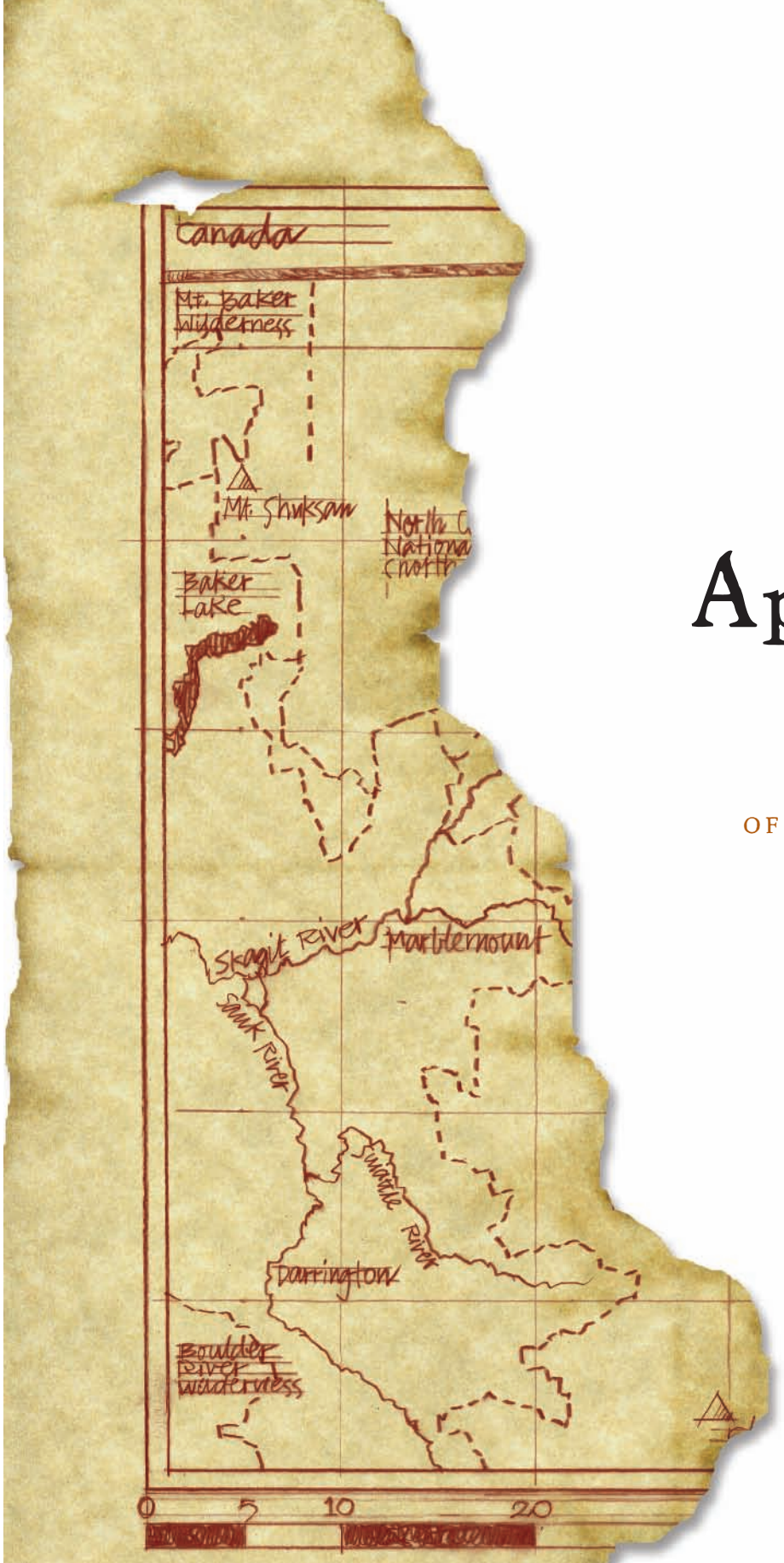

Appendix G

Detailed Discussion of Impact Thresholds for Aquatic Organisms

APPENDIX G: DETAILED DISCUSSION OF IMPACT THRESHOLDS FOR AQUATIC ORGANISMS

IMPACT CRITERIA AND METHODOLOGY

Four separate sets of impact thresholds, ranging from negligible to major intensity, were defined to address potential impacts on the plankton, macroinvertebrates, and amphibians in the 91 study area lakes and native fish in downstream drainages. Because there is incomplete knowledge of the actual impacts that are occurring or could occur in the 91 lakes under all four alternatives, impact thresholds were developed using predictive factors that have been shown to affect the distribution and viability of these organisms. These factors were identified from a review of scientific literature and past research. In addition to predictive factors, data and professional knowledge supplied by National Park Service (NPS) and Washington Department of Fish and Wildlife (WDFW) staff involved in the preparation of this *Draft Mountain Lakes Fishery Management Plan / Environmental Impact Statement* (plan/EIS) were used to arrive at impact intensities, whenever possible. The assessments were done on a lake-by-lake basis, using impact thresholds based on both the predictive factors and actual knowledge of site conditions, to arrive at a final impact level for each lake and associated downstream drainage.

The discussions below present more detail about the predictive factors that were used in the impact thresholds for four groups of aquatic organisms.

PLANKTON

The plankton community in lakes in the North Cascades National Park Service Complex (North Cascades Complex) is divided into two components: phytoplankton and zooplankton. Phytoplankton mainly include microscopic photosynthetic algae (such as diatoms and dinoflagellates), while zooplankton are non-insect invertebrate animals ranging in size from microscopic to as large as 0.25 inch in length that drift with the current.

The direct and indirect effects of fish stocking on each of these community components differ. Stocked trout generally do not prey directly on phytoplankton but can indirectly cause significant changes in the abundance of individual species and overall community structure in mountain lakes because their presence indirectly results in altered nutrient cycling and food web dynamics (Brett et al. 1994; Drake and Naiman 2000; Elser et al. 1995; Leavitt et al. 1994). While changes in abundance and community structure can be substantial, total loss of phytoplankton species has generally not been observed. Shifts in community composition (referred to as "state changes") tend to remain stable following fish removal, not returning to conditions that were present prior to fish stocking (Drake and Naiman 2000). Changes in the phytoplankton community caused by fish stocking resemble those that occur due to other natural events (e.g., catastrophic forest fires or volcanism).

Because changes to the phytoplankton community due to fish stocking are similar to those that occur under natural conditions, and food web dynamics generally remain resilient, effects on the phytoplankton community from fish stocking were considered minimal for the purpose of evaluating impacts. Therefore, the focus was placed on impacts to zooplankton species, especially larger copepods, which can be demonstrably affected by predation and changes in food web dynamics resulting from fish introduction.

Research has shown that, in some cases, fish introductions have been observed to result in the complete elimination of some zooplankton species, with large copepods and large cladoceran species appearing to be most vulnerable. For example, large copepods in high-altitude lakes in Alberta, Canada, were no

longer present as a result of very high densities of reproducing trout in some mountain lakes and, in some cases, did not recover following fish removal (Parker et al. 1996, 2001). This level of effects was observed to occur only in smaller shallow lakes (Donald et al. 1994). Another recent study found that the average recovery time for zooplankton assemblages from the influence of stocked salmonids in Canadian lakes was 19 years (Donald et al. 2001).

