQ	*USGS* *IDL, ACOE,* *USFWS, BEIPC,* *EPA* *IDWR*		
Action 4: Develop, fund, and use a *suite of bank stabilization technologies* for eroding riverbanks *and lakeshores. Support legislation enabling counties to assess user fees dedicated to lake and river protection activities.*	*Cons-Part,* *EPA,* *IDEQ, ACOE* *Tribe, IDWR,* *Local legislators,* *BEIPC, Counties*			
Action 5: Support funding for public land managers to implement bank stabilization on public lands. Stabilize banks at all existing recreation sites and newly developed sites.	*IDL* *IDFG* *USFS* *BLM* *Tribe, EPA*	*USFWS* *BEIPC* *IDWR*		

Table C7. Rivers, Bays, and Southern Shallows

Management Actions	Lead Group	Other Participants	Estimated Costs	Funding Sources
Action 6: Identify sources of trace (heavy) metal loads in the Cd'A River between Enaville and Harrison with special attention to: a) Need for tailings removal from banks or channel b) Assess if bank stabilization will be effective in curtailing metals loading c) Monitor bank erosion rates where heavy metal laden sediments have come to lie *d) Utilize USGS sediment transport models that have been developed using CWA funds.*	EPA, USGS IDEQ	*BEIPC* *Tribe* *IDWR*		
***Action 7**: Mitigate and manage the effects of lake level fluctuations and management upon shoreline erosion and bank sloughing.*	*Avista, IDEQ, Tribe, WDOE, IDFG, USFWS*			
Action 8: Develop a pamphlet explaining the bank stabilization permit *processes (ACOE, State, Tribal). The pamphlet could include:* *a) Stabilization design features including the utilization of softer vegetative components* *b)* Recommendations on methods to develop beach and wildlife areas *utilizing existing vegetation*	*ACOE* *IDWR* *IDL* *Tribe* *IDEQ* *IDFG* *Cons-Part*			
Action 9: Contract with nationally recognized river hydrology experts to develop a total river system management plan for the North Fork and South Fork Cd'A River above Cataldo.	IDEQ, Tribe, EPA, BEIPC	*IDWR*		

Table C7. Rivers, Bays, and Southern Shallows

Management Actions	Lead Group	Other Participants	Estimated Costs	Funding Sources
Action 10: *Work with landowners (public or private) to improve riparian zone management by developing buffer strips and bank stabilization along rivers and streams.*	*Cons-Part, TNC, INLT, landowners, Counties, Cities, Tribe, IDEQ*	*IDWR*		
Action 11: *Develop & implement TMDLs for 303(d) listed waterbodies in the Cd'A Basin as required under the Clean Water Act.*	*Tribe,IDEQ, EPA*	*other Tribes*		
Action 12: *Continue to fund and implement comprehensive water quality monitoring efforts basin wide.*	Tribe, IDEQ EPA, USGS	*BEIPC*		
Action 13: Continue to pursue funding for the study, inventory, and management of rooted aquatic plants with special attention to the invasive *Eurasian watermilfoil species.*	Counties, Tribe, IDPR, IDEQ	*PLRC&D, UofI*		

Comments and Rationale:

Action 1: *The LMP audit found, "No Wake Zone"signage throughout the lakes and rivers is insufficient and difficult to read and/or locate. County or Tribal (within reservation boundaries) funding is necessary for repairing these signs. Enforcement and* citations within "no wake zones" could be improved and citation revenues could provide supplemental funding.

Action 2: *County manuals have been printed and distributed in the past however, existing pamphlets do not highlight "no wake zones" and the impact that wakes can have on bank erosion. County and IDPR showed interest for improving education materials.*

Action 3: *Some inventories along the two rivers have been conducted, however, stream and riverbanks continue to erode annually. Ongoing inventories need to be established and funded.*

Action 4 *A Coordinated program among agencies needs to be established to produce a viable and accepted suite of stabilization technologies for future projects.*

Action 5: *Encourage interest groups to aid agency projects with labor and/or dollars for matching funding. Permits are required by ACOE, IDL, IDWR and Tribe within respective jurisdictions.*

Action 6: *Need to coordinate LMP process with EPA RI/FS (ROD) cleanup efforts.*

Management Actions Comments

***Action 7**: The parties involved in the AVISTA dam FERC reliscensing process are currently involved in evaluating the impacts and implications of current lake level fluctuations and management.*

***Action 8**: The LMP audit found those agencies involved with bank stabilization projects agree that the application process is confusing and not very "user friendly." All entities that were interviewed support a joint pamphlet explaining who, what, when, where, and why. There might be some reluctance to a "do it yourself" bank stabilization process, therefore, the detailed engineering should be left to professionals. There is an ACOE national brochure that could be adapted to make it more local to reflect local jurisdictions, needs, etc.*

***Action 9:** Coordination is necessary for long-range planning of Coeur d'Alene River hydrology dynamics. This is a recommendation that came out of the National Academy of Sciences report concerning basin wide planning and flood concerns.*

***Action 10:** Utilize voluntary methods such as conservation easements, long-term leases, donation, purchase, etc. These methods can improve or maintain riparian areas of rivers and streams in order to minimize excessive nutrients and sediments from entering waterbodies.*

***Action 11**: TMDLs for sediment, nutrients, temperature, metals, and bacteria have and are being developed. Funding for TMDL implementation is lacking and funds need to be identified and secured.*

***Action 12:** Continue and expand monitoring programs such as: EPA-Basin Environmental Monitoring Program, IDEQ- Beneficial Use Reconnaisance Program, NRCS- Stream Visual Assessment Program, IDEQ and Tribe- Cd'A Lake Monitoring program, Stream sampling by the Tribe's Water Resources Program.*

***Action 13**: Various control methods of Eurasian milfoil include: herbicide treatment, diver hand pulling, bottom barriers, and surface raking. As per conversation with the Kootenai County Noxious Weed Dept., mechanical harvesting is not considered viable, at this time.*

