TERRESTRIAL ENVIRONMENT

UPLAND VEGETATION

AFFECTED ENVIRONMENT

Upland vegetation types surrounding Diamond Lake and along Lake Creek are dominated by coniferous montane forests heavily influenced by snowpack, geology, fire, soils and topographic relief. In general these forests are typical for elevations of 4500-5500 feet in the Southern Cascade Mountains. Four distinct forest types exist within the project, the most abundant being a lodgepole pine (*Pinus contorta*) dominated forest. Lodgepole pine forests occupy flat zones with soils that hold little moisture and have little organic matter. Repeated stand replacing fires can result in large tracts of land being dominated by lodgepole. Associated species in these forests are common shrubs such as pinemat manzanita (*Arctostaphylos nevadensis*) and mahala mat (*Ceonothus prostratus*). Common forbs include Rydberg's beardstongue (*Penstemon rydbergii*) and spreading phlox (*Phlox diffusa*). The lack of a stand replacing fire would usually result in succession leading to a mountain hemlock/mixed fir dominated forest. These forest types are also more common along areas with some topographic relief especially with northeast to northwest aspects. Mountain hemlock (*Tsuga mertensiana*), Shasta red fir (*Abies magnifica var. shastensis*), white fir (*Abies concolor*), western white pine (*Pinus monticola)* and Douglas fir (*Pseudotsuga menziesii*) are the dominate tree species. The understory is often dominated by common prince's pine or pipssissewa (*Chimaphila umbellata*), thin-leaved huckleberry (*Vaccinium membranaceum*), grouse huckleberry (*Vaccinium scoparium*) and various Wintergreen species (*Pyrola spp.*). A third type of forest is fairly limited and occurs in wet depressions and along the edge of wetlands. This vegetation type is dominated by Englemann spruce (*Picea englemannii*) with a diverse understory of grasses and forbs including western mannagrass (*Glyceria elata*), bluebells (*Mertensia paniculata*), Jacob's ladder (*Polemonium carneum*), arrowleaf groundsel (*Senecio triangularis*) and a whole host of other grass and forb species. This forest type dominates along the banks of Lake Creek between Diamond Lake and Lemolo Lake. The fourth distinct forest type is dominated by Ponderosa pine (*Pinus ponderosa*) and is mostly confined to a relatively small area around the north end of Diamond Lake. Associated trees include white fir, Douglas-fir and mountain hemlock while the dominate understory species are serviceberry (*Amelanchier alnifolia*) and prince's pine. This forest type is more common on the east side of the Cascades, but small remnants remain in this area. Much of it is being encroached upon by true fir forest and would eventually be succeeded by those forests without the presence of fire on the landscape. The largest grove of aspen (*Populus tremuloides*) known on the Umpqua (about 2 acres) occurs in the main Diamond Lake Campground on the east side of Diamond Lake. It is unknown if this is a naturally occurring stand of aspen but it too is being encroached upon by conifers. Aspen is very limited on the forest so this population is important for maintaining this species. The following map shows (Figure XXX) the types and extent of forests surrounding this project area.

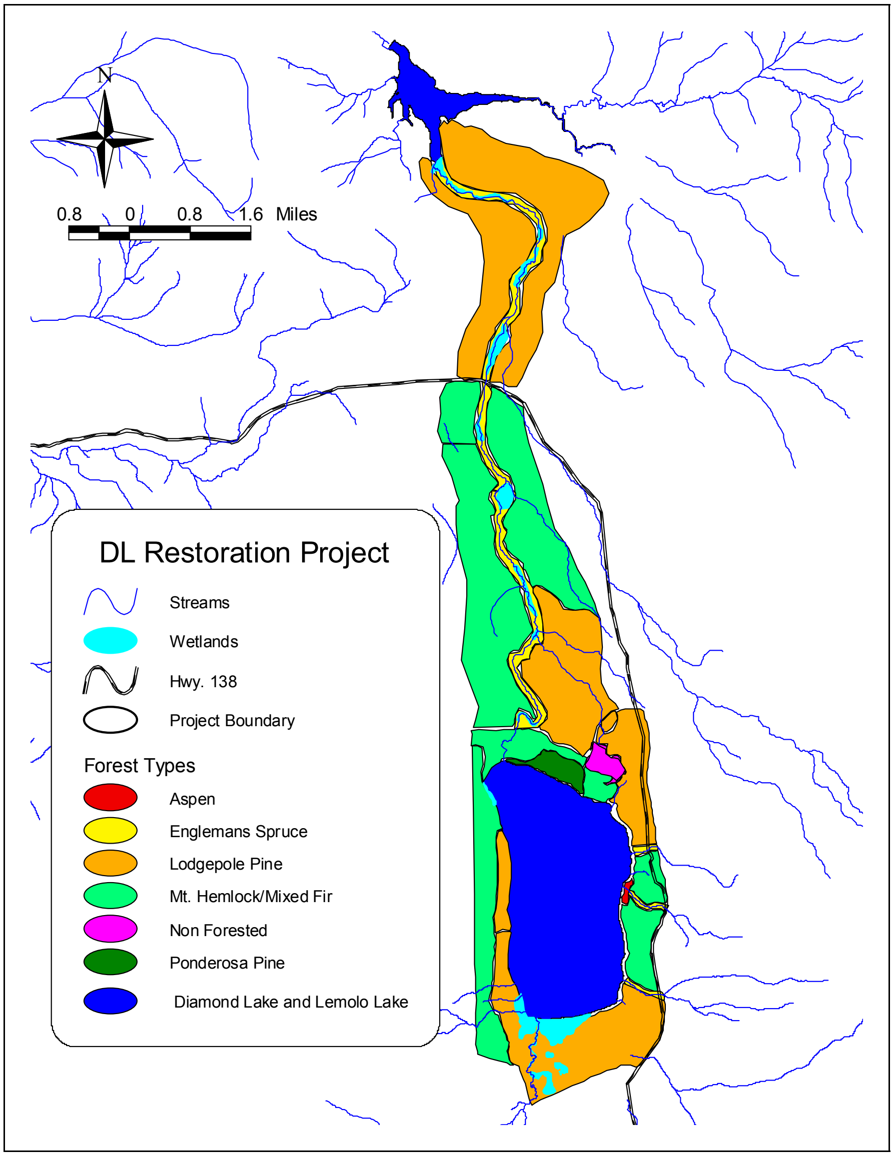


Figure X. Map showing forest types in the vicinity of the project.