Failure of copepods to recover has been attributed to the presence of scuds, or large amphipods (*Gammarus lacustris*), that prey on dormant copepod eggs, thus eliminating the potential for population recovery (Parker et al. 1996). Cladoceran species in shallow lakes were also no longer present in some cases, but they are likely to recover (Parker et al. 2001). Large amphipod species may also be vulnerable to extirpation (complete disappearance of a species) resulting from intense predation. It should be noted that zooplankton species were not extirpated in deeper lakes, even lakes with extremely high stocking densities (exceeding 800 fish/acre), because the profundal (deep) zone provides a refuge area against predation. Lakes greater than 50 feet in depth appear to provide sufficient refuge habitat for the large copepod and cladoceran species that are most vulnerable to extirpation (Donald et al. 1994). Similarly, larger lakes with more overall refuge habitat can provide areas for escape from fish predation. A size of 40 acres was selected for use in the impact thresholds (based on professional judgment and experience working in similar lakes) to help distinguish between impact levels.

Based on the information described above and the professional knowledge and judgment of the NPS and WDFW staff involved in this plan/EIS, the following impact thresholds were defined for plankton (to be applied on a lake-by-lake basis):

Major: Significant changes in community structure would potentially occur, and large copepod abundance would be reduced significantly such that they are undetectable. If fish were removed or died off, the community structure may not become comparable to currently fishless lakes. For this assessment, potentially major impacts to large zooplankton would be expected in a lake where the following predictive factors are found:

- Lake depth less than (<) 50 feet , and
- Lake area <40 acres, and
- Fish density is very high (reproducing trout or multiple age classes at greater than [>] 400 fish/acre)

Moderate: Noticeable changes in community structure would potentially occur, and large copepod abundance would be greatly reduced. If fish were removed or died off, the relative abundance of large copepods would increase. For this assessment, potentially moderate impacts to large zooplankton would be expected in a lake where the following predictive factors are found:

- Lake depth <50 feet, and
- Lake area <40 acres, and
- Fish density is high (reproducing trout at >50 fish/acre).

Minor: Minor changes in community structure would potentially occur. If fish were removed or died off, the community structure would become comparable to currently fishless lakes. For this assessment, minor impacts to the zooplankton community would be expected in a lake where the following predictive factors are found:

- Lake depth >50 feet, or
- Lake area >40 acres, or
- Fish density is low (stocked trout at <100 fish/acre or reproducing trout at <50 trout/acre).

Negligible: Long-term adverse impacts would potentially be negligible even though these lakes have historically been stocked. Abundance and community structure would be expected to be influenced primarily by biogeographical and evolutionary processes. For this assessment, negligible impacts to the zooplankton community would be expected in a lake that was previously stocked but is currently fishless.

Table G-1 (located at the back of this appendix) provides the analysis matrix used for the assessment of impacts on plankton, by alternative, for each of the 91 lakes in the study area.

MACROINVERTEBRATES

Impacts on the macroinvertebrate community were evaluated by considering the effects of fish stocking on the primary prey species of fish: aquatic insect species with terrestrial adult forms. These include mayflies (*Ephemeroptera*), stoneflies (*Plecoptera*), caddisflies (*Trichoptera*), and midges (*Diptera*). These species are considered to be primary prey because they are large, mobile, and most exposed to predation. Other macroinvertebrate species, such as snails and fingernail clams (mollusca), flatworms (*Platyhelminthes*), and nematodes frequent less exposed habitats and are less likely to be targeted by fish as prey. Populations of primary macroinvertebrate prey (*Diptera, Ephemeroptera, Trichoptera, Plecoptera*) are considered to exist at the drainage basin scale, due to the dispersal potential from individual lakes and streams (Bilton et al. 2001). Other species of macroinvertebrates, including terrestrial insects, snails, and nematodes, are generally minor prey species and not sensitive to predation at the population level but can be influenced by indirect effects on food web dynamics. The primary prey species are relatively resilient to fish predation at the population level in lake environments, with the exception of specific sensitive species such as phantom midges (*Chaoborus* spp.), which are highly sensitive to fish predation and can be extirpated by even low stocking densities. This is not an issue of concern, however, because the temperature regime in high-mountain lakes in the North Cascades Complex is too cold to support these sensitive species (Verschuren and Marnell 1997).

Fish predation may result in significant changes in abundance and biomass of some macroinvertebrates, as well as behavioral and phenotypical changes (Chess et al. 1993; Knapp 1996; Luecke 1990; Walters and Vincent 1973). Because population boundaries usually extend beyond individual lakes, these effects are limited to the segments of the population exposed to fish predation. While some population segments may be depressed or even temporarily extirpated from a given lake environment, the affected species are usually capable of recolonizing these habitats quickly because they have high dispersal rates (Bilton et al. 2001; Bohonak and Jenkins 2003).

Recent studies by NPS staff of the biological integrity of benthic macroinvertebrate (BMI) communities in 32 lakes have substantially improved the identification of factors contributing to changes in the community. Primary predictive factors identified include, among others, fish density, reproductive status of the fish, quality of the bottom habitat, and area of the lake. Major changes to the benthic macroinvertebrate communities in the 32 lakes studied were associated with a loss of over 40% of the expected taxa in a lake. Other lakes containing high densities of reproducing fish also showed major changes in macroinvertebrate communities (density and/or diversity), although those lakes that contained substantial refuge habitat showed a lessened effect (NPS, R. Glesne, pers. comm., 2004).

Based on the factors identified in the NPS BMI monitoring results, and actual monitoring data from several of the study area lakes, the following impact thresholds were defined for macroinvertebrates (to be applied on a lake-by-lake basis):

Major: Major impacts include the absence of more than 40% of taxa expected to commonly occur in fishless lakes of similar environmental characteristics. Additionally, significant changes in dominant taxa and functional feeding group composition would also occur. Recolonization might not occur for an extended period of time without active intervention. Of the 91 lakes where the benthic community has not been studied, major impacts would be expected where the following predictive factors are present:

- Fish density is high (stocked trout at >100 fish/acre or reproducing trout at >50 fish/acre), and
- Lake area is <10 acres, often with limited habitat complexity.

Moderate: Moderate changes in community structure and functional group composition in a lake would potentially occur, relative to currently fishless but otherwise similar lakes. Populations eventually would recover from impacts if fish were removed. For lakes where the benthic community has not been studied, moderate impacts would be expected when the following predictive factors are present:

- Fish density is high (stocked trout at >100 fish/acre or reproducing trout at >50 fish/acre), and
- Lake area is more than 10 acres or lake area is less than or equal to (≤) 10 acres with high habitat complexity.

Minor: Minor changes in community structure in a lake would potentially occur, although populations would recover if fish were removed. For lakes where the benthic community has not been investigated, minor impacts would be expected where the following predictive factor is present:

- Fish density is low (stocked trout at <100 fish/acre).

Negligible: Community structure would be comparable to fishless lakes with similar physical/chemical characteristics. Abundance and community structure would be predominantly influenced by biogeographical and evolutionary processes. Negligible impacts to the macroinvertebrate community would be expected in a lake that was previously stocked but is currently fishless.

Table G-2 (located at the back of this appendix) provides the analysis matrix used for the assessment of impacts, by alternative, on macroinvertebrates for each of the 91 lakes in the study area.

AMPHIBIANS

The amphibian community in mountain lakes is represented by a range of species that includes salamanders, newts, frogs, and toads. The aquatic amphibian community found in the study area consists of two subspecies of long-toed salamander (*Ambystoma macrodactylum macrodactylum* and *A. m. columbianum*), Northwestern salamander (*A. gracile*), rough-skinned newt (*Taricha granulosa*), Columbia spotted frog (*Rana luteiventris*), western toad (*Bufo boreas*), tailed frog (*Ascaphus truei*), and northern red-legged frog (*Rana aurora*). The latter four are listed species and are addressed in the "Affected Environment" chapter under the "Special Status Species" section of this plan/EIS. Due to their sensitivity to stocked trout, the long-toed salamander and Northwestern salamander were selected as the focus of the analysis of impacts on amphibians.