Table C8. Motorized Watercraft and Hazardous Materials

Management Actions	Lead Group	Other Participants	Estimated Costs	Funding Sources
Action 1*:* Pursuant to applicable codes (refer to Notes), *on board inspections* conducted by County and Tribal marine deputies in the CDA Lake basin shall include an examination of wastewater facilities on the craft to ensure their compliance with the referenced codes. Any violations shall be enforced according to said codes. *On the Idaho Boat Inspection Report, add a line item for inspecting wastewater facilities.*	*IDPR Counties PHD Tribe*			
Action 2: *Review and strengthen present codes and regulations that manage wastewater facilities discharge from motorized watercraft.*	*PHD, Legislature, Counties, Tribe*			
Action 3*:* *Require* that public and private marinas comply with applicable codes regarding pump-out and shore-based facilities.	Counties, PHD, Tribe, Marinas			
Action 4: *Complete, implement, and enforce with existing codes, the CDA Lake Clean Marina Program. This program is currently being developed and is in draft form and includes a public outreach component. (See notes for details).*	*IDEQ, Tribe, PHD, Counties, IDL*	*USCG, IDPR, Marinas, Marine shops, EPA*		
Action 5: *Develop and strengthen an aquatic spill response partnership basin wide.*	*IDEQ, Tribe, PHD, Counties*	*Marinas, EPA*		

Comments and Rationale:

Action 1. Idaho Code §67-7501 et. seq. (Marine Sewage Disposal Act) disallows the discharge or disposal of sewage or other wastes from any vessel into waters of the state. Rules of Panhandle Health District 1, IDAPA 41.01.01.200.01, requires any boat with wastewater facilities to have those facilities sealed to prevent discharge into any waters within District 1. There are also federal laws within the Clean Water Act that would apply to "no sewage discharge" lakes which DEQ has determined is the status of Coeur d'Alene Lake. With Idaho Legislative action, the State could take on enforcement of Clean Water Act laws regarding marine sewage disposal. *Note: The Idaho Boat Inspection Report was last revised 7/95. Adding a line item for wastewater facilities was recommended by Kootenai County Sherriff's department.*

Management Actions Comments

Action 2: *Recommend that IDAPA 41.01.01.200.01.(d) be amended as follows:*

If any watercraft located upon the waters of Panhandle Health District 1 is found to have ~~a marine toilet~~ wastewater facilities which ~~is~~ are not in compliance with the requirements of this section, the Health Officer or enforcement person shall have the following alternative or cumulative powers to:

i. cause the ~~marine toilet~~ wastewater facilities to be locked and sealed to prevent usage;
ii. *require such watercraft to be removed from the waters of Panhandle Health District 1 until the ~~marine toilets~~ wastewater facilities are made to conform with the requirements of this Code.*

The rationale behind changing the wording of marine toilets to wastewater facilities in the Health Code is that many large boats on Coeur d'Alene Lake would have facilities that generate both black water (sewage) from toilets and gray water from sinks and showers. Some boat manufactures do not make a holding tank for the gray water generated; this water becomes pumped overboard. By changing the code to wastewater facilities instead of marine toilets, both sewage and gray water discharges become prohibited. Idaho Code §67-7501 (Legislative Intent) cites "that is necessary to provide a uniform system for control and treatment of such marine sewage, gray water and other wastes; and that violators should be penalized."

Action 3: Rules of Panhandle Health District 1, IDAPA 41.01.01.200.02 require that marinas providing moorage for vessels with on-board wastewater facilities provide pump stations to adequately clean waste retention tanks on the largest boat that could reasonably use the moorage. All marinas must provide shore-based toilet facilities for their users.

Action 4: *The committee that is developing the CDA Lake Clean Marina Program is considering it to be an educational tool for use by marina operators, however there are many existing State, Federal, Local, and Tribal laws addressing hazardous and deleterious materials storage and spills. Compliance and enforcement of these laws should be incorporated into this program. For example:* A common winterization procedure for marine inboard engines is to store the engine block with two gallons of anti-freeze. In spring when such boats are first launched and started, the anti-freeze is ejected into the lake and replaced by fresh water. This could translate to substantial gallons of anti-freeze ejected into Coeur d'Alene Lake each year. In some boat launch areas, water is taken from the lake for household potable uses. The regional DEQ office in Coeur d'Alene is of the opinion that such disposal of anti-freeze violates Idaho Water Quality Standards, IDAPA 58.01.02.800 (Hazardous and Deleterious Material Storage).

The current CDA Lake Clean Marina Program is in draft form and does not sufficiently present a comprehensive public outreach approach. A public I & E program is needed that includes the following: effective methods of winterization of boats; pumping of holding tanks; fuel and oil transfers and spillage cleanup; proper boat cleansing procedures; safe boat operation; and ways to assure that these and other lake-oriented activities are conducted in an environmentally sound fashion. The program targets boat owners, marina and resort owners and the general public.

Management Actions Comments

Action 4 cont.

Address the problem of debris and litter. Available dumpsters around the basin are commonly filled beyond capacity. If dumpsters are to be used, there is a need for additional funding to maintain the refuse load and provide recycling receptacles. The LMP audit found Kootenai County prefers and suggests to the public a "Pack it in, Pack it out" policy. There are inherent problems with this policy such as transporting empty alcohol containers in vehicles.

Action 5: *Currently there is not an established communication system amongst the jurisdictions on spill response protocol.*

Appendix D – DEQ and the Tribe List of Impaired Water Bodies

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D.1 Introduction

A compilation of stream and lake segments on the DEQ and Tribe CWA §303(d) list within the Coeur d'Alene Lake Basin (Table D1). These are waterbodies where beneficial uses have been assessed as being impaired by one or more pollutants of concern: sediment, metals, nutrients, and/or bacteria. Many of the waterbody segments have EPA approved TMDLs, and in some cases there are current efforts of developing TMDL Implementation Plans. Streams where excess water temperature has been listed as a pollutant of concern have not been included unless there have been improvement projects on those segments. Table D1 does include streams not on the §303(d) list that have been identified by land management agencies, governments or other stakeholders as needing or would benefit from stream water quality improvement projects.

Table D1 includes identified improvement projects and their approximate costs that have been conducted on the list of stream segments from 1996 – 2007. **This list of projects is known to be incomplete.** DEQ and the Tribe have not captured all of the projects conducted by the various land management agencies, and private businesses, over this period of time. The far right column of proposed projects from 2008 on is blank in the draft 2008 LMP. The Tribe and DEQ have not yet held discussions with the land management agencies to identify planned, future projects.