ENVIRONMENTAL EFFECTS

<u>Alternatives 1, 2, 3 and 4</u>

Direct and Indirect Effects

The scale at which direct and indirect effects are addressed is the project area boundary. A small amount of ground disturbance would occur as a result of re-constructing the canal on the north end if alternative 2 or 3 is implemented.;

however, this low level of disturbance would not produce negative effects. No other ground disturbing activities are proposed that would have any direct or indirect effects on vegetation. The project would not lead to any negative direct or indirect effects with regards to upland vegetation.

Cumulative Effects
The scale at which cumulative effects are addressed is the 5th field watershed level. Many affects to the upland vegetation from past practices have occurred. Sheep grazing, telephone line installation, construction of campgrounds, road building, Lemolo 1 hydro project construction, construction of cabins, construction of the Dellenback trail, timber harvest, extensive road-building, stockman ignited fires and herbicide use for competition within timber plantations are some examples of actions that have impacted upland vegetation in the past within the vicinity of this project area. (see table x. Past Management Activities in the Cumulative Effects Analysis Area for more detailed information). Fewer activities are currently impacting the upland vegetation environment and include hazard tree removal, fuel reduction projects, fire camp expansion, and herbicide and non-herbicide treatments of noxious weeds. (see table x Present Management Activities Within the Cumulative Effects Analysis Area for more detailed information). Foreseeable projects in the future that may impact the upland vegetation include hazard tree removal, Lemolo timber sales, fuels reduction projects and herbicide and non-herbicide treatments of noxious weeds (see Table x. Reasonably Foreseeable Management Activities in the Cumulative Effects Analysis Area). Implementing any of the alternatives within this project is not likely to lead to any negative cumulative effects (when combined with the past, present and reasonably foreseeable actions) to upland vegetation because the scope of this project is focused on aquatic systems and does not propose any alteration of upland vegetation systems.

NOXIOUS WEEDS

AFFECTED ENVIRONMENT
Two non-native species were found to be occurring in the area that would be affected by this project. Reed canary grass (*Phalaris arundinaceae*) is not listed by the state or the Umpqua National Forest as a noxious weed, but is a non-native species that can cause displacement of native plants, especially in wetlands and along stream and river corridors. Reed canary grass was found to be growing all around Diamond Lake and along Lake Creek all the way down to Lemolo Lake. This grass is fairly abundant where it is found and forms dense colonies that choke out other vegetation.

Only one very common, nearly naturalized[1], state and forest listed noxious weed was found to be occurring within the project area. St. Johnswort

[1] naturalized- an otherwise non-native plant that is so well established and has inundated so many different types of ecosystems that it is all but adapted to the new continent it was brought to.

(*Hypericum perforatum*) is a perennial forb introduced from Europe that has become well established on the Diamond Lake Ranger District. It is mostly distributed along roads, but is also known to occur in natural meadows and forests with less than 30% canopy. It was found in the open dry forested area along the southwest corner of the lake as well as in campgrounds and along many roads in the project area.

ENVIRONMENTAL EFFECTS

<u>Alternatives 1 & 4</u>

Direct and Indirect Effects

The scale at which direct and indirect effects are addressed is the project area boundary for all alternatives. These alternatives would have no direct or indirect effects with regards to the spread of noxious weeds within the planning area. This is because these alternatives do not propose any activities that would disturb any of the reed canary grass populations that ring the lake or occur along Lake Creek nor do they propose any disturbance in any of the St. Johnswort populations within the project area.

Cumulative Effects

The scale at which cumulative effects are addressed is the 5th field watershed level. Many effects with regards to the spread of noxious weeds from past practices have occurred. Sheep grazing, telephone line installation, construction of campgrounds, road building, Lemolo 1 hydro project construction, construction of cabins, construction of the Dellenback trail, timber harvest and extensive roadbuilding are some examples of actions that have led to a spread of noxious weeds in the past within this project area. (see table x. Past Management Activities in the Cumulative Effects Analysis Area for more detailed information). Fewer activities currently have the potential to spread noxious weeds but include hazard tree removal, fuel reduction projects and fire camp expansion. A positive ongoing activity for removing noxious weeds is the treating of spotted knapweed (*Centaurea beibersonii*) with herbicide along highway 138 (see table x Present Management Activities Within the Cumulative Effects Analysis Area for more detailed information). Foreseeable projects in the future that may impact the spread of noxious weeds include hazard tree removal, Lemolo timber sales and fuels reduction projects (see Table x. Reasonably Foreseeable Management Activities in the Cumulative Effects Analysis Area). The continued use of herbicide and various methods to control noxious weeds is a positive impact. Implementing either of these alternatives is not likely to lead to any negative cumulative effects (when combined with past, present or reasonably foreseeable actions) to noxious weeds as these alternatives do not propose ground disturbing activities or a lake draw down.

Alternatives 2 and 3

Direct and Indirect Effects

Both of these alternatives propose a draw down of the lake and construction related to reforming a canal that exits at the north side of Diamond Lake. These actions have the potential to increase the populations of reed canary grass around the lake and especially at the outlet of Lake Creek. It is not possible to know exactly what would occur due to these actions and it may be that this weedy species would not spread at all or possibly even decrease due to the extended drying that would occur around the edge of the lake as a result of the draw down. In most cases where heavy machinery works and disturbs ground, weed problems are exacerbated. The risk is moderate to likely that the reed canary grass problem would be exacerbated by implementing either of these alternatives. Though not documented yet, a very important species to watch out for is Purple Loosestrife (*Lythrum salicaria*). All precautions would be made to make sure it does not show up along the lake through the use of equipment and other disturbances that would go on as this project is implemented. There are several other aquatic weed species that could inhabit the lake as a result of implementing these alternatives. Following the stated mitigation measures as described in chapter 2 is imperative in making sure they do not become a serious problem.

Cumulative Effects

Management activities that contribute to cumulative effects to noxious weeds are the same as described under alternatives 1 and 4. Implementing either of these alternatives has the potential to further the spread of noxious weeds, especially reed canary grass. Disturbing the existing sites of reed canary grass, as these alternatives propose to do, has the potential to combine with past, present and potential future projects to lead to a overall likely increase of this species within the watershed. However, because the species is already well established throughout the project area the consequences of this cumulative impact would be relatively minor.