Amphibians are both directly and indirectly impacted by the presence of stocked fish populations in mountain lakes. Direct impacts include predation and competition for prey. Indirect impacts include changes in prey availability resulting from changes in food web dynamics and nutrient cycling attributable to fish introductions in historically fishless lakes. Direct and indirect impacts of the proposed alternatives on amphibians are evaluated at the population level for each amphibian species.

The potential for adverse impacts on the salamander species varies with a number of factors, including the habitat requirements of each species, physical and chemical lake characteristics, the type (that is, stocked or reproducing), and density of stocked fish populations. The two species are generally not found in the same spawning and rearing habitats, but adult habitats are similar. In the adult stage, both species use animal burrows for migration and overwintering habitat, which in turn restricts their range to areas with sufficient soil depth for burrowing mammals (Semlitsch 1983). The differences in habitat preference and tendency for competition between the two species influence the extent of impacts from stocked trout on each species.

Northwestern salamanders are restricted to the west side of the Cascade Crest and require dense, closed-canopy forest during their terrestrial adult phase and downed woody debris in the nearshore areas of ponds and lakes for spawning substrate (Hoffman et al. 2003; Dvornich et al. 1997; Aubry and Hall 1991; Petranka 1998). Dense old-growth forest habitat is particularly important to hibernating adults in the Cascade Mountains from Mount Hood, north (Aubry and Hall 1991). Because this species requires a long juvenile rearing stage of at least two years, and often reaches maturity in aquatic form, spawning and juvenile rearing habitat must be perennial. Because of this range of habitat preferences, suitable lakes and pods for Northwestern salamanders are usually large and deep and typically found below the treeline. The available evidence indicates that when in their preferred habitat, Northwestern salamanders usually dominate and out-compete long-toed salamanders to the point of exclusion (Hoffman et al. 2003; Hoffman 2003; Hoffman and Larson 1999). Trout populations have been documented to reduce the numbers of larvae and neotenic adults (adults that retain some juvenile characteristics) of Northwestern salamanders in individual lakes. However, populations of Northwestern salamanders are likely to coexist with stocked trout and remain viable, albeit at reduced densities. This is likely due to the large size of older larvae and neotenic adults in this species (relative to long-toed salamanders), and a stronger propensity for behavioral adaptations for avoiding predation.

Because long-toed salamanders do not compete well with Northwestern salamanders in perennial bodies of water on the west side of the North Cascades, this species is usually found in lakes in open terrain above the treeline where its competitor is not present. However, these lake habitats will be within a relatively short distance of forested terrestrial habitat for adult salamanders. Lakes above the treeline lack the woody structure and debris required by Northwestern salamanders as spawning substrate. Long-toed salamander breeding sites on the east side of the Cascade Crest are still usually located in areas of open vegetation within a relatively short distance of forested terrestrial habitat, but they are more likely to occur in forested regions below treeline because Northwestern salamanders do not occur in this region. Long-toed salamanders are generally more sensitive to competition and predation by stocked trout and, therefore, are more likely to suffer adverse impacts.

Three predictive factors appear to influence the extent of impacts: the productivity of the rearing lakes (as measured by total Kjeldahl nitrogen, or TKN), the density of stocked trout populations, and the Index of Connectivity (IOC). Based on available evidence, long-toed salamanders are at highest risk of extirpation in low-productivity lakes (TKN values <0.045 mg/l) with high-density populations of reproducing fish (>50 fish/acre), or high-density populations of stocked fish (>100 fish/acre) (Liss et al. 1995, 1999, 2002). A lower potential for extirpation exists in high-productivity lakes (TKN values greater than or equal to [≥] 0.045 mg/l) with high-density fish populations. Lakes with low-density fish populations of stocked trout

(≤100 fish/acre) do not appear to be at risk of extirpation, but the density of rearing salamander larvae may be reduced.

A final factor to explain the variability of impacts from stocked trout on long-toed salamander larvae in lakes with otherwise suitable habitats is the IOC. The IOC was based on the density or number of potential long-toed salamander breeding ponds or lakes (lakes with suitable aquatic and terrestrial habitat) within a target lake's basin (lakes/mile), number of known long-toed salamander populations within a radius of 3.75 miles (maximum likely colonization distance) of the target lake or pond, and the number of potential long-toed salamander breeding ponds or lakes within a 0.4-mile radius (maximum likely dispersal distance) of the target lake. These values were used to calculate the IOC, which represents the level of gene flow likely to occur between lake populations, likelihood of colonization events, and degree of isolation of a lake from the long-toed salamander metapopulation. IOC cannot exceed a value of 1.0, but it can be below a value of 0. Lakes with an IOC below 0 are considered to have very low potential for colonization or recolonization events in the short term and low levels of genetic interchange. The higher the IOC, the higher the connectivity, and the more likely it is that genetic exchange would occur.

Based on the above information and the knowledge of the plan/EIS team experts about the presence of amphibians in study area lakes, the following thresholds were defined (to be applied on a lake-by-lake basis):

Major: Populations of long-toed salamanders would be permanently altered from normal levels and possibly eliminated from a lake, with recolonization unlikely. For the impact assessment, potentially major impacts to long-toed salamanders would be expected where the following predictive factors are present:

- Lake with suitable habitat (open terrain at the lake with forest nearby) is within the range of the long-toed salamander, and
- TKN is ≥0.045 mg/L, fish density is high, and IOC is less than 0;

OR

- Lake with suitable habitat is within their range, and
- TKN is <0.045 mg/L, fish density is high, and IOC is ≤0.3.

Major impacts to Northwestern salamanders are unlikely in any lake due to larger larvae than long-toed salamanders and behavioral adaptations for avoiding predation.

Moderate: Populations of long-toed salamanders would be present within their historic range, but density of larvae in a lake would potentially be smaller than in comparable fishless lakes, and populations may be eliminated on a temporary or local basis. Populations would deviate from normal levels. Potentially moderate impacts to long-toed salamanders would be expected where the following predictive factors are present:

- Lake with suitable habitat is within their range, and
- TKN is ≥0.045 mg/L, fish density is high, and IOC is ≥0;

OR

- Lake with suitable habitat is within their range, and
- TKN is <0.045 mg/L, fish density is high, and IOC is between 0.4 and 0.6.

Moderate impacts to Northwestern salamanders may occur where a lake with dense, closed-canopy forest habitat is within their range, and fish density is high.

Minor: Populations of long-toed salamanders likely would be present within their historic range, but density of larvae in a lake would potentially be slightly smaller than comparable fishless lakes. Minor impacts to long-toed salamanders would be expected where the following predictive factors are present:

- Lake with suitable habitat is within their range, and
- TKN is ≥0.045 mg/L, fish density is low, and IOC is ≤0.3.

Minor impacts to Northwestern salamanders may occur where a lake with suitable forested habitat is within their range and fish density is low.

Negligible: Populations likely would be present in any lake within their historic range, with larval density close to that of fishless lakes. For the impact assessment, negligible impacts to long-toed salamanders would be expected where the following predictive factors are present:

- Lake with suitable habitat is within their range, and
- TKN is ≥0.045 mg/L, fish density is low, and IOC is ≥0.4;

OR

- Lake with suitable habitat is within their range, and
- TKN is <0.045 mg/L and fish density is low;

OR

- Lake with suitable habitat is within their range, and
- TKN is <0.045 mg/L, fish density is high, and IOC is ≥0.7.

Table G-3 summarizes the outcome of various combinations of the principal predictive factors for impacts on the long-toed salamander larvae.