Again, the listed information in Table D1 is incomplete and should be viewed as a work in progress in accordance with the adaptive management approach. However incomplete, the Tribe and DEQ believe the list of improvement projects conducted from 1996 – 2007 illustrates the magnitude and cost of "on the ground" work required in the future. The approach to implementing future projects based on the goals of both TMDL implementation and the LMP would be to prioritize on a yearly basis those projects that make the most sense (environmentally and fiscally), and that offer the greatest potential for reducing pollutant inputs to the lake. Prioritization is done within the TMDL implementation process and from results based on the nutrient loading inventory discussed in Section 3.3. Other factors will also be used, such as available funding, favorable cost/benefit analyses, opportunities for project partnering and the ability to leverage other funds, etc. As projects are completed they will be removed from the list. Likewise, as other projects are needed they will be added to the list.

Table D1. DEQ and the Tribe List of CWA §303(d) Impaired Waterbodies within the Coeur d'Alene Lake Basin, TMDL Pollutants of Concern[a], Identified Projects and Expenditures by Land Management Agencies from 1996 – 2007, and Proposed Future Projects and Costs.

Stream name	Listed pollutants[b]/ EPA approved TMDL	Completed projects from 1996 - 2007	Project costs	Proposed project costs
HUC[c] 17010301 - Upper Coeur d'Alene (North Fork Coeur d'Alene River) Subbasin				
Cub Creek	S/yes			
Calamity Creek	S/yes			
Tepee Creek - headwaters to Big Elk	S/yes			
Big Elk Creek	S/yes			
Tepee Creek - Big Elk to mouth	non-303(d)	Road Removal, in-channel and habitat improvements	3,000,000	
North Fork mainstem - Tepee Creek to Yellowdog	S/yes	Road removals, stream improvements	315,000	
lower Independence Creek	non-303(d)	Floodplain decompaction & revegetation	30,000	
Yellow Dog Creek	S/yes	Road removal, habitat improvements	500,000	
Downey Creek	non-303(d)			
Shoshone Creek	S/yes	Road & stream improvements	235,000	
Falls Creek	S/yes	Road & stream improvements	63,000	
Lost Creek	S/yes			
North Fork mainstem - Yellowdog to mouth	S/yes	USFS bank stabiliz. & habitat improve.	315,000	
East Fork Eagle Creek	S,M/yes	Stream improvements	133,000	
East Fork Eagle Creek	S,M/yes	Mining related cleanup		
Prichard Creek	S,M/yes for S, pending for M	Mining related cleanup		
Butte Gulch (trib to Prichard)	S,M/yes for S, pending for M			
Cougar Gulch (trib to Prichard)	S/yes			
Beaver Creek	S,M/yes for S, pending for M			
Steamboat Creek	S/yes	Road removal & stream improvements	2,040,000	
upper Little North Fork CdA River	S/yes	Stream and road realignments	900,000	

Table D1 cont.

Stream name	Listed pollutants[b]/ EPA approved TMDL	Completed projects from 1996 - 2007	Project costs	Proposed project costs
Iron creek	non-303(d)	Stream and road realignments	600,000	
Burnt Cabin Creek	S/yes	Stream rehabilitation	250,000	
Skookum Creek	non-303(d)	Stream and road realignments	200,000	
Copper Creek	S/yes	Fish passage	8,4000	
HUC 17010302 - South Fork Coeur d'Alene River Subbasin				
Canyon Creek	S,M/yes for S, pending for M			
Ninemile Creek	S,M/yes for S, pending for M			
East Fork Ninemile Creek	S,M/yes for S, pending for M			
Lake Creek	M/pending			
South Fork CdA River - headwaters to mouth	S,M/yes for S, pending for M			
South Fork CdA River - 1st & 2nd order tributaries	M/pending	Road removals	30,000	
Government Gulch	S,M/yes for S, pending for M			
Moon Creek	S,M/pending			
Pine Creek	S,M/yes for S, pending for M			
East Fork Pine Creek	S,M/yes for S, pending for M			
HUC 17010303 - Coeur d'Alene Lake & River Subbasin				
Coeur d'Alene River - South Fork to mouth	S,M/pending	Streambank stabilization		
Latour Creek and Baldy Creek	S/yes	TMDL Implementation	35,000	
Fourth of July Creek	S/yes			
Evans Creek (Tribal reservation)	non-303(d)	Land acquisition and channel improvements	4,525,500	
Willow Creek (Tribal reservation)	S/pending	Land acquisition, stream rehab., stabiliz.	914,875	
Black Creek (Tribal reservation)	non-303(d)	Nutrient reduction	3,097,474	
Black Lake (State & Tribe jurisdictions)	N/pending			
Thompson Lake tributaries	S/pending			

Table D1 cont.

Stream name	Listed pollutants[b]/ EPA approved TMDL	Completed projects from 1996 - 2007	Project costs	Proposed project costs
Wolflodge Creek	S/yes	TMDL Implementation	131,000	
Marie & Cedar Creeks (tributaries to Wolf Lodge)	S/yes			
upper Fernan Creek	S/pending			
Cd'A Lake north of Hidden Lake	M/pending			
Beauty Creek	T/pending	Road Removal	37,500	
Cougar Creek	S/yes	TMDL Implementation	189,000	
Kid Creek	S/yes	TMDL Implementation for Mica & Kidd	170,000	
Mica Creek	S,B/yes	upper North Fork road improvements	70,000	
Mica Creek	S,B/yes	Cattle exclusion and farm land improve.		
Mica Creek	S,B/yes	Streambank and stream rehabilitation	140,000	
Fighting Creek (Tribal reservation)	S,N/pending	Land acquisition, stream rehab., stabilize.	424,000	
Bellgrove Creek	B/pending			
Lake Creek (Tribal reservation)	S/yes	Erosion control and enhancements	995,656	
Lake Creek (Tribal reservation)	S/yes	Land acquisition and stream restoration	16,272,400	
Lake Creek (Tribal reservation)	S/yes	Sediment pond construction	2,000,000	
Plummer Creek	non-303(d)	Land acquisition	600,000	
HUC 17010304 - St. Maries River Subbasin				
St. Maries River - headwaters to mouth	S/yes			
West Fork St. Maries River, Wood Creek, Hidden Creek	S/yes	Watershed rehabilitation	245,000	
Middle Fork Saint Maries River	S/yes			
Gold Center Creek	U/pending			
Emerald Creek	S/yes	Rehab.of recreational garnet dig	80,000	
Carpenter Creek	S/yes			
Tyson Creek	S/yes			

Table D1 cont.

