SUMMARY OF THE DIAMOND LAKE RESTORATION DRAFT ENVIRONMENTAL IMPACT STATEMENT

CHAPTER 1- PURPOSE OF AND NEED FOR ACTION

INTRODUCTION

The purpose of this Diamond Lake Restoration Project Draft Environmental Impact Statement (EIS) is to document the environmental analysis that considers options for improving water quality and the recreational fishery following the expansion of a population of tui chub fish. The tui chub is a member of the minnow family that is not native to Diamond Lake.

Diamond Lake is a high use recreation destination considered important to the economy of southern Oregon. Originally fishless, the lake has been managed as a recreational trout fishery since 1910. Tui chub were introduced into the lake in the mid-1940's and rapidly overpopulated the lake. In 1954, the Oregon Game Commission constructed a canal near the Lake Creek outlet, lowered the lake level, and treated Diamond Lake with the fish toxicant, rotenone, to eradicate tui chub. The lake was restocked with trout following the successful rotenone treatment and a thriving fishery was maintained for several decades.

In 1992, tui chub were again discovered in Diamond Lake and have since overpopulated the lake for a second time. As the tui chub population grew during the 1990's, the recreational trout fishery declined dramatically. Now, tui chub are estimated to have an annual population of 7.6 million adults and over 90 million younger fish. This has led to ecological changes to Diamond Lake resulting in the dramatic decline in both water quality and the recreational trout fishery. Declines in water quality, in the form of toxic algae blooms, have forced lake closures to protect public health in the summers of 2001, 2002, and 2003.

The project area is located on the Diamond Lake Ranger District, Umpqua National Forest within the Umpqua River Basin (Figure S-1). The project area is bounded to the North by the North Umpqua River, to the South by Crater Lake, to the East by Mt. Thielsen, and to the West by Mt. Bailey.

Negative impacts on the recreational fishery and on water quality in Diamond Lake and down stream prompted multiple local, state, and federal agencies to work cooperatively on solutions for the lake.