Threatened, Endgangered and Sensitive (TES) Plants

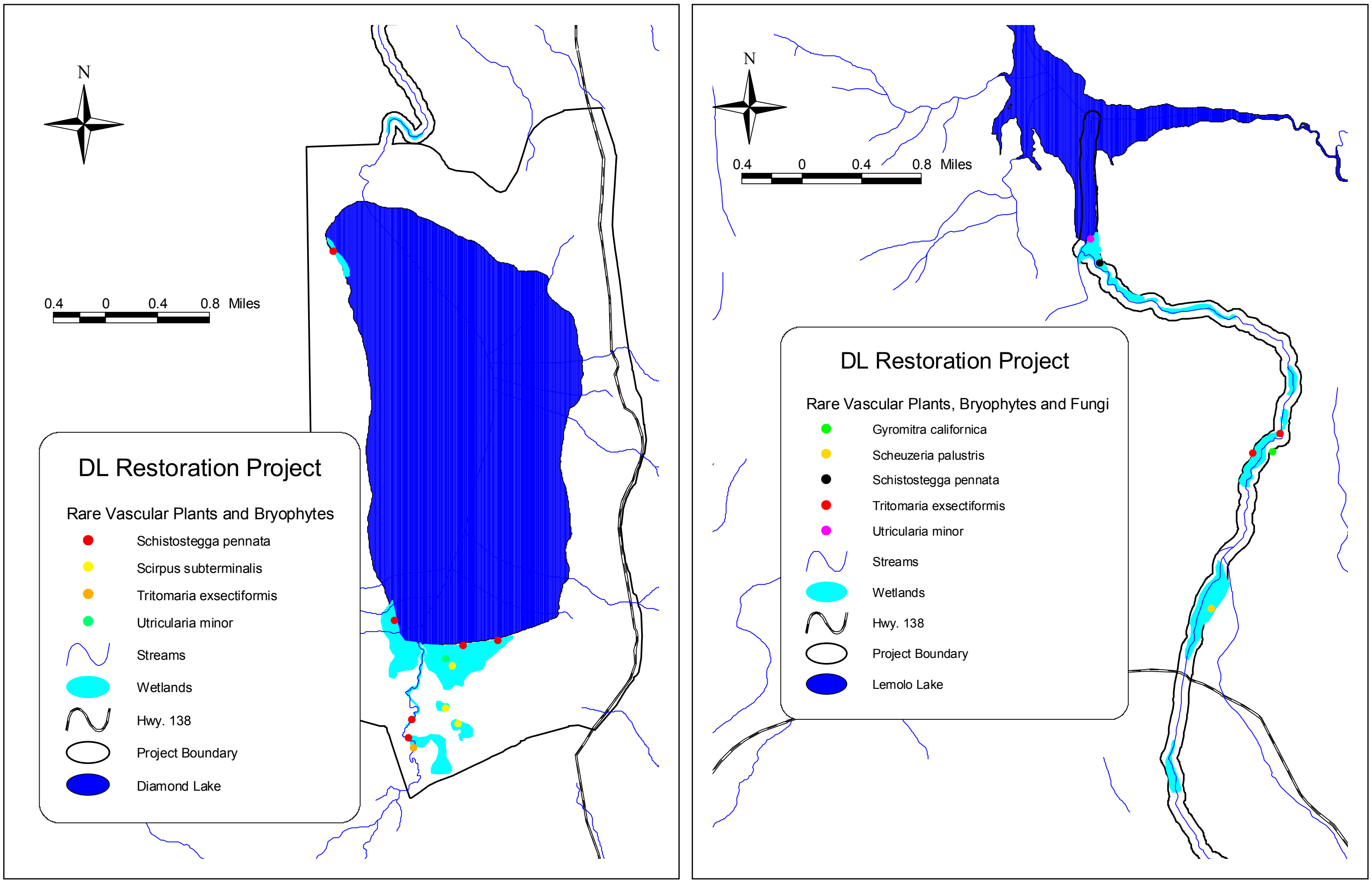
AFFECTED ENVIRONMENT

No Threatened or Endangered plants are known to occur on the Diamond Lake Ranger District and no habitat exists for any species listed as so. A complete Biological Evaluation (BE) disclosing affects to Regional listed Sensitive plants can be referenced in Appendix X. Also under the section on wetland plants and ecology there is a discussion about rare plants and their communities within the wetland ecosystems.

ENVIRONMENTAL EFFECTS

Refer to the Biological Evaluation in appendix x for effects disclosure on Sensitive plants within this project.

Figure x. Maps showing rare plant species sites within the project area.



Survey and Manage Species

AFFECTED ENVIRONMENT

Surveys to protocol for Survey and Manage flora requiring pre-habitat disturbing activities were conducted during the summer of 2003. Three rare Survey and Manage species were discovered within the project area during surveys; Two rare bryophytes adapted to wetland conditions that persist around Diamond Lake, along Silent Creek and Lake Creeks, and one fungus that seems to prefer wetland meadow edges.

Figure XXX. Goblin's gold moss.

Goblin's gold (*Schistostega pennata*) (Figure XXX) is a Survey and Manage category "A" moss requiring management of all known sites. Three sites are known on the Umpqua National Forest, two of which occur within this project area. The population along Silent Creek is the southern most known site on the west coast of North America. This species grows on soil, on the underside of rootwads of lodgepole pine that have tipped over in the wet unstable soils along Diamond Lake and in other wet meadows adjacent to Silent and Lake Creeks. The substrate and ecological niche this moss is adapted to is fairly specific and rare across the landscape. This is a morphologically unique moss because it appears to glow in the dark. The chloroplasts[2] within the protonema[3] are all congregating on one side of the cell wall giving the illusion of bioluminescence. The management recommendations for this species state that maintaining micro-climatic conditions and leaving rootwads intact are necessary for the persistence of the moss.

Little brownwort (*Tritomaria exsectiformis*) is a Survey and Manage category "B" liverwort species requiring management of all known sites. Of the seventeen known sites, five are occurring on the Umpqua National Forest; two are within this project area. This species forms tiny leafy mats on moist to wet decaying logs that have fallen from the edge of wetlands and are being decomposed slowly in the fen environment. It also can be found on hummocks of sphagnum[4] on the edge of slow moving streams. This unique wetland environment is fairly rare across the landscape, hence the rareness of this species. Existing management recommendations for this species are: maintain shade and cool, moist habitat for this species, avoid disturbance of substrate, minimize impacts from livestock and recreationists.

California elfin saddle *(Gyromitra californica)* is a Survey and Manage category "B" ascomycete[5] fungus. This species has only been found in two locations (including this site) on the Umpqua National Forest and is known from 33 sites in the Pacific Northwest. It seems to prefer edges of wet meadows, at least on the Umpqua National Forest, as it has been found in these types of locations at both known sites. This species is not covered under the "Management Recommendations for Survey and Manage Fungi" (September, 1997) and there is no other known source to reference for this information. This species is a decomposer, and not mychorrizal, so it is important to keep downed wood moist and intact where the fungus was found growing.