Stream name	Listed pollutants[b]/ EPA approved TMDL	Completed projects from 1996 - 2007	Project costs	Proposed project costs
Crystal Creek	S/yes			
Renfro Creek	S/yes			
Charlie Creek	S/yes			
Santa Creek	S/yes	§319 agricul. grant - stream rehabilitation	90,000	
John Creek	S/yes			
Thorn Creek	S/yes			
lower Alder Creek	S/yes			
Alder Creek (Tribe reservation)	S/yes	Land acquisition and stream restoration	2,447,136	
Alder Creek, Benewah Creek, Lake Creek, Evans Creek (Tribe reservation)	S for Alder & Benewah	Planting, stabilization, road improvements	660,190	
HUC 17010304 - St. Joe River Subbasin				
Quartz Creek/Gold Creek	T/yes	Road decommissioning	400,000	
Eagle Creek	non-303(d)	Road and stream rehabilitation	80,000	
Loop Creek	T/yes	Stream rehabilitation	300,000	
Fishhook Creek	S/yes			
Bear Creek/ Little Bear Creek	S/yes			
Mica Creek	S/yes	Experimental Forest		
Big Creek	U/pending	Headcut stabilization	100,000	
Benewah Creek (Tribal reservation)	S,DO/pending	Land acquisition and stream restoration	17,438,227	
Benewah Creek (Tribal reservation)	S,DO/pending	Watershed improvements	1,971,511	

a = With only a few exceptions, streams with water temperature as a cause for impairment are not included in this table.

b = §303(d) listed pollutants of concern
S = sediment
M = metals
N = nutrients
B = bacteria
U = unknown
T = water temperature

c = HUC – USGS Hydrologic Unit Code

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Appendix E – Table of Authorities

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Table E1. Jurisdictions and Authorities for Activities that Could Impact Surface or Groundwater Water Quality within the Coeur d'Alene Lake Basin

Programs and Activities	Responsible Agency	Authority, Permit or Approval Process
Water Quality Standards (WQS)		
Administer Federal Clean Water Act (CWA).	U.S. Environmental Protection Agency (EPA)	33 USC §1251 *et. seq.*
Requires that States adopt WQS with EPA review every three years. EPA approved the CdA Tribe as eligible for "treatment in the same manner as a state" (TAS). Grants Tribal authority to establish WQS and CWA Section 401 WQS certifications within waters of Tribal jurisdiction.		CWA Section 303
Adopt and implement Idaho WQS.	Idaho Dept. of Environmental Quality (DEQ)	IDAPA[a] 58.01.02
Adopt and implement Coeur d'Alene Tribe WQS.	Coeur d'Alene Tribe (CdA Tribe)	CdA Tribal Code Ch. 42
Adopt and implement Washington WQS.	Washington Department of Ecology (DOE)	WAC 173-201A
Water Quality Limited Waterbodies & Total Maximum Daily Loads (TMDLs)		
Approve State CWA §303(d) list of impaired waterbodies. Approve State TMDL documents.	EPA	CWA Section 303(d)
Promulgate Tribal CWA §303(d) list of impaired waterbodies. Initiate TMDL with Tribe, and final approval of TMDL documents.	EPA	CWA Section 303(d)
Identify water quality limited waterbodies and develop/publish a CWA §303(d) list outside of Tribal reservation boundaries.	DEQ	IDAPA 58.01.02
Identify water quality limited water bodies and develop/publish a Tribal list of impaired waterbodies within recognized reservation boundaries. This list is forwarded to EPA for promulgation of a §303(d) list.	CdA Tribe	CdA Tribal Code 42

Table E1 cont.

Programs and Activities	Responsible Agency	Authority, Permit or Approval Process
TMDLs cont.		
Develop Subbasin Assessments and TMDL pollutant load allocations outside of Tribal reservation boundaries. Develop TMDL Implementation Plans.	DEQ and an appointed Watershed Advisory Group. TMDL developed with partnership from Designated State Management Agencies: Idaho Soil Conservation Commission (ISCC) - Agriculture and grazing Idaho Dept. of Lands (IDL) - Timber harvest and mining Idaho Transportation Dept. (ITD) - Public roads	Idaho Code 39-3601 *et. Seq*
Develop TMDLs and TMDL Implementation Plans within Tribal Reservation.	EPA and CdA Tribe	CWA Section 303(d) CdA Tribal Code Ch. 42
Wastewater Treatment		
National Pollutant Discharge Elimination System (NPDES) permits for point source discharges from Municipal Wastewater Treatment Plants into waters of the U.S.	EPA	CWA NPDES Permit Program – EPA Permits
	Certification of EPA permit. DEQ and Tribe in respective jurisdictional waters	CWA Section 401
Operation of Municipal Wastewater Treatment Plants.	Sewer Districts and Cites within the Coeur d'Alene Lake Basin	Applicable Sewer District and Municipal codes and authorities
Individual/subsurface sewage disposal systems.	DEQ rules as administered by Panhandle Health District 1 (PHD1)	IDAPA 58.01.03 PHD1 Permit
Community drainfields (<2,500 gpd).	DEQ rules as administered by PHD1	IDAPA 58.01.03 PHD1 Permit
Large Soil Adsorption System (>2,500 gpd).	DEQ rules as administered by PHD1	IDAPA 58.01.03 PHD Permit with DEQ engineering review

Table E1 cont.

Programs and Activities	Responsible Agency	Authority, Permit or Approval Process
Wastewater Treatment cont.		
Sewage Lagoons, and Land Application Facilities including Reuse of wastewater.	DEQ for State jurisdictions	IDAPA 58.01.11 IDAPA 58.01.16 IDAPA 58.01.17 DEQ Permit
	CdA Tribe for Tribal jurisdictions	Tribal assessment and consultation with EPA
Stormwater Discharges and Construction Site Erosion Control		
Stormwater discharge into waters of the U.S. from construction sites disturbing 1 or more acres, and smaller sites that are part of a larger plan of development.	EPA	CWA NPDES Stormwater Permit Program – EPA Construction General Permit (CGP)
	Certification of EPA permit. DEQ and Tribe in respective jurisdictional waters	CWA Section 401
Stormwater discharge from a municipal separate storm sewer system leading to surface waters of the U.S.	EPA	CWA NPDES - Municipal Separate Storm Sewer System (MS4) Permit
	Certification of EPA permit. DEQ and Tribe in respective jurisdictional waters	CWA Section 401
Local municipal Stormwater Utility to fulfill portions of a MS4 NPDES permit.	City of Coeur d'Alene	City Ordinance No. 3177
Stormwater discharge from Industrial Activities (including mining) leading to surface waters of the U.S.	EPA	CWA NPDES – Multi-Sector General and Individual Permits for Stormwater Discharges Associated with Industrial Activities
	Certification of EPA permit. DEQ and Tribe in respective jurisdictional waters	CWA Section 401
Stormwater discharges to shallow injection wells.	Idaho Dept. of Water Resources (IDWR) rules as administered by PHD1	IDAPA 37.03.03 PHD1 Permit

Table E1 cont.