TABLE G-3: PRINCIPAL PREDICTIVE FACTORS FOR IMPACTS ON LONG-TOED SALAMANDER LARVAE

TKN ≥0.045 mg/L	**Fish Density**	**Index of Connectivity**	**Impact Level**
Yes	High	<0.0	Major
No	High	<0.0 - 0.3	Major
Yes	High	0.0 - 1.0	Moderate
No	High	0.4 - 0.6	Moderate
Yes	Low	<0.0 - 0.3	Minor
No	High	0.7 - 1.0	Negligible
Yes	Low	0.4 - 1.0	Negligible
No	Low	<0.0 - 1.0	Negligible

Table G-4 (located at the back of this appendix) provides the analysis matrix used for the assessment of impacts, by alternative, on amphibians for each of the 91 lakes in the study area.

NATIVE FISH

Impacts on native salmonids from downstream colonization by nonnative species can occur through competition for resources (such as prey species and spawning gravels), introgression (hybridization between nonnative trout and closely related native trout), and predation on juvenile native trout.

Native fish communities in watersheds below mountain lakes can be affected if salmonids stocked in mountain lakes establish populations in outlet streams. The extent of potential adverse impacts on native fish depends upon the species and strain stocked in a given mountain lake and the native species in the downstream areas of the watershed exposed to colonization. There is incomplete information regarding actual impacts currently occurring, or that could occur, for all 91 lakes under all alternatives; therefore, impact thresholds were developed using predictive factors based on the types of species stocked and the watershed locations (since certain species are native only to either the east or west side of the Cascades). Relevant literature and the professional experience of biologists on the plan/EIS team were used to relate the presence of certain nonnative fish to a likely level of impact. In addition to this predictive approach, actual knowledge of impacts (colonization and/or hybridization) occurring in certain drainages (as provided by WDFW staff involved in the preparation of this plan/EIS) was used to characterize impact levels whenever possible (see "Table G-5: Assessment of Impacts on Native Fish"). After the record of decision on this plan/EIS is made and a monitoring program is implemented, more specific biologically based factors would be developed and used in making future adaptive management decisions that would affect lake stocking.

The predictive factors used in this analysis focus on the potential for colonization and/or hybridization of downstream drainages. Colonization of downstream habitats by stocked mountain lake trout has been widely documented, but colonization success varies by species. For example, brook trout stocked in mountain lakes have successfully transited 80% gradient stream reaches and, in one case, a 60-foot waterfall to colonize tributaries with a gradient as high as a 23%. Downstream colonization over distances up to 68 miles has been documented (Adams et al. 2001). In contrast, Mt. Whitney rainbows and California golden trout have been widely stocked in high-elevation lakes in Washington, but successful colonization of downstream habitats by these species has never been documented in Washington State (WDFW, B. Pfeifer, pers. comm., 2002; WDFW, M. Downen, pers. comm., 2002). Various strains of cutthroat and rainbow trout have also been broadly stocked to high-elevation lakes and have had variable success with colonization of downstream habitats.

Because of the low potential of establishing populations in watersheds below mountain lakes, Ross Lake rainbows, Mt. Whitney rainbows, or California golden trout stocked in mountain lakes are unlikely to adversely affect native salmonids on the west side of the Cascade Crest. Also, the stocking of coastal cutthroat trout in a west-side lake would not create adverse effects, since these species are native to west-side watersheds.

Westslope cutthroat trout, however, are not native to stream basins on the west side of the Cascades and have the potential to compete with native trout, char, and salmon for resources and to hybridize with coastal rainbows and coastal cutthroat trout (WDFW, M. Downen, pers. comm., 2002, 2003). The Twin Lakes strain of westslope cutthroat trout has been widely stocked on the west side of the Cascades, with many reproducing populations established in both mountain lakes and streams. The zone of hybridization is likely to be restricted to reaches of streams where both westslope cutthroat and native trout can reproduce. Westslope cutthroat trout generally reproduce later in the year and in colder water

temperatures than coastal cutthroat and rainbow trout, which restricts the potential for introgression. Brook trout cannot hybridize with native rainbow or cutthroat trout, but can compete with native trout for available resources in headwater streams and tributaries (Adams et al. 2001). Brook trout are capable of hybridizing with bull trout, which are currently listed as threatened under the *Endangered Species Act*. A high percentage of the hybrids produced are thought to be sterile, giving the smaller but numerically superior brook trout a competitive advantage. A few lakes in the study area west of the Cascade Crest contain reproducing populations of rainbow trout strains, which are more closely related to native strains of rainbow trout and less likely to impact native trout than westslope cutthroat trout.

In the Lake Chelan / Stehekin River basin, Twin Lakes westslope cutthroat trout are stocked in many of the mountain lakes. Although this strain of westslope cutthroat may not be genetically identical to westslope cutthroats that are native to east-side streams, it is closely related and unlikely to have substantial impacts to native trout. Rainbow trout that were adapted to headwater stream and mountain lake environments (perhaps from Packwood Lake, Washington) were stocked into Rainbow Lake in the 1930s before the establishment of the Washington Game Department (currently the Washington Department of Fish and Wildlife). These stocked trout established a reproducing population of rainbow trout on the east side of the Cascade Crest. Reproducing populations of rainbow trout or populations of cutthroat/rainbow hybrids also exist in approximately three other lakes in the study area east of the Cascade Crest. Stocked rainbow trout have been documented to replace, through competition or hybridization, native populations of westslope cutthroat trout throughout its native range (Behnke 1992).

In general, the greatest threat to native fish in downstream drainages would occur from the presence of reproducing brook trout in a west-side lake with outlets to streams containing native char, or from rainbow or rainbow/cutthroat hybrids in an east-side lake, where native westslope cutthroat trout could occur in downstream reaches. These impacts would be considered major if both colonization and hybridization occur as a result of downstream dispersal.

Based on the above information, including the knowledge of WDFW biologists familiar with streams in the study area, the following impact thresholds were defined for native fish populations (to be applied on a lake-by-lake basis):

Major: There would be measurable evidence of colonization, and where interbreeding is possible, hybridization with native fish. Native species deviate from normal population levels or abundance, and/or genotypes are permanently altered. On a local basis, native species may be eliminated or become hybrid swarms. For this assessment, potentially major impacts would be expected when a surface outlet connects to a downstream basin AND the following additional predictive factors are found:

- Inventories demonstrate colonization and hybridization of the outlet stream from downstream dispersal of nonnative stocked fish has occurred,

AND

- Reproducing brook trout are present in a west-side lake, or

- Reproducing rainbow trout or rainbow/cutthroat hybrids are present in an east-side lake.

Moderate: Although individuals of nonnative species stocked into a lake could occasionally disperse downstream and rear in streams, there would be no measurable evidence of colonization or hybridization with native fish. All native species would be indefinitely viable. For this assessment, potentially moderate impacts would be expected when a surface outlet connects to a downstream basin AND the following additional predictive factors are found:

- Inventories demonstrate that colonization and/or hybridization of the outlet stream has not occurred from populations of nonnative stocked fish that have a long history of high levels of reproduction,

AND

- Reproducing brook trout are present in a west-side lake, or

- Reproducing rainbow trout or rainbow/cutthroat hybrids are present in an east-side lake.

Minor: Relatively small numbers of individuals could potentially be affected through intraspecies hybridization. Outbreeding depression may occur in vicinity of outlet stream, but effects would be localized. All native species would be indefinitely viable. For this assessment, potentially minor impacts would be expected when a surface outlet connects to a downstream basin AND one of the following additional predictive factors is found:

- Reproducing strains or subspecies of rainbow or cutthroat trout not native to the basin are present in a west-side lake,

OR

- Mt. Whitney rainbow trout are stocked in an east-side lake.

Negligible: If present in a lake with an outlet, fish are either native to the basin or are unlikely to colonize downstream areas if one or more of the following predictive factors applies:

- Ross Lake or Mt. Whitney rainbow trout, coastal cutthroat trout, or California golden trout are present in a west-side lake,

OR·

- Westslope cutthroat trout are present in an east-side lake,

OR

- The lake is fishless.