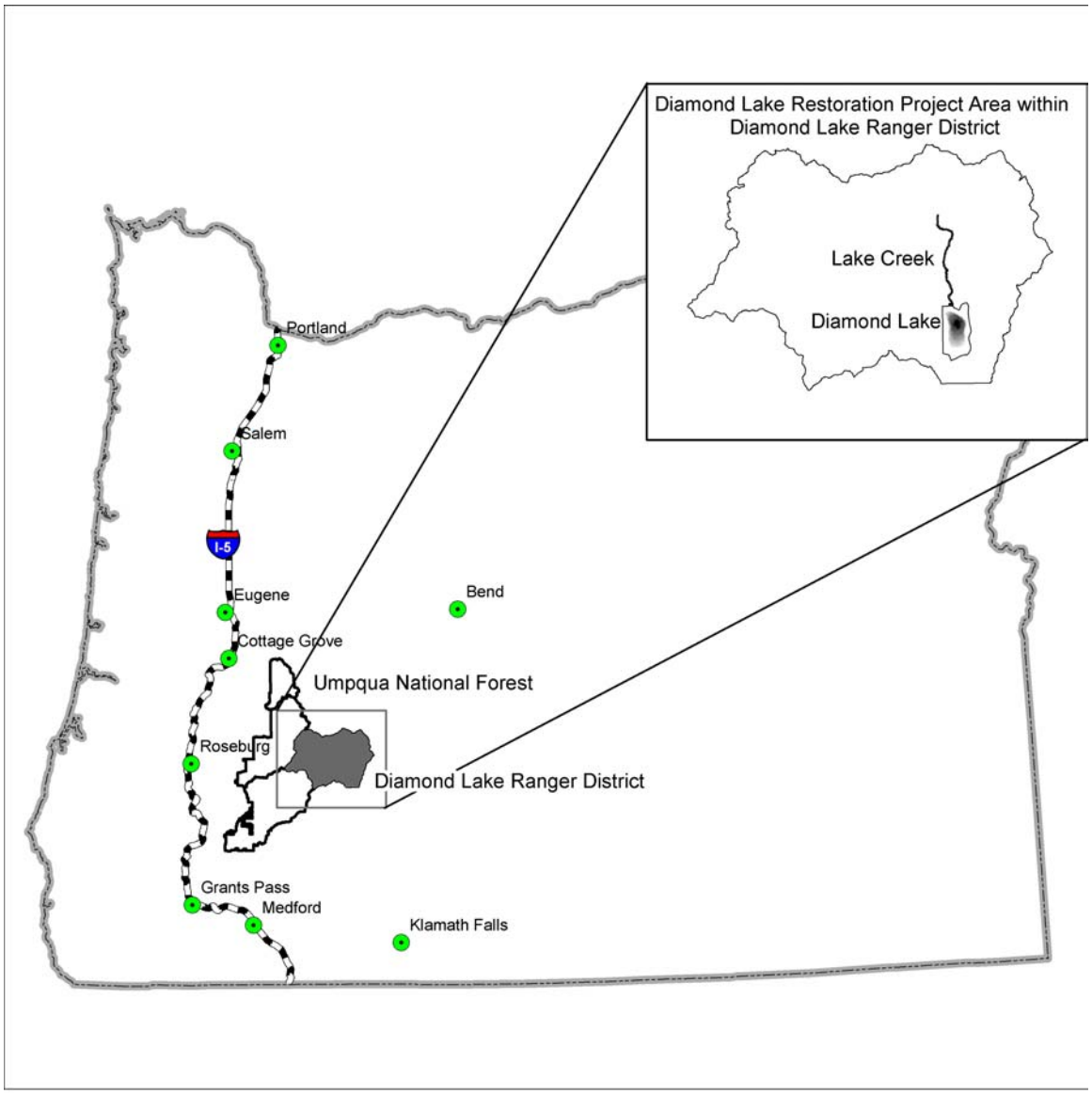

Figure S-1. Project Area Location on the Diamond Lake Ranger District, Umpqua National Forest.

PURPOSE OF AND NEED FOR ACTION

The Forest Supervisor of the Umpqua National Forest finds there is a need for improvement of Diamond Lake's water quality and recreational fishery. Eradication or control of the existing tui chub population is considered essential for accomplishing these objectives.

The difference between the existing conditions and the desired conditions defines the purpose and need for action in terms of elements that can be measured and analyzed. These elements are:

Water Quality

Diamond Lake currently does not meet Oregon State water quality standards,Umpqua National Forest Plan goals, or support the beneficial uses of the lake. Diamond Lake is included in the Oregon Department of Environmental Quality's (ODEQ) 303(d) list of water quality limited water bodies for pH and algae (ODEQ 2002). The beneficial uses for Diamond Lake that are currently negatively impacted by these water quality problems include: resident fish and aquatic life, water contact recreation, aesthetics, and fishing.

Annual monitoring data by ODEQ and others demonstrates that pH values exceeded standards during the summer season every year from 1992-2002. Similarly, annual monitoring data from 1992-2002 indicate that State standards for algae are not being met at Diamond Lake (JC Headwaters 2003). In the summers of 2001, 2002, and 2003, Diamond Lake experienced severe blooms of the cyanobacteria (blue-green algae) *Anabaena flos-aquae*. This type of algae produces a neurotoxin that in high concentrations is harmful to humans and other life. Another species of blue-green algae, *Microcystis aeruginosa*, was also present in the 2003 bloom. This species produces hepatotoxins which are also a health risk. To protect public health and safety, the Umpqua National Forest, in cooperation with the Douglas County Health Department, closed Diamond Lake to some public uses (wading, swimming, water skiing, and boating) during portions of all summers. Changes in lake ecology associated with overpopulation of the lake by tui chub are believed to be major contributing factors influencing the development of toxic algae blooms at Diamond Lake.

Diamond Lake is identified in the Umpqua National Forest Land and Resource Management Plan (LRMP) as a special management area (MA-2). As such, the lake is to be managed for concentrated developed recreation, favoring activities such as resort use, camping, picnicking, visitor information services, boating, fishing, interpretation and developed and dispersed winter sports (LRMP 1990, pgs. 110, 153). Summer-time lake closures due to degraded water quality are not compatible with MA-2 goals, are disappointing to some summer recreationists, and have negative economic impacts to some local businesses.

The desired condition for Diamond Lake is water quality that supports the beneficial uses of the lake and meets Forest Plan goals. The existing water quality conditions do not meet State standards, do not support beneficial uses of the lake, and do not meet recreation management goals. Therefore, there is a need for improvement of water quality at Diamond Lake.

This element of the purpose and need is measured and displayed in the DEIS by expected levels of primary production, phytoplankton density, and blue-green algae production.

Recreational Fishery

The Diamond Lake recreational fishery does not currently meet State of Oregon management objectives or Umpqua National Forest Plan goals. For several decades, Diamond Lake has supported a large and popular recreational trout fishery that is important to the local and regional economy. No natural trout reproduction occurs in the lake, so the Oregon Department of Fish and Wildlife (ODFW) traditionally maintained the fishery in a cost-effective manner, primarily by stocking the lake each year with about 400,000 fingerling (about 3-inches in length) rainbow trout.

In recent years, the recreational fishery at Diamond Lake has declined dramatically from a high annual average harvest rate of about 270,000 trout averaging approximately 12-inches in size from 1963 to 1978, to a 1999 low annual harvest rate of 5,000 trout averaging less than 10-inches in length (ODFW, unpublished creel data). Failure of the formerly successful recreational fishery is attributed largely to changes in the ecology of the lake caused by the overpopulation by tui chub.

The desired condition for the recreational fishery at Diamond Lake as described in *current* State regulations is:

> Diamond Lake shall be managed for hatchery production under the basic yield alternative of Oregon's Trout Plan (OAR 635-500-0703), which in summary states that the waters use their natural productivity to grow trout to a harvestable size with or without the addition of fingerling or yearly hatchery trout (OAR 635-500-0115).