Programs and Activities	Responsible Agency	Authority, Permit or Approval Process
Stormwater and Erosion Control cont.		
All new development and redevelopment on sites not meeting criteria under the Federal CGP, including private roads and driveways.	Local Planning, Building and Zoning divisions within Cities and Counties of the Coeur d'Alene Lake Basin.	Permits and requirements under Local Ordinances: Stormwater Site Disturbance Flood Plain Hillside Overlay Subdivisions
Stormwater discharges and erosion control for public constructed and maintained roads.	ITD Local Highway Districts County Road Departments	Pertinent State, Highway District and Road Dept. Rules and Regulations.
Water-Related Activities		
Discharge of fill material into waters of the U.S. and wetlands.	U.S. Army Corps of Engineers (ACOE)	CWA Section 404
Dredge, excavation, and fill within navigable lakes and rivers (below ordinary high water mark, OHW) of State jurisdiction.	IDL	IDAPA 20.03.04
Encroachments on navigable waters (below OHW) of State jurisdiction; e.g., docks and piers, boat houses, shoreline alteration, river bank stabilization – may involve dredge and fill operations.	IDL	IDAPA 20.03.04
Alterations to flow, beds, and banks (below OHW) of perennial streams of State jurisdiction.	IDWR	IDAPA 37.03.07. Use "Idaho Joint Application for Permits" for all activities
	Certification of ACOE permit. DEQ and Tribe in respective jurisdictional waters	CWA Section 401
Dredge, excavation, fill, and stream channel alterations within Tribe jurisdiction.	CdA Tribe Law and Order Code	CdA Tribe Ch. 44 – 14.01 & 44-20.01 Encroachment Standards Sec. 7.10
Encroachments on navigable waters of Tribe jurisdiction.	CdA Tribe Law and Order Code	CdA Tribe Ch. 44 – 8.01 Encroachment Standards Sec. 5.03

Table E1 cont.

Programs and Activities	Responsible Agency	Authority, Permit or Approval Process
Water-related Activities cont.		
Suction dredge operations within waters of the U.S.	EPA	CWA NPDES – Suction Dredge General and Individual Permits.
	Certification of EPA permit. DEQ and Tribe in respective jurisdictional waters	CWA Section 401
Suction dredge operations within Tribe jurisdiction.	CdA Tribe Law and Order Code	CdA Tribe Ch. 44 – 20.01 Encroachment Standards Sec. 7.10
Discharge of wastewater from boats and houseboats into waters within PHD1.	PHD1 Kootenai and Benewah County Sheriff Depts.	IDAPA 41.01.01 and Idaho Code §67-7503 (Idaho Marine Sewage Disposal Act)
Discharge of wastewater from boats and houseboats into Tribal jurisdictional waters.	CdA Tribe Law and Order	CdA Tribal Code Ch. 43
Wastes and wastewater from float homes in State jurisdictional waters.	IDL	IDAPA 20.03.04
Wastes and wastewater from float homes in Tribal jurisdictional waters.	CdA Tribe Law and Order	CdA Tribal Code Ch. 44-7.14 & 16.01
Sewage waste disposal facilities at public and private marinas – boat pump-out stations and shore-based toilet facilities.	PHD1	IDAPA 41.01.01
	Kootenai County Parks and Waterways Department	County Ordinance No. 279D
	Benewah County	County Ordinances
	City of St. Maries	City Ordinances
	CdA Tribe Law and Order	CdA Tribal Code Ch. 44-14.01 &44-20.01 Encroachment Standards Sec. 7.05

Table E1 cont.

Programs and Activities	Responsible Agency	Authority, Permit or Approval Process
Water-related Activities cont.		
Watercraft operation relating to boat speed, no-wake zones, and riverbank erosion.	Kootenai County Parks and Waterways Dept. and Sheriffs Dept.	County Ordinance No. 279D
	Benewah County Sheriffs Dept.	County Ordinances
	CdA Tribe Law and Order	CdA Tribal Code Ch. 43
Control of nuisance aquatic organisms (e.g., Eurasian watermilfoil).	U.S. Department of Agriculture (USDA)	Plant Protection Act 7 USC §7701
	Idaho Dept. of Agriculture Idaho Invasive Species Council	IDAPA 02.03.03 IDAPA 02.06.22
	Kootenai and Benewah County Noxious Weed Departments	Local weed control authority Idaho Code 22-2405 & 2406
	CdA Tribe	Integrated Pest Management Title 40 CFR parts 156 and 171 EPA
Coeur d'Alene Lake water level and outflow rate of the Spokane River as maintained by the Post Falls Hydroelectric Project. Currently under relicensing process.	Federal Energy Regulatory Commission	FERC Relicensing 18 CFR Part 4, Subpart F, Sec. 4.51
	AVISTA Corporation	
Land Use Activities		
Idaho State identification and implementation of nonpoint source Best Management Practices.	State agencies	1999 Idaho Nonpoint Source Management Plan
Forest Practices (including timber roads) on state land and private land.	IDL	IDAPA 20.02.01 Notification of Forest Practice
Forest Practices and road systems on federal land.	U.S. Forest Service U.S. Bureau of Land Management	Various Federal Forest Acts National Environmental Policy Act (NEPA)
Forest Management within Tribal trust and fee lands.	CdA Tribe	CdA Tribal Forest Management Plan

Table E1 cont.