TABLE G-1: ASSESSMENT OF IMPACTS ON PLANKTON

Lake Name	NPS Lake Code	Zone	Elevation (ft)	Surface Area (acres)	Maximum Depth (ft)	Water Temp (°C)	Fish Status	Fish Density	Reproducing Trout	Management Action Fish Densities				Level of Impact			
										Alternative A	Alternative B	Alternative C	Alternative D	Alternative A	Alternative B	Alternative C	Alternative D
Azure	MP-09-01	W	4,055	91.6	344.5	8.5	FL	N	N	Fishless	Fishless	Fishless	Fishless	Negligible	Negligible	Negligible	Negligible
Battalion	MLY-02-01	E	5,340	6.3	15.6	12.2	M	H	Y	Fish-high density	Fishless	Fishless	Fishless	Moderate	Negligible	Negligible	Negligible
Bear[a]	MC-12-01	W	5,795	25.7	151.9	11.4	R	H	Y	Fish-high density	Fish-low density	Fishless	Fishless	Minor	Minor	Negligible	Negligible
Berdeen[a]	M-08-01	W	5,000	126.7	215.0	9.3	M	H	Y	Fish-high density	Fish-low density	Fishless	Fishless	Minor	Minor	Negligible	Negligible
Berdeen, Lower	M-07-01	W	4,460	7.5	36.1	9.7	R	H	Y	Fish-high density	Fishless	Fishless	Fishless	Moderate	Negligible	Negligible	Negligible
Berdeen, Upper	M-09-01	W	5,050	9.5	—	—	R	H	Y	Fish-high density	Fishless	Fishless	Fishless	Moderate	Negligible	Negligible	Negligible
Blum (Largest/Middle, No. 3)	M-11-01	W	5,030	12.9	—	11.0	M	H	Y	Fish-high density	Fishless	Fishless	Fishless	Moderate	Negligible	Negligible	Negligible
Blum (Lower/West, No. 4)	LS-07-01	W	4,940	6.4	25.9	12.9	R	VH	Y	Fish-high density	Fish-low density	Fishless	Fishless	Major	Minor	Negligible	Negligible
Blum (Small/North, No. 2)	MC-01-01	W	5,620	0.9	10.0	19.5	FL	N	N	Fishless	Fishless	Fishless	Fishless	Negligible	Negligible	Negligible	Negligible
Blum (Vista/Northwest, No. 1)	MC-02-01	W	5,900	2.7	35.0	11.0	FL	N	N	Fishless	Fishless	Fishless	Fishless	Negligible	Negligible	Negligible	Negligible
Bouck, Lower	DD-04-01	W	3,850	10.8	63.2	11.2	R	H	Y	Fish-high density	Fish-low density	Fish-low density	Fishless	Minor	Minor	Minor	Negligible
Bouck, Upper	DD-05-01	W	5,030	5.5	29.0	10.5	S	L	N	Fish-low density	Fishless	Fishless	Fishless	Minor	Negligible	Negligible	Negligible
Bowen	MR-12-01	E	6,495	1.5	13.1	—	S	L	N	Fish-low density	Fishless	Fishless	Fishless	Minor	Negligible	Negligible	Negligible
Coon	MM-10-01	E	2,172	11.3	19.0	16.6	S	L	N	Fish-low density	Fish-low density	Fish-low density	Fishless	Minor	Minor	Minor	Negligible
Copper[b]	MC-06-01	W	5,263	12.9	67.2	10.3	S	L	N	Fish-low density	Fishless	Fishless	Fishless	Minor	Negligible	Negligible	Negligible
Dagger	MR-04-01	E	5,508	8.2	15.9	12.3	R	H	Y	Fish-high density	Fishless	Fishless	Fishless	Moderate	Negligible	Negligible	Negligible
Dee Dee, Upper	MR-15-01	E	6,303	12.2	89.2	7.4	M	H	Y	Fish-high density	Fishless	Fishless	Fishless	Minor	Negligible	Negligible	Negligible
Dee Dee/Tamarack, Lower	MR-15-02	E	6,260	0.8	9.8	7.1	S	L	N	Fish-low density	Fishless	Fishless	Fishless	Minor	Negligible	Negligible	Negligible
Despair, Lower	M-14-01	W	4,820	1.7	—	—	FL	N	N	Fishless	Fishless	Fishless	Fishless	Negligible	Negligible	Negligible	Negligible
Despair, Upper	M-13-01	W	5,100	2.1	—	—	FL	N	N	Fishless	Fishless	Fishless	Fishless	Negligible	Negligible	Negligible	Negligible
Diobsud No. 1	LS-01-01	W	4,220	1.0	11.2	14.1	R	H	Y	Fish-high density	Fishless	Fishless	Fishless	Moderate	Negligible	Negligible	Negligible
Diobsud No. 2, Lower	LS-02-01	W	4,220	3.1	17.2	13.7	M	H	Y	Fish-high density	Fishless	Fishless	Fishless	Moderate	Negligible	Negligible	Negligible
Diobsud No. 3, Upper	LS-03-01	W	4,420	3.9	17.1	14.8	S	L	N	Fish-low density	Fishless	Fishless	Fishless	Minor	Negligible	Negligible	Negligible
Doubtful	CP-01-01	E	5,385	30.2	68.2	10.9	R	H	Y	Fish-high density	Fish-low density	Fishless	Fishless	Minor	Minor	Negligible	Negligible
Doug's Tarn	M-21-01	W	3,951	5.0	10.2	11.2	R	H	Y	Fish-high density	Fish-low density	Fishless	Fishless	Moderate	Minor	Negligible	Negligible
East, Lower	MC-14-02	W	5,460	8.0	—	15.6	FL	N	N	Fishless	Fishless	Fishless	Fishless	Negligible	Negligible	Negligible	Negligible
East, Upper	MC-14-01	W	5,595	6.2	—	—	FL	N	N	Fishless	Fishless	Fishless	Fishless	Negligible	Negligible	Negligible	Negligible
Firn	MP-02-01	W	5,472	5.7	37.7	12.6	M	L	N	Fish-low density	Fish-low density	Fishless	Fishless	Minor	Minor	Negligible	Negligible
Green[a]	M-04-01	W	4,261	80.0	153.2	8.7	R	H	Y	Fish-high density	Fishless	Fishless	Fishless	Minor	Negligible	Negligible	Negligible
Green Bench	LS-04-01	W	4,870	3.9	21.5	10.5	FL	N	N	Fishless	Fishless	Fishless	Fishless	Negligible	Negligible	Negligible	Negligible
Hanging[a,c]	MC-08-01	W	4,522	88.8	—	—	R	H	Y	Fish-high density	Fishless	Fishless	Fishless	Minor	Negligible	Negligible	Negligible
Hidden[a]	SB-01-01	W	5,733	61.7	258.2	7.2	M	L	N	Fish-low density	Fish-low density	Fishless	Fishless	Minor	Minor	Negligible	Negligible
Hidden Lake Tarn	EP-14-01	W	5,830	4.9	42.7	12.8	S	L	N	Fish-low density	Fishless	Fishless	Fishless	Minor	Negligible	Negligible	Negligible
Hi-Yu	M-01-01	W	3,830	3.6	18.0	16.4	S	L	N	Fish-low density	Fishless	Fishless	Fishless	Minor	Negligible	Negligible	Negligible
Hozomeen[a]	HM-02-01	W	2,823	97.4	66.7	17.4	R	VH	Y	Fish-high density	Fishless	Fishless	Fishless	Minor	Negligible	Negligible	Negligible
Ipsoot	LS-06-01	W	4,460	8.9	50.8	19.7	R	L	Y	Fish-low density	Fish-low density	Fishless	Fishless	Minor	Minor	Negligible	Negligible
Jeanita	DD-01-01	W	4,904	1.4	8.0	12.7	R	L	N	Fish-low density	Fish-low density	Fishless	Fishless	Minor	Minor	Negligible	Negligible
Kettling	MR-05-01	E	5,375	9.9	23.0	11.4	R	H	Y	Fish-high density	Fishless	Fishless	Fishless	Moderate	Negligible	Negligible	Negligible
Kwahnesum	MC-07-01	W	5,102	16.4	104.3	12.3	S	L	N	Fish-low density	Fishless	Fishless	Fishless	Minor	Negligible	Negligible	Negligible
McAlester	MR-10-01	E	5,507	13.2	23.0	13.0	R	H	Y	Fish-high density	Fishless	Fishless	Fishless	Moderate	Negligible	Negligible	Negligible
Middle, Lower	MC-16-02	W	5,595	2.9	8.0	7.9	FL	N	N	Fishless	Fishless	Fishless	Fishless	Negligible	Negligible	Negligible	Negligible
Middle, Upper	MC-16-01	W	5,700	4.5	25.9	3.4	FL	N	N	Fishless	Fishless	Fishless	Fishless	Negligible	Negligible	Negligible	Negligible
Monogram[a]	M-23-01	W	4,873	29.1	122.0	12.3	M	H	Y	Fish-high density	Fish-low density	Fishless	Fishless	Minor	Minor	Negligible	Negligible
Monogram Tarn	M-23-11	W	4,860	—	—	—	S	L	N	Fish-low density	Fishless	Fishless	Fishless	Minor	Negligible	Negligible	Negligible
Nert	M-05-01	W	4,556	3.6	29.5	15.8	S	L	N	Fish-low density	Fishless	Fishless	Fishless	Minor	Negligible	Negligible	Negligible