Specific fish stocking strategies and harvest goals associated with these regulations are generated through an adaptive management process. Appropriate numeric goals for out-year stocking would be determined by ODFW using existing data and knowledge, ecological indices of lake health (i.e., zooplankton and benthic invertebrate populations), annual fish monitoring data and applicable nutrient loading allocations provided in Oregon Department of Environmental Quality's (ODEQ) pending Total Daily Maximum Load (TMDL) publication regarding the amount of acceptable pollutants in the lake.

The Umpqua National Forest Land and Resource Management Plan states that fishing is a recreational activity that will be supported through management activities at Diamond Lake. Many members of the public have expressed dissatisfaction with the current recreational fishing opportunities at Diamond Lake.

The desired condition for Diamond Lake is an ecologically sustainable recreational fishery that meets State management objectives and Forest Plan goals. The existing fishery meets neither. Therefore, there is a need for improvement of the recreational fishery at Diamond Lake.

This element of the purpose and need is measured and displayed in the EIS by expected tui chub populations, trout body condition, and annual angler catch.

PROPOSED ACTION

The Umpqua National Forest, in cooperation with multiple state and federal agencies, proposes to implement a series of actions that would meet the need for improvement of water quality and the recreational fishery at Diamond Lake. Proposed activities include: canal reconstruction, a fall/winter lake draw down, mechanical fish removal and utilization, a September rotenone (fish toxicant) treatment to eradicate tui chub, fish carcass removal and utilization, water management during lake refill period, monitoring, fish restocking, educational activities, and contingency measures for controlling tui chub if they are reintroduced to Diamond Lake in the future.

The proposed action would also include a non-significant amendment to the 1990 Umpqua National Forest Land and Resource Management Plan (LRMP). The amendment would allow the use of rotenone within Diamond Lake, Short and Silent Creeks, which would not normally occur under Standard and Guideline Water Quality/Riparian Areas #8 (LRMP IV-60) and Prescriptions C2-I (LRMP 169-171)and C2-IV (LRMP IV-178).

DECISIONS TO BE MADE BASED ON THIS ANALYSIS

Based on the analysis documented in this environmental impact statement, the Responsible Official will make the following decisions: to implement this project as proposed, to implement a modified version (alternative) of this project which addresses unresolved issues, or not implement this project at this time; to decide which management requirements, mitigation measures, monitoring and water quality best management practices are necessary to achieve resource goals, objectives, and the desired future condition; to amend the 1990 Umpqua National Forest Land and Resource Management Plan, as proposed; whether the proposed amendment would result in a significant change to the 1990 Umpqua National Forest Land and Resource Management Plan.

INTERAGENCY COOPERATION

An interagency collaborative group, referred to as the Diamond Lake Project Working Group formed in October of 2001, hosted a technical forum in May of 2002, and has met nearly every month since July of 2002.

The working group is composed of Oregon State Representative Susan Morgan, US Fish and Wildlife Service, US Forest Service, US Environmental Protection Agency, Douglas County, Oregon Department of Fish and Wildlife, Oregon Department of Environmental Quality, Oregon Water Resources Department, Oregon Economic and Community Development Department, and Oregon Division of State Land. These parties formalized their roles in a memorandum of understanding (MOU). Although not parties to the MOU, representatives of the National Oceanic and Atmospheric Administration and PacifiCorp also work cooperatively with the working group.

For the development of this Draft Environmental Impact Statement (DEIS), another MOU was signed by three of the agencies, with the Forest Service as the lead agency and ODFW and ODEQ as cooperating agencies in the DEIS. Oregon Department of Fish

and Wildlife has full authority to decide what fish stocking strategy would be utilized in Diamond Lake. Fish stocking is a State, not a Federal action. However, based on the three-agency MOU, ODFW has agreed to pursue approval of fish stocking strategies described under individual alternatives in the DEIS through the Oregon Fish and Wildlife Commission and the appropriate public process.

SCOPING

Public involvement to assist the Forest Service in developing the framework of the proposed action for the Diamond Lake Restoration project began in the fall of 2002. Public forums, presentations to special interest groups, electronic distribution of presentations, a technical meeting with actively interested publics, and multiple information mailings were all components of the early public involvement process for the project. The Confederated Tribes of Siletz, Cow Creek Band of Umpqua Indians, and Confederated Tribes of the Grande Ronde were each notified about the upcoming Diamond Lake project. The concerns and information raised from this early involvement process helped the Forest Service to formulate the proposed action.