Programs and Activities	Responsible Agency	Authority, Permit or Approval Process
Land Use Activities cont.		
Nonpoint source controls for agricultural and grazing lands.	ISCC – lead and Idaho Association of Soil Conservation Districts (IASCD), Soil & Water Conservation Districts (SWCD), DEQ	Agricultural Pollution Abatement Plan-2003 IDAPA 58.01.14 IDAPA 02.05.03 (Water Quality Program for Agriculture)
	Technical assistance and USDA farm bill cost-share programs provided by: National Resources Conservation Service (NRCS) Farm Service Agency (FSA)	
	CdA Tribe for Tribal trust and fee lands	CdA Tribal NPS Management Plan Aug. 2006
Mining – exploration and surface mining, and closure of cyanidation facilities.	IDL	IDAPA 20.03.02a Approval of Surface Mining Reclamation Plan
Mining – dredge and placer mining.	IDL	IDAPA 20.03.01 IDL Permit
Environmental cleanup within the designated administrative areas (Operational Units) of the Bunker Hill Mining and Metallurgical Superfund site (OU1, OU2, and OU3).	Federal agencies State agencies Coeur d'Alene Basin Environmental Improvement Project Commission (BEIPC)	Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of 1980.
Construction and excavation activities for contaminant management within the designated Institutional Control Program areas of the Bunker Hill Superfund Site.	ICP program administered by PHD1 from their Kellogg office.	IDAPA 41.01.01 PHD1 - ICP Permit, license, and other requirements
Land activities involving cultural resources.	Coeur d'Alene Tribe	CdA Tribal Code Ch. 52

a = IDAPA: Idaho Administrative Code; legally promulgated administrative rules, pursuant to Idaho Code, that are currently in effect and fully enforceable.

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Appendix F – Detailed Budgets

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Table F1. Budget Summary & Schedule for the 2008 LMP for Fully Staffed Approach

I. CORE 2008 LMP PROGRAM	Year 1	Year 2	Year 3	Year 4	Year 5	Comments
1. LMP Nutrient Management & Coordination						*All personnel positions in this Table have been budgeted as "fully loaded" **
DEQ						
a. DEQ LMP Coordinator - Analyst 4	110,000	115,500	121,275	127,339	133,706	1.0 FTE - existing DEQ position/facilities
b. DEQ administrative support	16,500	17,325	18,191	19,101	20,056	0.25 FTE - new DEQ position/facilities
c. LMP materials (reports, CDs, mailing)	4,000	2,000	2,000	2,500	2,500	
d. Conduct Management Action Table audit	--	--	--	--	5,000	Use existing staff
DEQ LMP subtotal	130,500	134,825	141,466	148,940	161,262	
Tribe						
a. Tribe LMP Coordinator	110,000	115,500	121,275	127,339	133,706	1.0 FTE - new Tribe position/existing facilities
b. Tribe administrative support	16,500	17,325	18,191	19,101	20,056	0.25 FTE - new Tribe position/existing facil.
c. LMP materials (printing, CDs, mailing)	4,000	2,000	2,000	2,500	2,500	
d. Conduct Management Action Table audits	--	--	--	--	5,000	Use existing staff
Tribe LMP subtotal	130,500	134,825	141,466	148,940	161,262	
LMP Nutrient Management & Coordin. Total:	**261,000**	**269,650**	**282,933**	**297,879**	**322,523**	
2. Routine Monitoring						
DEQ						*Note: Years 2 - 4 staff conduct both routine monitoring & nutrient inventory*
a. Limnology position - Analyst 3	102,000	107,100	112,455	118,078	123,982	1.0 FTE - new DEQ position/existing facilities
b. Technician position - Analyst 2	70,000	73,500	77,175	81,034	85,085	1.0 FTE - new DEQ position/existing facilities
c. Administrative staff	16,500	17,325	18,191	19,101	20,056	0.25 FTE - new DEQ position/existing facil.
d. Nutrient & phytoplankton samples - lab analysis	14,500	21,750	22,403	23,075	23,767	Increase 50% for Years 2 and on
e. Metals & chlorophyll samples - EPA lab analysis	(13,000)	(14,300)	(14,730)	(15,170)	(15,625)	EPA financed in 2008 (not in subtotal)
f. Monitoring supplies, equipment, operating	10,000	11,000	11,330	11,670	12,020	Increase by 10% in Year 2
g. Aquatic plant assess. & nuisance species mgmt.	--	2,000	2,000	2,000	2,000	Use existing staff
DEQ subtotal	213,000	232,675	243,554	254,957	266,910	

Table F1 cont.

I. CORE 2008 LMP PROGRAM	Year 1	Year 2	Year 3	Year 4	Year 5	Comments
2. Routine Monitoring cont.						
CdA Tribe						
a. Limnology position	102,000	107,100	112,455	118,078	123,982	1.0 FTE - new Tribe position/existing facilities
b. Technician position	70,000	73,500	77,175	81,034	85,085	1.0 FTE - new Tribe position/existing facilities
c. Administrative staff	16,500	17,325	18,191	19,101	20,056	0.25 FTE - new Tribe position/existing facil.
d. Nutrient & phytoplankton samples - lab analysis	14,500	21,750	22,403	23,075	23,767	Increase 50% for Year 2 and on
e. Metals & chlorophyll samples - EPA lab analysis	(13,000)	(14,300)	(14,730)	(15,170)	(15,625)	EPA financed in 2008 (not in subtotal)
f. Monitoring supplies, equipment, operating	10,000	11,000	11,330	11,670	12,020	Increase by 10% in Year 2
g. Aquatic plant assess. & nuisance species mgmt.	--	2,000	2,000	2,000	2,000	Use existing staff
Tribe subtotal	213,000	232,675	243,554	254,957	266,910	
Shared Position/Program						DEQ & Tribe share costs 50/50
a. Tribe computer modeler, analysis, reporting	115,000	120,750	126,788	133,127	139,783	1.0 FTE - new Tribe position/existing facilities
b. Contractual for CWR modeling support	10,000	10,000	10,000	10,000	10,000	
Shared subtotal	125,000	130,750	136,788	143,127	149,783	
Routine Monitoring Total:	**551,000**	**596,100**	**623,895**	**653,040**	**683,603**	
3. Initial Basin-wide Nutrient Inventory (3 years)		**Begin**		**End**		
Sampling, data mining, analysis, computer modeling, reporting						Use new staff from monitoring (I.2)
DEQ						
a. Limnologist - Analyst 3	--	--	--	--	--	Costed in number 2 "Routine Monitoring"
b. Technician position	--	--	--	--	--	Costed in number 2 "Routine Monitoring"
c. Administrative staff	16,500	17,325	18,191	19,101	20,056	0.25 FTE - new DEQ position/existing facil.
d. Nutrient samples - lab analysis	--	8,000	8,000	8,000	--	
e. Operating, supplies, equipment	--	2,000	2,000	2,000	--	
DEQ subtotal	16,500	27,325	28,191	29,101	20,056	