ENVIRONMENTAL EFFECTS

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[2]Chloroplasts are the photosynthetic material within plant cells.
[3]Protonema are tiny green masses of filament that are produced when a moss or liverwort spore germinates on a given substrate. The initial start of the moss or liverwort essentially.
[4]Sphagnum is a general term for moss forming peat mounds.
[5]Ascomycetes are a fleshy fungus producing its spores on a smooth surface and having eight spores per sac as opposed to a basidiomycete (typical mushroom) which produces its spores on the edges of gills and has four spores per sac.

Goblins gold

Alternative 1 & 4

Direct and Indirect Effects

These alternatives do not propose any draw down of Diamond Lake or associated affects to Lake Creek. The habitats for this Survey and Manage moss depends solely on these hydrologic systems and the humidity and habitat they create. These alternatives do not propose to alter any of these systems and would lead to no direct or indirect effects to goblins gold.

Cumulative Effects

The scale at which cumulative effects are addressed is the 5th field watershed level for all alternatives. Past actions that may have had effects on this moss would be the 1954 rotenone treatment which drew down Diamond Lake and water rights which affect the levels and margins of Diamond Lake (see Table XX for past management activities). The only current ongoing activity that may be affecting this population is the water rights that continue to impact the lake level of Diamond Lake (see Table XXX for present management activities). This action may actually be a positive effect to this moss because it keeps the habitat wet for longer each year, which seems to be necessary for the moss to persist. Under these two alternatives the only future foreseeable action that would have affects on this plant would be maintaining the water rights (see Table XX for reasonably foreseeable management activities). Implementing either of these alternatives would not lead to any negative cumulative effects to goblins gold, since no lake manipulation activities would occur.

Alternatives 2 and 3

Direct and Indirect Effects

No direct effects are expected to occur as a result of implementing either of these alternatives. Indirect effects are likely to occur as a result of lowering Diamond Lake and drying the margins of the lake and the sedge meadow/fen systems along the south shore (Breeden, 2003, Kemmers and Jansen, 1988, Beltman et. al. 2001). Species of moist habitats (eg. *Schistostega pennata*) are always killed by even slight drying (Proctor 1982). According to Regional Bryophyte Taxa Expert, Judy Harpel PhD., it is likely that *S. pennata* would return to the south shore sites as long as the populations along Silent and Lake Creeks remain as dispersal sources for future re-colonization (Harpel pers. Comm., 2003).

Therefore there is a minimal risk that it would be extirpated from the south shore wetlands but populations would continue to persist along Silent Creek, Lake Creek, and near Lemolo Lake, as well as other populations outside of this project in the Kelsay Valley.

Cumulative Effects

The past, present and future actions that contribute to cumulative effects would be the same as described under alternatives 1 and 4 for this species. Implementing either of these alternatives may lead to negative cumulative effects, when combined with the past, present, and reasonably foreseeable effects, as continued drying may impact the habitat for this species. However, it is thought that these populations would re-establish after a few years, as long as there is a source for re-colonization (Harpel pers. com., 2003 see official statement in appendix x.). The populations up Silent Creek would not be impacted and would provide a source for dispersal and re-colonization. In addition, mitigations described in chapter 2 would facilitate maintenance of a portion of the affected individuals throughout the draw period and would promote re-colonization.

Little brownwort

<u>Alternative 1 & 4</u>

Direct and Indirect Effects
These alternatives do not propose any draw down of Diamond Lake or associated affects to Lake Creek. The habitats for this Survey and Manage liverwort depend solely on these hydrologic systems and the humidity and habitat they create. These alternatives do not propose to alter any of these systems and would lead to no direct or indirect effects to little brownwort.

Cumulative Effects
The scale at which cumulative effects are addressed is the 5th field watershed level for all alternatives. Past actions that may have had affects on this liverwort would be the 1954 rotenone treatment which drew down Diamond Lake and may have affected Lake Creek (see Table XX for past management activities). No current activities are affecting the populations of this species (see Table XX for present management activities). Under these two alternatives there are no future foreseeable projects that would affect this species (see Table XX for reasonably foreseeable management activities). Implementing either of these alternatives would not produce any negative cumulative effects, when combined with past, present or reasonably foreseeable actions for little brownwort.

<u>Alternatives 2 and 3</u>

Direct and Indirect Effects
No direct effects are expected to occur as a result of implementing either of these alternatives. There is potential for indirect effects to occur if Lake Creek floods or dries significantly enough to dry out the areas where the liverwort is growing. There is minimal risk that this would occur and even if it did there are several sites far enough away from Lake Creek that don't seem to be under any influence from the creek and would continue to persist. These sites would serve as dispersal populations should some of the little brownwort sites be impacted by the project. The proposed effects to this liverworts habitat would be temporary. No long term impacts to habitat conditions are anticipated.

Cumulative Effects
The past, present and future actions that contribute to cumulative effects would be the same as described under alternatives 1 and 4 for this species. Implementing either of these alternatives may lead to negative cumulative effects when combined with

past, present, and reasonably foreseeable effects described for little brownwort. However, there is minimal risk that negative cumulative effects would occur and it is anticipated that it would take a one hundred year flood or severe drying much worse than expected to produce those effects. If these kinds of events do take place, several sites far enough away from Lake Creek would remain and would not be impacted by the project. These sites would serve as dispersal populations if some of the little brownwort sites were impacted.

California elfin saddle

Alternative 1 & 4

Direct and Indirect Effects
These alternatives do not propose any draw down of Diamond Lake or associated affects to Lake Creek. The habitats for this Survey and Manage fungus depend on these hydrologic systems and the humidity and habitat they create. These alternatives do not propose to alter any of these systems and would lead to no direct or indirect effects to California elfin saddle.

Cumulative Effects
The scale at which cumulative effects are addressed is the 5th field watershed level for all alternatives. Past actions that may have had affects on this fungus would be the 1954 rotenone treatment which drew down Diamond Lake and may have affected Lake Creek (see Table XX for past management activities). No current activities are affecting the populations of this species (see Table XX for present management activities). Under these two alternatives there are no future foreseeable projects that would affect this species (see Table XX for reasonably foreseeable management activities). Implementing either of these alternatives is not likely to lead to any negative cumulative effects when combined with past, present, and reasonably foreseeable actions described for California elfin saddle.

Alternatives 2 and 3

Direct and Indirect Effects
No direct effects are expected to occur as a result of implementing either of these alternatives. There is potential for indirect effects to occur if Lake Creek floods or dries significantly enough to dry out the areas where the fungus is growing. There is minimal risk that this would occur (Hofford pers. com., 2003). With the minimal risk present, it is likely that no indirect effects would occur to this fungus.