Once the proposed action was developed, formal scoping began with publication of the Notice of Intent (NOI) and Proposed Action on April 25, 2003. Numerous area radio and television stations and newspapers published articles about the project. A public meeting soliciting scoping comments was held in Roseburg on May 27, 2003. Sixty-three letters were received during the formal scoping period. Comments ranged from: concern over whether fish should be stocked at all to the type of fish stocking; the likelihood of actually eradicating tui chub and the chances of a re-introduction; concerns over the effect of the proposed action on water quality in the lake and downstream; and concerns over the cost of implementing the project and not considering the other economic contributions of the lake beyond the trout fishery.

Members of the public made numerous suggestions for alternative treatment options for Diamond Lake. Some public recommendations were incorporated into action alternatives and some were considered, but eliminated from detailed study as described in Chapter 2.

SIGNIFICANT ISSUES

Significant issues associated with a proposed action are the focus of an environmental impact statement because they provide the basis for formulating and comparing alternatives to the proposed action. Significant issues are based on unresolved conflicts concerning alternative uses of available resources. Issues are points of debate, dispute or disagreement over the effects of the proposed action.
Scoping identified a number of significant issues related to the proposed treatment of Diamond Lake. These issues, together with applicable laws, regulations, and policies, were used to develop alternatives. Issues expressed for the Diamond Lake Restoration Project and the measures for those issues are as follows:

1. Fish Stocking: Some members of the public felt that certain fish stocking strategies, different from past or proposed strategies, may now be appropriate for use in the management of the recreational fishery at Diamond Lake because: they believe past/proposed strategies have and would compromise water quality in the lake; or

they believe different fish species would make better predators on tui chub than rainbow trout. This issue is measured by comparing the ODFW management strategy and the fish species mix associated with each DEIS alternative.

2. Non-target Species: Some members of the public expressed a concern that rotenone treatment would kill non-target fish and wildlife species (i.e. amphibians, aquatic insects, rainbow trout) in Diamond Lake and could have negative impacts on other fauna in the Diamond Lake food chain (i.e. bald eagles, waterfowl, river otters). In addition, there were concerns about the potential negative effects on non-target species in Lake Creek, Lemolo Lake, and the North Umpqua River system if rotenone treated water escaped Diamond Lake through Lake Creek or groundwater. This issue is measured by an assessment of the expected effects on bald eagles and coho salmon, both listed under the Endangered Species Act.

3. Water Quality: Some members of the public were concerned that a lake draw down would affect downstream water quality; that rotenone would affect water quality downstream and in wells near the lake; and that the combination of rotenone followed by fish stocking would affect water quality by affecting the lake's food chain. This issue is measured by assessing the expected levels of pH, aquatic plant growth (primary production), blue-green algae toxins, zooplankton population structure and risk of well contamination.

4. Wetland Ecology: Some members of the public expressed concern that the proposed draw down could affect wetlands adjacent to the lake and the flora and fauna associated with them. In addition, there were public concerns over the potential effects of the draw down on the condition of Lake Creek. This wetland issue is measured in the DEIS by assessing the expected acres of wetlands temporarily dewatered; the expected changes in Lake Creek's channel morphology; and the effects to rare plant communities.

In addition to the measures used to track the above significant issues, eight other issues (those that did not drive additional alternatives) are displayed and assessed in the DEIS. These issues include Diamond Lake's historically fishless condition, impacts on indigenous fish species, likelihood of tui chub reintroduction, human health risks, economics, recreation, water rights, and tui chub transport into Lemolo Lake. Moreover many other aspects of physical, biological, and social environment are assessed and disclosed in the DEIS in order to meet current regulations and policy regarding the National Environmental Policy Act.

CHAPTER 2 – ALTERNATIVES, INCLUDING THE PROPOSED ACTION

Four alternatives for the Diamond Lake Restoration Project are considered in detail. The National Environmental Policy Act (NEPA) requires analysis of a proposed action and other reasonable alternatives, including no action. The no action alternative provides a baseline for estimating environmental effects. The additional action alternatives were developed following extensive public outreach and interagency coordination in response to the issues identified. In response to scoping, 24 additional

alternatives were considered, but eliminated from detailed study due to prohibitive costs, inconsistency with regulatory requirements, or lack of feasibility or effectiveness. These are described at the end of Chapter 2.

ALTERNATIVES CONSIDERED IN DETAIL

Alternative 1 (No Action)

This alternative serves as the baseline for estimating environmental effects of the action alternatives. No canal reconstruction, lake draw down, mechanical fish harvest, chemical treatment, fish carcass removal, or lake refill would occur. No active measures to improve water quality at Diamond Lake would be implemented. Potentially harmful algae blooms and lake closures would be expected to continue.

ODFW would continue with the existing experimental fish stocking program (100,000 fish) in 2004 and 2005. In 2006, ODFW and the Oregon Fish and Wildlife Commission (OFWC) would revisit the Diamond Lake Fishery Management Plan to determine appropriate stocking. Based on current knowledge and budget, it is expected that ODFW would stock Diamond Lake with 24,000 legal sized rainbow trout on annual basis in 2006 and beyond.