Table F1. cont

I. CORE 2008 LMP PROGRAM	Year 1	Year 2	Year 3	Year 4	Year 5	Comments
3. Initial Basin-wide Nutrient Inventory cont.		**Begin**		**End**		
CdA Tribe						
a. Limnology position	--	0	0	0	--	Costed in number 2 "Routine Monitoring"
b. Technician position	--	0	0	0	--	Costed in number 2 "Routine Monitoring"
c. Administrative staff	16,500	17,325	18,191	19,101	20,056	0.25 FTE - new Tribe position/existing facil.
d. Nutrient samples - lab analysis	--	8,000	8,000	8,000	--	
f. Operating, supplies, equipment	--	2,000	2,000	2,000	--	
Tribe subtotal	16,500	27,325	28,191	29,101	20,056	
Shared Position/Programs						
a. Tribe computer modeler, analysis, reporting	--	--	--	--	--	Costed in number 2
b. GIS contract land use inventory	--	10,000	10,000	10,000	--	
c. Contractual (e.g., PHD septic inventory)	(70,000)	10,000	10,000	10,000	--	Septic inventory - contract with CWA grant
Shared subtotal	0	20,000	20,000	20,000	0	
Nutrient Inventory Total:	**33,000**	**74,650**	**76,383**	**78,202**	**40,112**	
4. Education & Outreach Center						
DEQ						
DEQ outreach specialist - Analyst 3	102,000	107,100	112,455	118,078	123,982	1.0 FTE - new DEQ position/new facility
Tribe						
Tribe outreach specialist	102,000	107,100	112,455	118,078	123,982	1.0 FTE - new Tribe position/new facility
Shared Position/Program						DEQ & Tribe share costs 50/50
a. Administrative position	66,000	69,300	72,765	76,403	80,223	1.0 FTE - new DEQ position/ new facility
b. Facility cost (rental, utilities)	24,000	25,200	26,460	27,783	29,172	
c. Services, equipment & supplies	50,000	10,000	10,000	10,000	10,000	
d. Outreach materials and programs (i.e., science library, printing, CDs, mailing, school displays)	5,000	10,000	10,000	12,000	12,000	Major function of outreach center
Shared subtotal	145,000	114,500	119,225	126,186	131,396	
Education & Outreach Total:	349,000	328,700	344,135	362,342	379,359	

Table F1. cont.

I. CORE 2008 LMP PROGRAM	Year 1	Year 2	Year 3	Year 4	Year 5	Comments
CORE Total:	***1,194,000***	***1,269,100***	***1,327,345***	***1,391,463***	***1,425,596***	
II. 2ND TIER STUDIES, PROJECTS AND PROGRAMS						
1. Special Studies (Including Contractual)						
a. Purchase, establish, and maintain two (2) in-lake meteorological stations	--	120,000	1,000	1,000	1,000	
b. Zooplankton sampling and analysis (existing Tribe staff)	6,000	1,000	1,000	1,000	1,000	2008 purchase of dissecting scope & nets
c. Benthic invertebrate sampling, analysis, and impacts due to metals	--	10,000	10,000	--	--	
d. Update fish consumption advisory: conduct fish tissue sampling - study food chain biomagnification of metals concentrations	--	--	--	10,000	10,000	
e. Lake-bed sediment coring	--	--	--	10,000	10,000	
f. Continue sediment benthic flux of metals/nutrients (through USGS contract)	--	--	--	--	50,000	
g. DEQ land use change and runoff characteristics, existing proposed study (March 2006)	--	20,000	20,000	--	--	
h. Nearshore studies of suspected septic drainfield impacts (periphyton, aquatic plants, groundwater monitoring wells)	--	--	--	75,000	75,000	
i. Aquatic plant contributions to internal nutrient loading (existing Tribe plant specialist)	--	10,000	10,000	10,000	--	
Special Studies Total:	**6,000**	**161,000**	**42,000**	**107,000**	**147,000**	

Table F1. cont.

II. 2ND TIER STUDIES, PROJECTS AND PROGRAMS	Year 1	Year 2	Year 3	Year 4	Year 5	Comments
2. TMDL Implementation Planning & Oversight						
DEQ						
a. TMDL Coordinator - Analyst 3	102,000	107,100	112,455	118,078	123,982	1.0 FTE - existing DEQ TMDL Coordinator
b. TMDL administrative support	16,500	17,325	18,191	19,101	20,056	0.25 FTE - new DEQ position/existing facil.
c. LMP materials (reports, CDs, mailing)	2,000	2,000	2,000	2,000	2,000	
DEQ subtotal	120,500	126,425	132,646	139,179	146,037	
CdA Tribe						
a. TMDL Coordinator	102,000	107,100	112,455	118,078	123,982	1.0 FTE - new Tribe position/existing facilities
b. TMDL administrative support	16,500	17,325	18,191	19,101	20,056	0.25 FTE – new Tribe position/existing facil.
c. LMP materials (reports, CDs, mailing)	2,000	2,000	2,000	2,000	2,000	
Tribe subtotal	120,500	126,425	132,646	139,179	146,037	
TMDL Coordination Total:	**241,000**	**252,850**	**265,293**	**278,357**	**292,075**	
TIER II, 1 - 2 Total:	***247,000***	***413,850***	***307,293***	***385,357***	***439,075***	
3. TMDL Implementation Projects						
a. Projects on TMDL & non-303(d) waterbodies	2,000,000	2,000,000	2,000,000	2,000,000	2,000,000	Estimates based on Appendix D expenditures
GRAND TOTAL (Tiers I & II)	**3,441,000**	**3,682,950**	**3,634,638**	**3,776,820**	**3,864,671**	

Table F1. cont.