TABLE G-1: ASSESSMENT OF IMPACTS ON PLANKTON (CONTINUED)

Lake Name	NPS Lake Code	Zone	Elevation (ft)	Surface Area (acres)	Maximum Depth (ft)	Water Temp (°C)	Fish Status	Fish Density	Reproducing Trout	Management Action Fish Densities				Level of Impact			
										Alternative A	Alternative B	Alternative C	Alternative D	Alternative A	Alternative B	Alternative C	Alternative D
Noisy Creek, Upper	LS-14-01	W	3,660	0.3	—	—	FL	N	N	Fishless	Fishless	Fishless	Fishless	Negligible	Negligible	Negligible	Negligible
No Name	PM-01-01	W	3,843	7.5	31.2	7.6	S	L	N	Fish-low density	Fish-low density	Fishless	Fishless	Minor	Minor	Negligible	Negligible
Panther Potholes, Lower	RD-05-02	W	3,375	0.5	17.2	17.4	S	L	N	Fish-low density	Fishless	Fishless	Fishless	Minor	Negligible	Negligible	Negligible
Panther Potholes, Upper	RD-05-01	W	3,380	0.2	9.4	17.8	FL	N	N	Fishless	Fishless	Fishless	Fishless	Negligible	Negligible	Negligible	Negligible
Pegasus	EP-10-01	W	5,620	10.9	—	—	FL	N	N	Fishless	Fishless	Fishless	Fishless	Negligible	Negligible	Negligible	Negligible
Pond SE of Kettling Lakes	MR-09-01	E	5,945	4.7	16.1	—	S	L	N	Fish-low density	Fish-low density	Fish-low density	Fishless	Minor	Minor	Minor	Negligible
Quill, Lower	M-24-02	W	4,510	1.0	18.0		S	L	N	Fish-low density	Fishless	Fishless	Fishless	Minor	Negligible	Negligible	Negligible
Quill, Upper	M-24-01	W	4,510	1.2	10.0	20.0	S	L	N	Fish-low density	Fishless	Fishless	Fishless	Minor	Negligible	Negligible	Negligible
Rainbow	MR-14-01	E	5,630	15.5	107.6	13.1	R	H	Y	Fish-high density	Fish-low density	Fish-low density	Fishless	Minor	Minor	Minor	Negligible
Rainbow, Upper (North)	MR-13-01	E	5,900	0.6	7.2	15.7	FL	N	N	Fishless	Fishless	Fishless	Fishless	Negligible	Negligible	Negligible	Negligible
Rainbow, Upper (South)	MR-13-02	E	5,865	3.6	24.1	10.6	S	L	N	Fish-low density	Fishless	Fishless	Fishless	Minor	Negligible	Negligible	Negligible
Rainbow, Upper (West)	MM-11-01	E	6,473	3.5	27.6	13.4	S	L	N	Fish-low density	Fishless	Fishless	Fishless	Minor	Negligible	Negligible	Negligible
Redoubt	MC-11-01	W	5,300	18.4	45.9	9.3	FL	N	N	Fishless	Fishless	Fishless	Fishless	Negligible	Negligible	Negligible	Negligible
Reveille, Lower	MC-21-02	W	4,995	4.4	9.8	13.8	FL	N	N	Fishless	Fishless	Fishless	Fishless	Negligible	Negligible	Negligible	Negligible
Reveille, Upper	MC-21-01	W	4,995	3.4	16.4	8.0	FL	N	N	Fishless	Fishless	Fishless	Fishless	Negligible	Negligible	Negligible	Negligible
Ridley	HM-03-01	W	3,140	10.9	35.1	18.2	S	L	N	Fish-low density	Fish-low density	Fish-low density	Fishless	Minor	Minor	Minor	Negligible
Sky	EP-13-01	W	5,380	1.9	—	—	FL	N	N	Fishless	Fishless	Fishless	Fishless	Negligible	Negligible	Negligible	Negligible
Skymo	PM-03-01	W	5,277	10.8	20.0	11.1	M	H	Y	Fish-high density	Fish-low density	Fishless	Fishless	Moderate	Minor	Negligible	Negligible
Sourdough	PM-12-01	W	4,623	27.6	107.0	14.7	M	VH	Y	Fish-high density	Fishless	Fishless	Fishless	Minor	Negligible	Negligible	Negligible
Sourpuss	ML-01-01	W	4,835	2.0	3.9	7.8	FL	N	N	Fishless	Fishless	Fishless	Fishless	Negligible	Negligible	Negligible	Negligible
Stiletto	MR-01-01	E	6,795	9.9	85.3	6.1	S	L	N	Fish-low density	Fishless	Fishless	Fishless	Minor	Negligible	Negligible	Negligible
Stout[a]	EP-09-02	W	5,215	25.2	175.5	5.4	M	L	Y	Fish-low density	Fish-low density	Fishless	Fishless	Minor	Minor	Negligible	Negligible
Stout, Lower	EP-09-01	W	5,190	1.0	8.2	13.2	R	L	Y	Fish-low density	Fish-low density	Fishless	Fishless	Minor	Minor	Negligible	Negligible
Sweet Pea	ML-02-01	W	5,540	10.3	92.0	6.5	S	L	N	Fish-low density	Fish-low density	Fishless	Fishless	Minor	Minor	Negligible	Negligible
Talus Tarn	M-06-01	W	5,355	1.5	11.8	11.7	FL	N	N	Fishless	Fishless	Fishless	Fishless	Negligible	Negligible	Negligible	Negligible
Tapto, Lower	MC-17-03	W	5,700	0.4	—	—	FL	N	N	Fishless	Fishless	Fishless	Fishless	Negligible	Negligible	Negligible	Negligible
Tapto, Middle	MC-17-02	W	5,730	1.2	18.0	12.9	FL	N	N	Fishless	Fishless	Fishless	Fishless	Negligible	Negligible	Negligible	Negligible
Tapto, Upper	MC-17-01	W	5,750	10.2	43.0	—	FL	N	N	Fishless	Fishless	Fishless	Fishless	Negligible	Negligible	Negligible	Negligible
Tapto, West	MC-17-04	W	5,660	2.3	14.1	11.7	FL	N	N	Fishless	Fishless	Fishless	Fishless	Negligible	Negligible	Negligible	Negligible
Thornton, Lower	M-20-01	W	4,486	55.1	108.3	12.2	M	L	N	Fish-low density	Fish-low density	Fishless	Fishless	Minor	Minor	Negligible	Negligible
Thornton, Middle	M-19-01	W	4,700	11.9	78.7	8.2	S	L	N	Fish-low density	Fish-low density	Fishless	Fishless	Minor	Minor	Negligible	Negligible
Thunder	RD-02-01	W	1,350	6.8	24.6	15.3	FL	N	N	Fishless	Fishless	Fishless	Fishless	Negligible	Negligible	Negligible	Negligible
Tiny	MC-15-01	W	6,100	0.3	6.0	17.0	FL	N	N	Fishless	Fishless	Fishless	Fishless	Negligible	Negligible	Negligible	Negligible
Torment	ML-03-01	W	6,560	3.6	49.9	8.0	S	L	N	Fish-low density	Fishless	Fishless	Fishless	Minor	Negligible	Negligible	Negligible
Trapper[a]	GM-01-01	E	4,165	147.2	160.8	14.1	R	H	Y	Fish-high density	Fish-low density	Fishless	Fishless	Minor	Minor	Negligible	Negligible
Triplet, Lower	SM-02-01	E	6,331	2.2	7.2	17.5	R	H	Y	Fish-high density	Fish-low density	Fish-low density	Fishless	Moderate	Minor	Minor	Negligible
Triplet, Upper	SM-02-02	E	6,551	2.3	12.5	19.7	R	H	Y	Fish-high density	Fishless	Fishless	Fishless	Moderate	Negligible	Negligible	Negligible
Triumph	M-17-01	W	3,685	4.3	20.5	17.1	S	L	N	Fish-low density	Fish-low density	Fishless	Fishless	Minor	Minor	Negligible	Negligible
Unnamed	FP-01-01	W	5,140	13.5	—	—	FL	N	N	Fishless	Fishless	Fishless	Fishless	Negligible	Negligible	Negligible	Negligible
Unnamed	MR-11-01	E	6,111	2.9	28.9	14.6	S	L	N	Fish-low density	Fish-low density	Fish-low density	Fishless	Minor	Minor	Minor	Negligible
Unnamed	MR-16-01	E	6,230	1.9	6.6	—	R	L	N	Fish-low density	Fish-low density	Fish-low density	Fishless	Minor	Minor	Minor	Negligible
Vulcan	ML-04-01	W	5,180	8.2	25.2	10.7	FL	N	N	Fishless	Fishless	Fishless	Fishless	Negligible	Negligible	Negligible	Negligible
Wilcox/Lillie, Upper	EP-06-01	W	5,136	10.5	65.0	14.5	R	H	Y	Fish-high density	Fishless	Fishless	Fishless	Minor	Negligible	Negligible	Negligible
Wilcox/Sandie, Lower	EP-05-01	W	5,120	5.4	19.7	13.5	R	H	Y	Fish-high density	Fish-low density	Fishless	Fishless	Moderate	Minor	Negligible	Negligible
Wild	MC-27-01	W	4,880	12.7	28.9	10.1	FL	N	N	Fishless	Fishless	Fishless	Fishless	Negligible	Negligible	Negligible	Negligible
Willow	HM-04-01	W	2,853	16.9	26.9	19.5	S	L	N	Fish-low density	Fish-low density	Fish-low density	Fishless	Minor	Minor	Minor	Negligible