Alternative 2 (Proposed Action)

The Umpqua National Forest, in cooperation with multiple state and federal agencies, proposes to implement a series of actions that would meet the need for improvement of water quality and the recreational fishery at Diamond Lake.

Canal Reconstruction: A blocked and debris-filled existing earthen canal that connects Diamond Lake to Lake Creek would be reconstructed to facilitate a lake draw down. The portion of the canal within Diamond Lake would be dredged to its original depth using a floating suction dredge or other appropriate equipment. Dredge spoils would be used to expand an existing wetland. From the lakeshore to the canal outlet, the canal would be excavated to its original configuration and fitted with a new head-gate structure to control water flow. If necessary, new bridges or culverts would be constructed over the canal to maintain access to the bike trail and summer homes using Forest Service Road 4795.

Fall/Winter Lake Draw Down: Diamond Lake's water level would be lowered by eight feet from its normal summer level using both the reconstructed canal and Lake Creek for water transport. The lake draw down would begin on or around September 15 in the year prior to a chemical treatment. A gravity-driven draw down would occur at a discharge rate approximating a bankfull flow in Lake Creek.

Mechanical Fish Removal and Utilization: Several methods would be used to remove and utilize fish from Diamond Lake prior to chemical treatment including: liberalizing catch limits on fishing at the lake; harvest of fish by individual crews using traps, nets and seines; and harvest of fish through commercial fishing operations. Harvested fish carcasses would be converted to an organic fish emulsion product on site (lake shore) or trucked to an off-site plant for utilization as fertilizer.

September Rotenone Treatment: The powdered formulation of the fish toxicant rotenone would be applied to Diamond Lake in September (about a year after the lake draw down begins). This would happen when water temperature and chemistry reached conditions considered optimal for achieving a complete fish kill. Rotenone would be administered according to label instructions at the necessary amounts based on water volume, temperature, and chemistry in Diamond Lake at the time of application. Sections of Silent Creek and Short Creek would also be treated with liquid rotenone.

Non-Significant Forest Plan Amendment: The proposed action would include a non-significant amendment to the 1990 Umpqua National Forest LRMP. The amendment would allow the use of rotenone within Diamond Lake, Short and Silent Creeks, which would not normally occur under Standard and Guideline Water Quality/Riparian Areas #8 (LRMP IV-60) and Prescriptions C2-I(LRMP IV-169-171) and C2-IV (LRMP IV-178). The non-significant Forest Plan Amendment (Amendment #5) would apply to this project only; upon completion of the project, Standard and Guideline Water Quality/Riparian Areas #8 and Prescription C2-IV would again apply to Diamond Lake, Short and Silent Creeks.

Mechanical Fish Carcass Removal and Utilization: A commercial fishing or professional fish mortality recovery and recycling operation would be employed to collect fish carcasses following a chemical treatment of the lake. Fish carcasses would be converted to an organic fish emulsion product on site or trucked to an off-site plant for utilization as fertilizer.

Water Management during Lake Refill Period: An active water management strategy would be implemented to limit the length of time that Lake Creek is reduced to no or very low flows. When water in Diamond Lake becomes suitable for release (about November), canal headgates would be opened to allow approximately 10 cubic feet per second (cfs) of water to flow into Lake Creek and through the North Umpqua River system.

Monitoring: A variety of monitoring activities would be used to verify assumptions, evaluate project success, and formulate appropriate lake management strategies including: stream flows and water quality in Lake Creek; water quality in Diamond and Lemolo Lakes and the North Umpqua River; tui chub presence; and phytoplankton, zooplankton and benthic invertebrate and trout populations.

Fish Restocking Strategy: ODFW would pursue approval for a change to the following strategy for restocking Diamond Lake through the Oregon Fish and Wildlife Commission (OFC) and the appropriate public process.

Diamond Lake would be restocked with fish using an ecologically sustainable stocking strategy. The Oregon Department of Fish and Wildlife would manage the lake for hatchery production under the Basic Yield Alternative of Oregon's Trout Plan. However, ecological indices of lake health (i.e., zooplankton and benthic invertebrate populations), existing data and knowledge, annual fish monitoring data and applicable nutrient loading allocations provided in ODEQ's pending Total Maximum Daily Load (TMDL) publication would be used to determine appropriate numeric goals for annual fish stocking and harvest post-project.

Under this stocking strategy, it is expected that conservatively small numbers of fingerling "Fishwich" or Oak Springs rainbow trout and legal and/or trophy sized predacious fish species (Eagle Lake rainbow trout, brown trout, or spring Chinook) would be introduced into Diamond Lake as soon as the food chain recovered adequately to support them without compromising progress toward water quality goals. Annual stocking rates would be expected to increase as the food chain and water quality continued to recover.

Education: A number of educational activities would be used to reduce the likelihood of tui chub reintroduction into Diamond Lake potentially including: "angler stamps", interpretive signs and brochures, and boat inspections.