II. 2ND TIER STUDIES, PROJECTS AND PROGRAMS	Year 1	Year 2	Year 3	Year 4	Year 5	Comments
4. Upgrades to Wastewater Treatment Plants- Upstream						
a. South Fork Coeur d'Alene River Sewer District	--	14,000,000				While WWTP costs are shown for 1 year (Year 2), these costs are spread over multiple years
b. Smelterville	--					
c. Clarkia WWTP	--	30,000				
d. Santa/Fernwood WWTP	--	39,000				
e. St. Maries WWTP	--	59,000				
f. Harrison WWTP	--					
g. Plummer WWTP	--	8,000,000				
Upstream WWTP Upgrades Total:		**22,128,000**				
5. Embayment Sewage Systems and Upgrades						
	--	--				To be determined
6. Upgrades to Wastewater Treatment Plants-Downstream						
a. City of Coeur d'Alene WWTP	--	15,000,000				
b. City of Post Falls WWTP	--	14,000,000				
c. Hayden Area Regional Sewer Board	--					
Downstream WWTP Upgrades Total:		**29,000,000**				
7. Increased Funding/Staffing for MATs Shortfall						
	--	--				To be determined

*Note: the term, "fully loaded" is referring to all costs associated with employment, including: salary, fringe benefits, travel, office space, equipment, administrative costs, indirect, and other associated expenses.

Table F2. Budget Summary & Schedule for the 2008 LMP Partial Contract Approach

I. CORE 2008 LMP PROGRAM	Year 1	Year 2	Year 3	Year 4	Year 5	Comments
1. LMP Nutrient Management & Coordination						*All personnel positions in this table have been budgeted as "fully loaded" **
Same Detailed Budget Costs for DEQ and Tribe as Listed in Table F1						1.0 FTE - existing DEQ LMP Coordinator 0.25 FTE - existing DEQ Admin
LMP Nutrient Management & Coordin. Total	**261,000**	**269,650**	**282,933**	**297,879**	**322,523**	
2. Routine Monitoring						
DEQ						*Note: Years 2 - 4 staff conduct both routine monitoring & nutrient inventory*
a. Contract Support for Monitoring and Inventory	344,000	361,200	379,260	398,223	418,134	DEQ service contract
b. Nutrient & phytoplankton samples - lab analysis	14,500	21,750	22,403	23,075	23,767	Increase 50% for Year 2 and beyond
c. Metals & chlorophyll samples - EPA lab analysis	(13,000)	(14,300)	(14,730)	(15,170)	(15,625)	EPA financed in 2008 (not in subtotal)
DEQ subtotal	358,500	382,950	401,663	421,298	441,901	
Same Detailed Budget Costs for Tribe as Listed in Table F1						
Tribe subtotal	213,000	232,675	243,554	254,957	266,910	
Same Detailed Budget Costs for Shared as Listed in Table F1						
Shared subtotal	125,000	130,750	136,788	143,127	149,783	DEQ & Tribe share costs 50/50
Routine Monitoring Total	**696,500**	**746,375**	**782,004**	**819,381**	**858,594**	
3. Initial Basin-wide Nutrient Inventory (3 years)		**Begin**		**End**		
Sampling, data mining, analysis, computer modeling, reporting						Use staff from monitoring (I.2)
DEQ						
a. Contract Support for Monitoring and Inventory	--	0	0	0	--	Costed in number 2 "Routine Monitoring"
b. Nutrient samples - lab analysis	--	8,000	8,000	8,000	--	
DEQ subtotal	--	8,000	8,000	8,000	--	
Same Detailed Budget Costs for Tribe as Listed in Table F1						
Tribe subtotal	16,500	27,325	28,191	29,101	20,056	Staff costed in number 2 "Routine Monitoring"

Table F2. cont.

I. CORE 2008 LMP PROGRAM	Year 1	Year 2	Year 3	Year 4	Year 5	Comments
3. Initial Basin-wide Nutrient Inventory cont.		**Begin**		**End**		
Same Detailed Budget Costs for Shared as Listed in Table F1						
Shared subtotal	0	20,000	20,000	20,000	0	DEQ & Tribe share costs 50/50
Nutrient Inventory Total	**16,500**	**55,325**	**56,191**	**57,101**	**20,056**	
4. Education & Outreach Center						
DEQ						
a. Outreach contract support	75,000	78,750	82,688	86,822	91,163	DEQ service contract
Tribe						
a. Tribe outreach specialist	102,000	107,100	112,455	118,078	123,982	1.0 FTE - new Tribe position/new facility
Same Detailed Budget Costs for Shared as Listed in Table F1						DEQ & Tribe share costs 50/50
Shared subtotal	145,000	114,500	119,225	126,186	131,396	1.0 FTE – DEQ service contract for Admin
Education & Outreach Total	**322,000**	**300,350**	**314,368**	**331,086**	**346,540**	
CORE Total:	***1,296,000***	***1,371,700***	***1,435,495***	***1,505,447***	***1,547,713***	
II. 2ND TIER STUDIES, PROJECTS AND PROGRAMS						
1. Special Studies (Including Contractual)						
Same Detailed Budget Costs for DEQ and Tribe as Listed in Table F1						
Special Studies Total:	**6,000**	**161,000**	**42,000**	**107,000**	**147,000**	
2. TMDL Implementation Planning & Oversight						
Same Detailed Budget Costs for DEQ and Tribe as Listed in Table F1						0.25 FTE – existing DEQ Admin
TMDL Coordination Total	**241,000**	**252,850**	**265,293**	**278,357**	**292,075**	

Table F2. cont.

II. 2ND TIER STUDIES, PROJECTS AND PROGRAMS	Year 1	Year 2	Year 3	Year 4	Year 5	Comments
TIER II, 1 – 2 Total:	***247,000***	***413,850***	***307,293***	***385,357***	***439,075***	
3. TMDL Implementation Projects						
a. Projects on TMDL & non-303(d) waterbodies	2,000,000	2,000,000	2,000,000	2,000,000	2,000,000	Estimates based on Appendix D expenditures
GRAND TOTAL (Tiers I & II):	**3,543,000**	**3,785,550**	**3,742,788**	**3,890,804**	**3,986,788**	
4. Upgrades to Wastewater Treatment Plants - Upstream						
Same Detailed Budget Costs for WWTPs as Listed in Table F1						While WWTP costs are shown for 1 year (Year 2), these costs are spread over multiple years
Upstream WWTP Upgrades Total	**--**	**22,128,000**				
5. Embayment Sewage Systems and Upgrades						
	--	--				To be determined
6. Upgrades to Wastewater Treatment Plants-Downstream						
Same Detailed Budget Costs for WWTP as Listed in Table F1						
Downstream WWTP Upgrades Total	**--**	**29,000,000**				
7. Increased Funding/Staffing for MATs Shortfall						
	--	--				To be determined

*Note: the term, "fully loaded" is referring to all costs associated with employment, including: salary, fringe benefits, travel, office space, equipment, administrative costs, and indirect, other associated expenses