TABLE G-1: ASSESSMENT OF IMPACTS ON PLANKTON (CONTINUED)

Notes:

Zone: E = East side of Cascade Crest
W = West side of Cascade Crest

Fish Status: S = Stocked
S* = Stocked with reproducing fish. Limited reproduction in the past – needs verification.
R = Reproducing
M = Mixed reproducing and stocked
NF = No fish (historically stocked)
FL = No fish (historically fishless)

Fish Density: H = High fish density (> 100 trout/acre for stocked fish or > 50 trout/acre for reproducing fish)
L = Low fish density (< 100 trout/acre for stocked fish or < 50 trout/acre for reproducing fish)
N = No fish present
VH = Very High fish density (> 400 trout/acre of reproducing fish or stocked fish with multiple year-classes approximating age structure of reproducing fish)

Reproducing Trout: N = No
Y = Yes

Management Action Fish Densities:

Level of Impact:

For impact thresholds, refer to "Table 31: Summary of Impact Thresholds—Aquatic Organisms" in the "Environmental Consequences" chapter.

a. The feasibility of complete removal of fish in these lakes would need to be evaluated.

b In August 2004, a large fish kill was observed in Copper Lake, possibly due to disease. Further surveys are needed to confirm that the lake is fishless.

c. Remove all reproducing fish from Hanging Lake pending agreement with British Columbia.