Cumulative Effects
The past, present and future actions that contribute to cumulative effects would be the same as described under alternatives 1 and 4 for this species. Implementing either of these alternatives may lead to negative cumulative effects when combined with the past, present, and reasonably foreseeable actions for California elfin saddle. There is minimal risk that negative effects would occur and it would take a one hundred year flood or severe drying much worse than anticipated to produce those effects. However, if this site is extirpated it is the only known site in the watershed and would produce significant cumulative effects at this scale. There is one other

known site in the Fish Creek Desert area, 13 miles to the west. However, with the minimal risk associated with these alternatives, it is anticipated that no cumulative effects would occur.

OTHER FLORA & FAUNA

WETLAND PLANTS

Relationship to Issues: Plants are relevant to the issue of wetland ecology.

AFFECTED ENVIRONMENT

An issue relating to negatively affecting wetlands was brought up during the scoping process of this NEPA document. Approximately 300 acres of wetlands occur within the affected environment of this project. Roughly 140 acres of wetlands border the south shore of Diamond Lake. About 100 acres occur sporadically as small fens along Lake Creek between Diamond Lake and Lemolo Lake. Another fairly large wetland complex borders Lemolo Lake near the mouth of Lake Creek. An emergent wetland area roughly 6 acres in size occurs along the northwest edge of Diamond Lake. An additional .5 acres of wetlands will be constructed in this area and planted with emergent wetland species.

These wetlands are classified mostly as "poor fens" or "transitional wetlands" (Crum, 1988; Mitch & Gosselink, 1993; McNamara et. al., 1992; Boeye et. al., 1995) because of the presence of standing water with abundant sedges and grasses along with some areas being dominated by various moss species and *Sphagnum spp.*. These are systems that are in a successional state between being a minerotrophic[6] fen and an ombrotrophic[7] bog, a process that is occurring over thousands of years.

[6] minerotrophic fen- wetland ecosystems rich in nutrients deriving nutrients and water from precipitation and groundwater. Usually with a higher more basic pH.

[7] ombrotrophic bog- wetland ecosystem that derives nutrients and water solely from the atmosphere because of the large amount of peat accumulation creating an impermeable barrier from groundwater. Usually with a very low acidic pH.

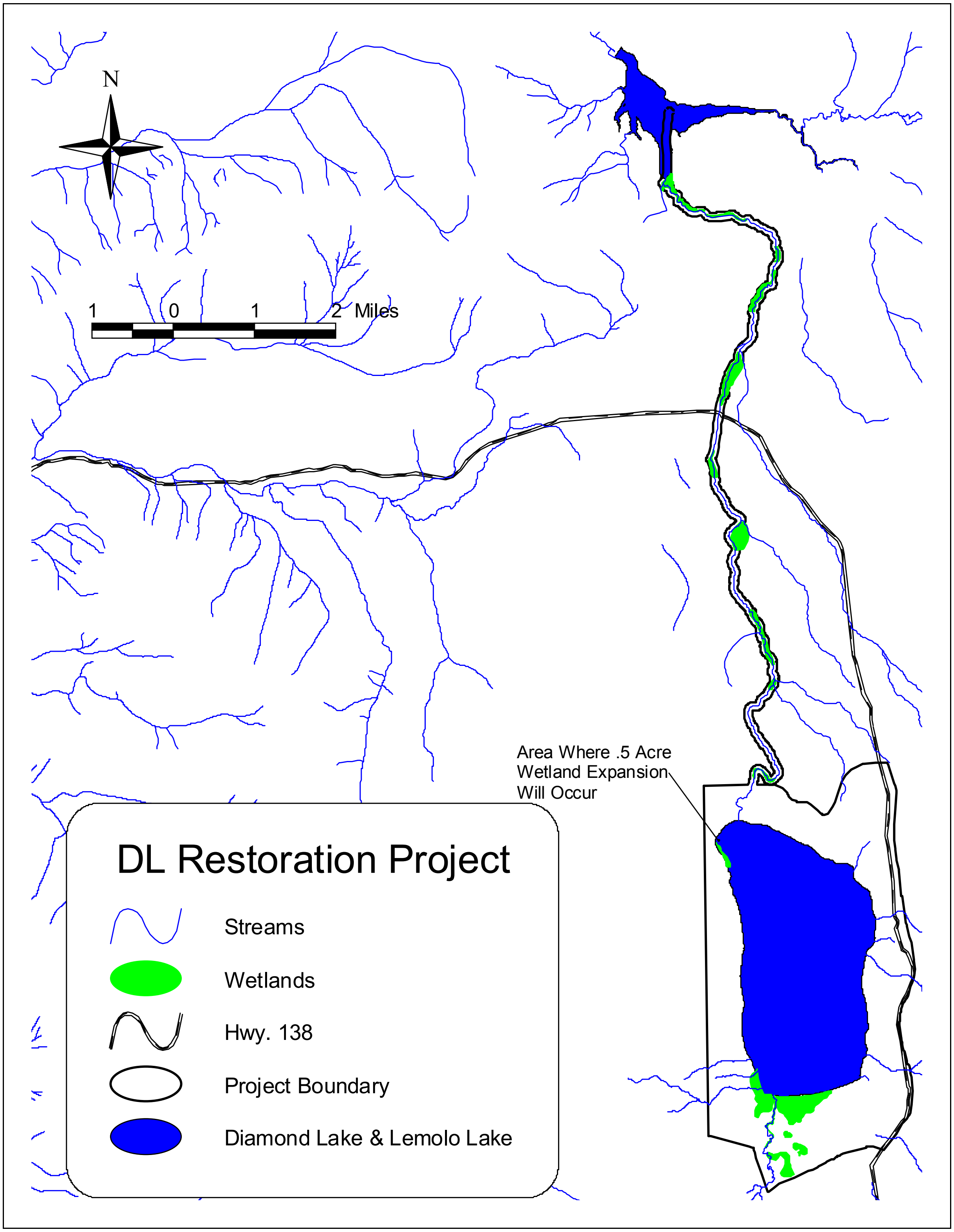

Figure XX. Wetlands Within the Project Area

Some areas are in a more minerotrophic stage while some specific areas appear to be advancing towards an ombrotrophic state. Subtle changes in plant species can be seen that indicate different pH and nutrient levels correlating with the different stages leading to a bog condition. Plants from the *Ericaceae* family such as bog laurel (*Kalmia polifolia*) and bog blueberry (*Vaccinium uliginosum*) are tolerant of the more acidic conditions persisting within the ombrotrophic peat bog areas (Crum, 1988, Beltman et. al., 1996, Boeye et al., 1994).