Tui Chub Contingency Plan: Because it is recognized that tui chub may be illegally reintroduced, several actions designed to control tui chub populations would be implemented including: an extensive monitoring program to facilitate early detection of tui chub presence in the lake; stocking with predacious fish species following rotenone treatment and increasing the numbers of predacious fish if tui chub are detected; and using mechanical treatments such as netting and electro-shocking to limit tui chub population growth.

Connected Actions: A permit would be issued to Diamond Lake Resort to conduct maintenance and clean-up at the Resort Marina and the South Shore Pizza parlor dock while Diamond Lake is drawn down to eight feet below its normal level. This would involve the removal of accumulated sediment at the mouth of a tributary stream and the removal of obstacles/water hazards such as old cribbing, concrete blocks, pilings, etc. that are remnants of old boat docks and moorage.

Alternative 3 (Put and Take Fishery)

Alternative 3 was developed to respond to the fish stocking issue. This alternative is designed to provide a recreational fishery that minimizes potential effects of stocked fish on water quality in Diamond Lake. Alternative 3 is identical to the proposed action except that it would utilize a different fish stocking strategy to restock Diamond Lake following a rotenone treatment.

Alternative 3 includes all of the following components of the proposed action described in Alternative 2: canal reconstruction, fall/winter lake draw down, mechanical fish removal and utilization, rotenone treatment, mechanical fish carcass removal and utilization, water management during the lake refill period, monitoring, education, and a tui chub contingency plan and a non-significant amendment to the 1990 Umpqua National Forest LRMP. Connected actions proposed by the Diamond Lake Resort would also be permitted under this alternative.

Additionally, under this alternative, ODFW would pursue approval for a change to the following strategy for restocking Diamond Lake with fish through the OFWC and the appropriate public process.

If approved by OFWC, management of the Diamond Lake recreational fishery would change from a Basic Yield Alternative under Oregon's Trout Plan to an Intensive Use

Alternative[1]. In layman's terms this is a "put and take fishery" where legal sized fish are stocked in the spring and are harvested by anglers later in the same season.

Under this stocking strategy, it is estimated that ODFW would stock Diamond Lake annually with approximately 100,000-400,000 12-inch domesticated rainbow trout. Trout from this brood stock would not reproduce successfully in Diamond Lake, would not prey significantly on available food organisms, and the majority would not survive over winter. Diamond Lake would be stocked with domesticated trout in late spring following a fall rotenone treatment (since these fish would not require a robust existing food base). Stocking would occur periodically from late spring to early fall on an annual basis.

Subsequently, as part of the "tui chub contingency plan", legal or trophy sized predacious fish species (Eagle Lake rainbow trout, brown trout, or spring Chinook) would be introduced into Diamond Lake as soon as the food base recovered adequately to support them without compromising progress toward water quality goals. Ecological indices of lake health (i.e., zooplankton and benthic invertebrate populations), existing data and knowledge, annual fish monitoring data and applicable nutrient loading allocations provided in ODEQ's pending Total Maximum Daily Load (TMDL) publication would be used to determine appropriate numeric goals for all annual fish stocking and harvest post-project.

Alternative 4 (Mechanical/Biological)

Alternative 4 was developed to respond to the issues of fish stocking, non-target species, water quality, wetland ecology, and human health risks associated with rotenone use. This alternative was designed to minimize effects of a chemical treatment and associated lake draw down on resources while limiting/controlling the tui chub population. This alternative does not include a lake draw down so potential impacts to water quality and wetland ecology from a draw down are eliminated; and it does not include a chemical treatment so potential impacts to non-target species, water quality, and health risks from chemicals are eliminated. This alternative includes a modified fish stocking strategy designed to reduce the potential impacts of a recreational fishery on water quality in Diamond Lake.

Alternative 4 would use mechanical techniques in combination with predacious fish stocking to selectively harvest chub, disrupt chub spawning and increase predation on chub, with the objective of severely diminishing chub populations over time. Alternative 4 would include the education and monitoring components of Alternative 2. Additionally, this alternative includes all of the following components:

Annual Mechanical Harvest: Mechanical fish harvest treatments would occur on an annual basis for six consecutive years utilizing a variety of commercial fishing tools/techniques determined to be most effective through an adaptive management

[1] Intensive Use--"....Waters managed for this alternative are apt to be near large population centers or attract intensive angler use because of easy accessibility or location of other water-oriented recreational facilities. Many of these waters support fisheries year-round. Many of these waters can be used heavily by anglers or for short periods (April, May, and June) and afterwards be used for sailboating, water skiing, swimming, and camping. Other waters can support fisheries year-round. Some of these waters are stocked with yearling rainbow trout on a regular basis. Guidelines which apply are:...." (OAR 635-500-0115)

process. Potential tools include: seine nets, trawl nets, cast nets, gill nets, lampara[2] and beach seines, custom-built traps, or other types of commercial nets, seines, and traps. Fish harvest activities would likely occur for two months in June and July prior to and during the chub spawning period at Diamond Lake. Commercial fishing operations would only occur in certain portions of the lake at a given point in time and would be rotated to different portions of the lake during the two month period. Areas where commercial fishing was occurring would be closed to recreational angling. Commercial fishing would also occur annually for approximately one month in September in an effort to harvest chub as they move from the shallows into more open water within the lake. Mechanical fish harvest treatments would target reproductive age chub. The goal of these activities would be to harvest 90-95% of the reproductive-age chub annually, while attempting to maintain a biological control (predacious fish) on the tui chub population. It is expected that annual commercial fishing operations described above would be needed to effectively limit tui chub recruitment in Diamond Lake over time.