The plant communities dependent on these wetland systems are fairly uncommon on the Umpqua National Forest and are habitat for three vascular plants listed as Sensitive and two rare bryophytes on the Survey and Manage list; these were described previously.

South Shore Diamond Lake Wetlands

The largest expanse of wetland ecosystems occur on the south shore of Diamond Lake. These wetlands seem to fit the classification of sedge meadows more than that of a fen system (Crum, 1988). However, certain areas within these meadows are showing more of a rich fen type system, as can be seen by the presence of certain species of peat moss, (*Sphagnum subsecundum & S. squarrosum*), which are rich fen indicator species. Sedge meadows are similar to marshes, but tend to be a bit drier during the summer months and can tolerate more drying in general. The fen ecosystem differs in that there is a constant supply of water rich in minerals (especially calcium) and by accumulating significant peat. Closer to Silent Creek the sedge meadow wetland gives way to a more classic type of a minerotrophic fen with a higher diversity of forbs. While forb abundance and diversity seem low in the south shore wetland, sedge diversity and especially abundance are fairly high. Table XXX lists the plant species that were found during field surveys in the summer of 2003.

Table x. Plant Species Occurring in the South Shore Diamond Lake Wetland Complex

Scientific Name	Common Name
VASCULAR PLANTS	
Carex aquatilis	water sedge
Carex canescens	silvery sedge
Carex echinata	star sedge
Carex utriculata	beaked sedge
Carex simulata	analogue sedge
Cicuta douglasii	western water hemlock
Comarum palustris	purple marshlocks
Drosera anglica	English sundew
Eleocharis pauciflora	fewflower spikerush

Eriophorum gracile	slender cottongrass
Juncus sp.	Rush
Nuphar lutea ssp. polysepala	Rocky Mountain pond lily
Pedicularis groendlandica	elephants head
Pinus contorta var. latifolia	lodgepole pine
Potamogeton sp.	Pondweed
Salix sp.	willow
Scirpus subterminalis	water bulrush
Sparganium natans	small bur-reed
Spiranthes romanzoffiana	hooded ladies'-tresses
Utricularia minor	lesser bladderwort
Vaccinium uliginosum	bog blueberry
MOSSES	
Aulocomnium palustre	ribbed bog moss
Drepanocladus sp.	
Schistostegga pennata	goblins gold
Sphagnum subsecundum	peat moss

Much of the wetlands are covered by sedges of one species or another. Figure xx shows a band (light beige color) of star sedge (*Carex echinata*) surrounded by the most common and abundant sedge in the wetlands, beaked sedge (*Carex utriculata*). In areas where water is standing other communities have begun to develop and yellow pond lily (*Nuphar lutea ssp. polysepela*) is usually present floating on the surface. In the shallow waters on the margins of standing water lesser bladderwort (*Utricularia minor*) and water bulrush (*Scirpus subterminalis*) were found.

Figure x. Picture looking north standing in the middle of the south shore wetland complex.

Figure X shows slender cottongrass (*Eriophorum gracile*) (the white cottony looking plant in the background) and its habit of forming nearly pure stands in certain areas of the wetland. The other plant in this picture is fewflower

Figure X. Cottongrass growing within the south shore meadow.

spikerush (*Eleocharis quinqueflora)* and can be seen on the left side of the photo having small brown spike like inflorescences. An interesting aspect to the communities in these wetlands is how different plant species seem to take over and dominate given areas. Very few species were found to be occurring throughout the wetland in every distinct community.

The dependence of these wetlands on lake levels of Diamond Lake and groundwater discharge and recharge is imperative in understanding how these ecosystems have developed and are maintained. Groundwater studies show that these underwater aquifers play important roles in feeding water to Diamond Lake and the wetlands around the lake (Breeden pers. com., 2003).

<u>Wetlands Along Lake Creek and Lemolo Lake</u>

The wetlands along Lake Creek consist of minerotrophic and transitional fens as well as riparian wetlands and floodplains (Crum, 1988; Mcnamara et. al., 1992). In some of these wetlands, much more peat and bog type conditions exist as opposed to the wetlands on the south shore of Diamond Lake. A diverse array of forb species were documented in these areas. It appears that mineral rich springs and underground water sources are feeding the wetlands along Lake Creek. The wetlands on the south shore of Lemolo Lake are similar to those along Diamond Lake but there is greater diversity in shrub and forb species. Figures x & x show some of the diverse shrub and forb communities in these areas.

Figure X. This picture is from the wetland complex bordering Lemolo Lake and shows the abundance of Bog Birch (*Betula glandulosa*).

Figure X. Picture showing the diverse forb communities within the wetland complex adjacent to Lemolo Lake. Slender cottongrass (*Eriophorum gracile*) dominates in this picture.

Shrub species such as bog birch (*Betula glandulosa*) and sitka alder (*Alnus sinuata*) dominate some areas,while diverse forb communities with species like slender cottongrass (*Eriophorum gracile*), hairy arnica (*Arnica mollis*), streamside groundsel (*Senecio psuedaureus*) and Columbian monkshood (*Aconitum columbianum*) are interspersed throughout the wetlands.

ENVIRONMENTAL EFFECTS

Introduction

The draw down of Diamond Lake along with potential flooding and then drying of Lake Creek are the actions in this project which may have impacts on the wetland ecosystems in the project area. No other direct or connected actions proposed would have any effects.

Alternative 1 & 4

Direct and Indirect Effects

The scale at which direct and indirect effects are addressed is the project area boundary. These alternatives do not require draining of Diamond Lake and the associated actions necessary to perform the draw down. Alternative 1 does nothing, basically leaving the existing condition as status quo. No adverse effects are currently known to be occurring to the wetland ecosystems. Though the water quality and recreational opportunities at the lake are being negatively affected, there has not been any correlation made that this would eventually affect the wetland ecosystems. Implementing either of these alternatives is expected to have no direct or indirect impacts on the wetland environment or the rare plant species dependent on those environments.

Cumulative Effects

Many effects to the wetlands from past practices have occurred, and have been described previously (see Table XX of past management activities). Some activities have had minor affects, while others have likely contributed to some severe changes in these ecosystems. For instance, the affects of recreation has probably had little impact with campers and hikers periodically trampling vegetation while the affects of road building directly impacted the wetlands with heavy machinery. The previous rotenone treatment and draw down probably caused some decline in species diversity and may have changed some of the composition of the south shore wetland complex. There is no way to be certain but with the potential for sustained drying under alternatives 2 and 3 it can be assumed that there was also sustained drying 50 years ago. Sustained drying in wetlands can, and has in other cases, led to lower species richness (Kemmers et. al., 1988). Unfortunately, no quantitative or qualitative data from that era exists that describes the past effects. Fewer activities are currently impacting the wetland environments, but include hazard tree removal, Lemolo 1 hydro project implementation, recreation use and water rights use (see Table XX for present management activities). In particular, existing water rights may be significantly affecting the south shore Diamond Lake by not allowing the natural seasonal fluctuations of water on the lakes margins. This may be having the affect of eliminating certain species that would otherwise be emergent colonizers of the lakes edge. Foreseeable projects in the future that may impact the wetland environment include hazard tree removal, continued use of water rights, continued heavy recreation use and the Lemolo 1 hydro project (see Table XX for reasonably foreseeable management activities). The implementation of Alternatives 1 or 4 would not further contribute to cumulative effects, because neither alternative proposes a lake draw down.

Alternative 2 & 3

Direct Effects

Both of these alternatives propose an 8 foot draw down of Diamond Lake. The change in water table and groundwater recharge expected from this action has the potential to temporarily dewater the south shore wetlands (Breeden pers. com., 2003). Dewatering the south shore wetland would result in some short term negative effects, in that some individual plants may dry and desiccate. Some of the species identified from the area are rhizomatous and are expected to recover from one season of drying. There is minimal risk that the draw down would result in permanent changes to the wetland environment on the south shore of Diamond Lake. There is some uncertainty as to whether the wetlands would incur any permanent changes, potentially changing the rare plant communities that are adapted to them. However, based on professional judgment and the low likelihood of permanent impacts, there is minimal risk that this would occur.

These alternatives also propose to raise the level of Lake Creek to bank full while Diamond Lake is being drained and then lower the level of Lake Creek to nearly no flow after the 8 foot draw down is completed. Most of the wetlands along Lake Creek are fed by localized springs and groundwater. However there are some uncertainties about raising the creek to bank full during the fall and winter months because of the potential for severe flooding should a large rain or rain on snow event occur. The affects that severe flooding could have on the fen ecosystems adjacent to Lake Creek are unknown. Flooding is a natural disturbance and is within the historic range of variability for the area. But the flooding that may occur would most likely be exacerbated by the actions implemented from these alternatives in this project. Flooding could also lead to positive effects due to increasing diversity of the fens allowing for new species to colonize or it could lead to negative effects by allowing noxious weeds such as reed canary grass to colonize new areas. Although uncertainty exists, the risk is fairly minimal that negative effects to the fen vegetation would occur over the long term.

The lack of water in the Lake Creek channel after the draw down is complete also has potential to produce negative effects on these ecosystems. Lake Creek is expected to be fairly dry from the outlet at Diamond Lake down to the inlet of Thielsen Creek into Lake Creek (Hofford pers. com., 2003). See figure x below for details of where this would occur.

Most of the fen systems along Lake Creek are supported by localized springs and groundwater that would not be impacted by the draw down. There is uncertainty as to how much the water from Lake Creek affects these fen ecosystems and what would happen when that water is not available for an entire season. Literature does exist stating that manipulating hydrology in given catchment areas can have affects on certain types of minerotrophic fens (Khmers and Jansen, 1988; Boeye et. al., 1995; Beltman et. al., 2001).

However, it is not possible to say what the specific outcome of this temporary impact would be. It is anticipated that a moderate risk of direct negative effects to these fen ecosystems may occur as a result of the prolonged lack of water in Lake Creek under alternatives 2 & 3.

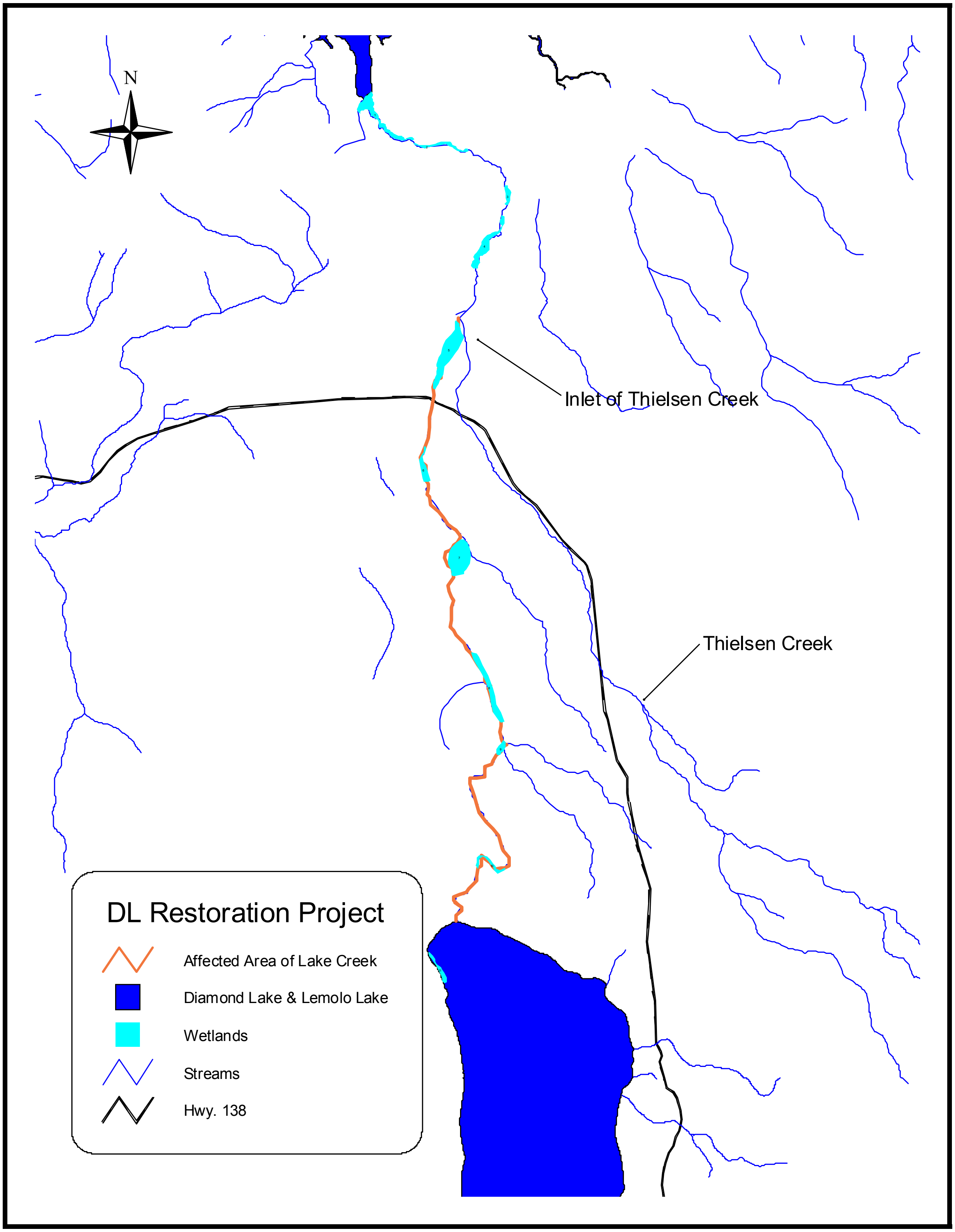

Figure X. Map Showing Affected Area of Lake Creek From Drying After Draw Down Is Complete.