Contingent on available funding, ODFW would pursue approval from OFWC for the establishment of a bounty on tui chub at Diamond Lake. A bounty would be used as a supplementary tool to remove tui chub from the lake while informing the public about the chubs' role in the declining health of Diamond Lake.

Spawning Disruption: In addition to the above activities, electro-fishing boats would be used during the peak chub spawning period to disrupt spawning in the shallow areas of the lake that have abundant aquatic macrophytes.

Predacious Fish Stocking: ODFW would pursue approval for a change to the following strategy for restocking Diamond Lake with fish through the OFWC and the appropriate public process. In general, Diamond Lake would be stocked annually with large predacious fish in sufficient numbers and of sufficient size/age classes to serve as potentially effective predators on the tui chub as well as to provide a recreational fishery. Specifically, if approved by OFWC, management of the Diamond Lake recreational fishery would change from a Basic Yield Alternative under Oregon's Trout Plan to either a Featured Species[3] or Trophy Fish Alternative[4].

Oregon administrative regulations under the Basic Yield Alternative states: "The productive capacity of the waters in this alternative will be maintained or enhanced so that no net loss of natural fish production occurs. Problem waters[5] can be transferred into a higher priority alternative. Both the Featured Species and Trophy Fish alternatives are higher priority alternatives in the Oregon Trout Plan.

A Featured Species stocking strategy would include annual stocking with legal and/or trophy sized Eagle Lake rainbow trout. A Trophy Fish stocking strategy would include

[2] A lampara net is a type of open water seine with tapered ends and a relatively deep, loosely hung center section. The net is set in a circle around the fish school and the two ends are brought together capturing the fish in the middle (Nielsen and Johnson 1989)

[3] Featured Species and Waters—Management under this alternative emphasizes species or stocks that are uncommon or unique and waters that have historical benefit or potential for unique natural beauty, water quality, aesthetics or recreational capabilities

[4] Trophy Fish—Certain waters are capable of producing large "bragging-size" trout

[5] Problem waters are not defined in the OARS however, according to ODFW personnel, the degraded water quality at Diamond Lake qualifies it as "problem water".

annual stocking with legal and/or trophy sized brown trout or Kamloops rainbow trout. Special angler harvest regulations to protect large trout would be considered. Ecological indices of lake health(i.e., zooplankton and benthic invertebrate populations), existing data and knowledge, annual fish monitoring data and applicable nutrient loading allocations provided in ODEQ's pending TMDL publication would be used to determine appropriate numeric goals for annual fish stocking and harvest post-project.

BEST MANAGEMENT PRACTICES, MANAGEMENT REQUIREMENTS, MITIGATION MEASURES, AND MONITORING

Requirements relating to best management practices, management requirements, mitigation measures, and monitoring will be implemented for all alternatives to meet laws, regulations, and policies. In most cases they have been designed to reduce potential environmental effects. General Water Quality Best Management Practices are prescribed to protect the beneficial uses of water and to address water quality objectives as required by the Federal Clean Water Act and the 1990 Umpqua National Land and Resource Management Plan, as amended.

CHAPTER 3 – AFFECTED ENVIRONMENT & ENVIRONMENTAL EFFECTS

This section of the Environmental Impact Statement presents the scientific and analytic basis for the comparison of alternatives. The effects are discussed in terms of social and environmental changes from the current situation and include quantitative assessments where possible, as well as qualitative assessments. For each aspect of the affected environment, direct and indirect impacts from the proposed alternatives, as well as cumulative impacts from past, proposed, present, and foreseeable activities are evaluated. This portion of the summary highlights topics covered in the DEIS.

AQUATIC ENVIRONMENT

Affected aquatic environments discussed in the DEIS include important factors such as: lake ecology; water quality; stream ecology; zooplankton; phytoplankton and primary productivity; benthic organisms; fish and fish habitat; and groundwater.

TERRESTRIAL ENVIRONMENT

Affected terrestrial environments discussed in this DEIS include such factors as: upland vegetation, noxious weeds, rare plants, survey and manage plants/fungi, and wildlife including survey and manage wildlife, sensitive, threatened and endangered species and management indicator species.

SOCIAL ENVIRONMENT

Within the realm of the social environment, human health, recreation and economics are discussed in detail. All three of these aspects of the social environment were identified as non-significant issues identified in the DEIS.