Indirect Effects
The scale at which indirect effects are addressed is the project area boundary. The effects to hydrochemistry could play a role in what happens to the vegetation in these wetlands (Kemmers and Jensen, 1988). No data is available on the hydrochemistry of the wetlands so it is not possible to assess risk with regards to hydrochemistry. The proposal does not involve any changes in chemistry to Diamond Lake besides adding rotenone, which does not affect plants and would not change the hydrochemistry of the wetlands long term. From assessing the vegetation it appears some areas are high in acidic components as these areas support species tolerant of those chemicals. Other areas appear to be high in various nutrients, especially phosphorous (Johnston pers. com., 2003). Minimal risk of long term change to the plant communities from hydrochemistry alteration is likely.

The only other potential indirect effect is a minimal risk, but includes the potential for noxious weeds to enter the wetlands (Emerson, 2003; see Noxious Weed section of this document). These effects were described previously.

Cumulative Effects
The scale at which cumulative effects are addressed is the 5th field watershed level. Many effects to the wetlands from past and present practices and were described under alternatives 1 and 4. They are the same for these alternatives. Implementing alternative 2 or 3 of this project would likely contribute to negative cumulative effects to the wetland environments in the project area, especially those along the south shore of Diamond Lake. The combined effects of the previous rotenone treatment and other past actions along with the proposed actions from alternative 2 and 3 would lead to an overall negative effect through drying, desiccation and simplification of species richness. However it is expected that only short term negative effects would occur. There is minimal to moderate risk that long term negative cumulative effects would occur.

Summary of Effects Calls For Wetland Impacts

Comparison Factor	No Action		Alt. 2		Alt. 3		Alt. 4	
Effects to rare plant communities within the wetland ecosystems	***Short Term***	***Long Term***	***Short Term***	***Long Term***	***Short Term***	***Long Term***	***Short Term***	***Long Term***
	No Effect	No Effect	Likely Negative Effects	Minimal Risk of Effects	Likely Negative Effects	Minimal Risk of Effects	No Effect	No Effect

Planting Prescription for NW Diamond Lake Wetland Expansion

An area roughly .5 acres in size will be filled with 900 cubic yards of sediment fill as the canal is constructed in Diamond Lake. In this area it is possible to mitigate for negative effects to wetlands that would occur as a result of a lake draw-down by enhancing the ecosystem through wetland expansion. Three vital aspects of wetland creation include hydrology, soil and flora. This prescription for planting seeks to capture the need to establish wetland vegetation in the area to ensure the integrity of the developing ecosystem. Thorough and thoughtful planning is important in meeting this need. Plant seed, cuttings and transplants would need to be collected well ahead of time to establish in a forest service nursery in order to increase the likelihood of successful out-planting. The following table lists those plants that should be used in this effort:

Species	Common Name	# of plants	Cost/plant	Total Cost
Scirpus acutus	hardstem bulrush	3000	.60	$1650
Carex vesicaria	inflated sedge	3000	.60	$1650
Typha latifolia	cat tail	1000	.60	$550
Eleocharis palustris	common spike-rush	2000	.60	$1100
Totals		**9000**		**$5400**

This plant list represents obligate emergent macrophytes that are already growing in the adjacent NW Diamond Lake wetland. The spacing would be roughly one plant for every two square feet. Other floating macrophytes may also be considered in the future. This prescription could change depending on the exact engineering that occurs to establish the 900 cubic yards of sediment. This planting prescription assumes depths of water to be planted into to be from 1 to 3 feet. The exact time and methods for planting will be determined as the project progresses. Seed collection should begin in the summer and early fall of 2004 to ensure the nursery has enough time to propagate the 9000 plants as container plugs. In the table, $.15 per plant is added to the cost for seed collection. It is expected that it would take one person 18 days to plant the entire area with 9000 plants. This roughly equates to a cost of $2700 for the labor involved in out-planting. That leaves the total cost of the vegetation portion of this wetland expansion at **$8100**.

Botany Mitigation/Monitoring

Native Plant Revegetation

Terrestrial areas that would be impacted by canal construction and other miscellaneous activities should be re-vegetated in accordance with Umpqua National Forest policy, using only local native plant species. Site specific planting prescriptions would be prepared by the District Botanist and plants and seed would be made available as deemed necessary. This responds to the 2002 Integrated Weed Management Strategy Forest Plan Amendment.

Monitoring of Wetlands

In order to assess the impacts of the drawdown on the wetland vegetation at the south shore of Diamond Lake and other sites to be determined in the future, it is recommended that a vegetation monitoring protocol be established prior to and during implementation and for 5 years after the project is completed. This information can then be used to assist in the development of future projects that may impact wetland systems.

Mitigation/Monitoring for Goblins Gold

The populations on the south shore would be closely watched throughout the draw down period. If desiccation and mortality is observed then water should be brought to the rootwad holes in buckets and poured into the holes to maintain humidity. Also lightly misting the soil could be applied to areas where continued drying is being observed. It is estimated that there are upwards of 60 rootwad holes with goblins gold. At least 20 holes would be maintained throughout the draw down to reduce impacts to this species.

Mitigation/Monitoring for Noxious Weeds

Follow standard contract provisions and Best Management Practices (BMP's) that require all machinery and vehicles to be pressure washed and free of weed seed before coming on to the work site and before leaving the forest. Avoid working in infested areas as much as possible; this may be very difficult at times especially at the outlet into Lake Creek. Educate work crews as to the locations of reed canary grass and inform them how to reduce the spread of this weed. This responds to the 2002 Integrated Weed Management Strategy Forest Plan Amendment.

Monitor the lake after the project to detect any new invasive aquatic plants to ensure that if there are invading species, they can be quickly treated as required in the 2002 Integrated Weed Management Strategy.

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