Other factors evaluated in this section include scenery and visual quality; unavoidable adverse impacts; irreversible and irretrievable commitments of resources; short term and long term productivity; public and worker safety; cultural resources; unique habitats; wetlands and floodplains; prime farmlands, rangelands, forestlands or parklands; potential or unusual expenditures of energy; conflicts with plans or policies of other jurisdictions; consumers, civil rights, minority groups, and women; and environmental justice.

Table S-1 summarizes the effects of implementing the alternatives on selected aspects of the terrestrial, aquatic, and social environment.

Table S-1. Effects of Alternative Implementation on Selected Factors.

Selected Factor	Indicator	Unit of measure	Alt. 1 /No Action	Alt. 2 Rotenone and put-grow-take fishery	Alt. 3 Rotenone and put and take fishery	Alt. 4 Mechanical and Biological Control of Chub
Water Quality	**Long-Term Algae Toxin Production & Probability of Annual Lake Closures**	High, Low, Temporarily Lower	High	Low	Low	Temporarily lower
	Risk of Well Water Contamin-ation w/Rotenone	High, Moderate, low to None	None	Low to none with mitigation	Low to none with mitigation	None
Recreational Fishery	**Expected Tui Chub Population**	High, Moderate, None	High	None	None	Moderate to high
	Fish Stocking Projections	Projected numbers & types/size of fish stocked annually (***** based on 2006 or 2007 projections)	24,000 8-inch predacious fish (Eagle L. rainbow, brown trout or chinook salmon)	*****100,000-200,000 trout fingerlings & 10,000 8-10-inch predacious trout/salmon	*****24,000 8-inch Eagle Lake rainbow & 100,000-200,000 14-16-inch domesticated rainbow trout	*****200,000 8-10-inch predacious fish (Eagle L. rainbow) & 50,000 14-16-inch, brown, Eagle Lake, or Kamloops trout)
	Fishing Success	Estimated Yearly Catch (in 2007-2009)	10,000	100,000 to 200,000	80,000 to 160,000	50,000 to 70,000
Lake Ecology	**Zooplankton and Aquatic Invertebrate Populations**	Population Trends	Remain depressed with low species diversity	Short-term drop, returning to pre-chub conditions	Short-term drop, returning to pre-chub conditions	Limited increase in populations and species diversity
Wetland Ecology	**Wetlands Impacts**	Acres Temporarily Dewatered	0	135	135	0
Non-Target Species	**Bald Eagles**	Effects determination for Endangered Species Act	Likely to adversely affect (due to continued algae	Likely to adversely affect (due to temporary prey	Likely to adversely affect (due to temporary prey	Not likely to adversely affect

Selected Factor	Indicator	Unit of measure	Alt. 1 /No Action	Alt. 2 Rotenone and put-grow-take fishery	Alt. 3 Rotenone and put and take fishery	Alt. 4 Mechanical and Biological Control of Chub
			toxins)	base loss)	base loss)	
	Coho Salmon	Effects determination for Endangered Species Act	Not likely to adversely affect	Not likely to adversely affect	Not likely to adversely affect	Not likely to adversely affect
Human Health	**Exposure to either algae or rotenone toxins**	Exposure of general public	Hundreds of water recreationists potentially exposed to algal toxins annually	No exposure to either toxin (due to mitigation for rotenone & substantially lowered algae toxins)	No exposure to either toxin (due to mitigation for rotenone & substantially lowered algae toxins)	Hundreds of water recreationists potentially exposed to algal toxins annually
Recreation	**Availability of water sports activities**	Amount and period of user displacement	Long-term displacement of water recreationists (due to poor water quality and poor fishing)	18 month limited use period (due to draw down and associated rotenone activities)	18 month limited use period (due to draw down and associated rotenone activities)	1/3 of lake unavailable for use in June, July, and September every year (due to annual fish removal activities)
Economics	**Sales** Estimates for the year 2009 only	Dollars generated from sales to local and non-local anglers	$376,251	$3,762,513	$3,010,010	$1,881,258
	Implementa-tion Costs	Estimated cost to implement	$709,800	$2,697,600—$2,922,600	$5,696,600—$5, 921,600	$6,099,200—$6,149,200

CHAPTER 4 – CONSULTATION WITH OTHERS

Over 400 people participated in the planning process by attending open houses, public forums, meetings, field trips, or by submitting written comments. Four regulatory agencies were consulted including NOAA Fisheries, US Fish and Wildlife Service, State Historic Preservation Office, and Oregon Department of Environmental Quality. Three Indian Tribes were notified of the project including The Cow Creek Band of Umpqua Tribe of Indians, Confederated Tribe of Grand Ronde of Indians, and the Confederated Tribe of Siletz Indians. The Draft EIS was sent to 21 Federal Agencies, 16 State Agencies in Oregon and to about 120 individuals and groups who requested a copy.

The public involvement and scoping process used for the Diamond Lake Restoration Project is summarized earlier in this Summary document.

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