TABLE G-2: ASSESSMENT OF IMPACTS ON MACROINVERTEBRATES

Lake Name	NPS Lake Code	Zone	Elevation (ft)	Surface Area (acres)	Max. Depth (ft)	Water Temp (°C)	Fish Status	Fish Density	Management Action Fish Densities				Level of Impact			
									Alternative A	Alternative B	Alternative C	Alternative D	Alternative A	Alternative B	Alternative C	Alternative D
Azure	MP-09-01	W	4,055	91.6	344.5	8.5	FL	N	Fishless	Fishless	Fishless	Fishless	Negligible	Negligible	Negligible	Negligible
Battalion	MLY-02-01	E	5,340	6.3	15.6	12.2	M	H	Fish-high density	Fishless	Fishless	Fishless	Major	Negligible	Negligible	Negligible
Bear[a]	MC-12-01	W	5,795	25.7	151.9	11.4	R	H	Fish-high density	Fish-low density	Fishless	Fishless	Moderate	Minor	Negligible	Negligible
Berdeen[a]	M-08-01	W	5,000	126.7	215.0	9.3	M	H	Fish-high density	Fish-low density	Fishless	Fishless	Moderate	Minor	Negligible	Negligible
Berdeen, Lower	M-07-01	W	4,460	7.5	36.1	9.7	R	H	Fish-high density	Fishless	Fishless	Fishless	Major	Negligible	Negligible	Negligible
Berdeen, Upper	M-09-01	W	5,050	9.5	—	—	R	H	Fish-high density	Fishless	Fishless	Fishless	Major	Negligible	Negligible	Negligible
Blum (Largest/Middle, No. 3)	M-11-01	W	5,030	12.9	—	11.0	M	H	Fish-high density	Fishless	Fishless	Fishless	Moderate	Negligible	Negligible	Negligible
Blum (Lower/West, No. 4)	LS-07-01	W	4,940	6.4	25.9	12.9	R	VH	Fish-high density	Fish-low density	Fishless	Fishless	Major	Minor	Negligible	Negligible
Blum (Small/North, No. 2)	MC-01-01	W	5,620	0.9	10.0	19.5	FL	N	Fishless	Fishless	Fishless	Fishless	Negligible	Negligible	Negligible	Negligible
Blum (Vista/Northwest, No. 1)	MC-02-01	W	5,900	2.7	35.0	11.0	FL	N	Fishless	Fishless	Fishless	Fishless	Negligible	Negligible	Negligible	Negligible
Bouck, Lower	DD-04-01	W	3,850	10.8	63.2	11.2	R	H	Fish-high density	Fish-low density	Fish-low density	Fishless	Moderate	Minor	Minor	Negligible
Bouck, Upper	DD-05-01	W	5,030	5.5	29.0	10.5	S	L	Fish-low density	Fishless	Fishless	Fishless	Minor	Negligible	Negligible	Negligible
Bowan	MR-12-01	E	6,495	1.5	13.1	—	S	L	Fish-low density	Fishless	Fishless	Fishless	Minor	Negligible	Negligible	Negligible
Coon	MM-10-01	E	2,172	11.3	19.0	16.6	S	L	Fish-low density	Fish-low density	Fish-low density	Fishless	Minor	Minor	Minor	Negligible
Copper[b]	MC-06-01	W	5,263	12.9	67.2	10.3	S	L	Fish-low density	Fishless	Fishless	Fishless	Minor	Negligible	Negligible	Negligible
Dagger	MR-04-01	E	5,508	8.2	15.9	12.3	R	H	Fish-high density	Fishless	Fishless	Fishless	Moderate	Negligible	Negligible	Negligible
Dee Dee, Upper	MR-15-01	E	6,303	12.2	89.2	7.4	M	H	Fish-high density	Fishless	Fishless	Fishless	Major	Negligible	Negligible	Negligible
Dee Dee/Tamarack, Lower	MR-15-02	E	6,260	0.8	9.8	7.1	S	L	Fish-low density	Fishless	Fishless	Fishless	Minor	Negligible	Negligible	Negligible
Despair, Lower	M-14-01	W	4,820	1.7	—	—	FL	N	Fishless	Fishless	Fishless	Fishless	Negligible	Negligible	Negligible	Negligible
Despair, Upper	M-13-01	W	5,100	2.1	—	—	FL	N	Fishless	Fishless	Fishless	Fishless	Negligible	Negligible	Negligible	Negligible
Diobsud No. 1	LS-01-01	W	4,220	1.0	11.2	14.1	R	H	Fish-high density	Fishless	Fishless	Fishless	Major	Negligible	Negligible	Negligible
Diobsud No. 2, Lower	LS-02-01	W	4,220	3.1	17.2	13.7	M	H	Fish-high density	Fishless	Fishless	Fishless	Major	Negligible	Negligible	Negligible
Diobsud No. 3, Upper	LS-03-01	W	4,420	3.9	17.1	14.8	S	L	Fish-low density	Fishless	Fishless	Fishless	Major	Negligible	Negligible	Negligible
Doubtful	CP-01-01	E	5,385	30.2	68.2	10.9	R	H	Fish-high density	Fish-low density	Fishless	Fishless	Moderate	Minor	Negligible	Negligible
Doug's Tarn	M-21-01	W	3,951	5.0	10.2	11.2	R	H	Fish-high density	Fish-low density	Fishless	Fishless	Major	Minor	Negligible	Negligible
East, Lower	MC-14-02	W	5,460	8.0	—	15.6	FL	N	Fishless	Fishless	Fishless	Fishless	Negligible	Negligible	Negligible	Negligible
East, Upper	MC-14-01	W	5,595	6.2	—	—	FL	N	Fishless	Fishless	Fishless	Fishless	Negligible	Negligible	Negligible	Negligible
Firn	MP-02-01	W	5,472	5.7	37.7	12.6	M	L	Fish-low density	Fish-low density	Fishless	Fishless	Minor	Minor	Negligible	Negligible
Green[a]	M-04-01	W	4,261	80.0	153.2	8.7	R	H	Fish-high density	Fishless	Fishless	Fishless	Moderate	Negligible	Negligible	Negligible
Green Bench	LS-04-01	W	4,870	3.9	21.5	10.5	FL	N	Fishless	Fishless	Fishless	Fishless	Negligible	Negligible	Negligible	Negligible
Hanging[a,c]	MC-08-01	W	4,522	88.8	—	—	R	H	Fish-high density	Fishless	Fishless	Fishless	Moderate	Negligible	Negligible	Negligible
Hidden[a]	SB-01-01	W	5,733	61.7	258.2	7.2	M	L	Fish-low density	Fish-low density	Fishless	Fishless	Minor	Minor	Negligible	Negligible
Hidden Lake Tarn	EP-14-01	W	5,830	4.9	42.7	12.8	S	L	Fish-low density	Fishless	Fishless	Fishless	Minor	Negligible	Negligible	Negligible
Hi-Yu	M-01-01	W	3,830	3.6	18.0	16.4	S	L	Fish-low density	Fishless	Fishless	Fishless	Minor	Negligible	Negligible	Negligible
Hozomeen[a]	HM-02-01	W	2,823	97.4	66.7	17.4	R	VH	Fish-high density	Fishless	Fishless	Fishless	Moderate	Negligible	Negligible	Negligible
Ipsoot	LS-06-01	W	4,460	8.9	50.8	19.7	R	L	Fish-low density	Fish-low density	Fishless	Fishless	Minor	Minor	Negligible	Negligible
Jeanita	DD-01-01	W	4,904	1.4	8.0	12.7	R	L	Fish-low density	Fish-low density	Fishless	Fishless	Minor	Minor	Negligible	Negligible
Kettling	MR-05-01	E	5,375	9.9	23.0	11.4	R	H	Fish-high density	Fishless	Fishless	Fishless	Major	Negligible	Negligible	Negligible
Kwahnesum	MC-07-01	W	5,102	16.4	104.3	12.3	S	L	Fish-low density	Fishless	Fishless	Fishless	Minor	Negligible	Negligible	Negligible
McAlester	MR-10-01	E	5,507	13.2	23.0	13.0	R	H	Fish-high density	Fishless	Fishless=	Fishless	Moderate	Negligible	Negligible	Negligible
Middle, Lower	MC-16-02	W	5,595	2.9	8.0	7.9	FL	N	Fishless	Fishless	Fishless	Fishless	Negligible	Negligible	Negligible	Negligible
Middle, Upper	MC-16-01	W	5,700	4.5	25.9	3.4	FL	N	Fishless	Fishless	Fishless	Fishless	Negligible	Negligible	Negligible	Negligible

TABLE G-2: ASSESSMENT OF IMPACTS ON MACROINVERTEBRATES (CONTINUED)

Lake Name	NPS Lake Code	Zone	Elevation (ft)	Surface Area (acres)	Max. Depth (ft)	Water Temp (°C)	Fish Status	Fish Density	Management Action Fish Densities				Level of Impact			
									Alternative A	Alternative B	Alternative C	Alternative D	Alternative A	Alternative B	Alternative C	Alternative D
Monogram[a]	M-23-01	W	4,873	29.1	122.0	12.3	M	H	Fish-high density	Fish-low density	Fishless	Fishless	Moderate	Minor	Negligible	Negligible
Monogram Tarn	M-23-11	W	4,860	—	—	—	S	L	Fish-low density	Fishless	Fishless	Fishless	Minor	Negligible	Negligible	Negligible
Nert	M-05-01	W	4,556	3.6	29.5	15.8	S	L	Fish-low density	Fishless	Fishless	Fishless	Minor	Negligible	Negligible	Negligible
Noisy Creek, Upper	LS-14-01	W	3,660	0.3	—	—	FL	N	Fishless	Fishless	Fishless	Fishless	Negligible	Negligible	Negligible	Negligible
No Name	PM-01-01	W	3,843	7.5	31.2	7.6	S	L	Fish-low density	Fish-low density	Fishless	Fishless	Minor	Minor	Negligible	Negligible
Panther Potholes, Lower	RD-05-02	W	3,375	0.5	17.2	17.4	S	L	Fish-low density	Fishless	Fishless	Fishless	Minor	Negligible	Negligible	Negligible
Panther Potholes, Upper	RD-05-01	W	3,380	0.2	9.4	17.8	FL	N	Fishless	Fishless	Fishless	Fishless	Negligible	Negligible	Negligible	Negligible
Pegasus	EP-10-01	W	5,620	10.9	—	—	FL	N	Fishless	Fishless	Fishless	Fishless	Negligible	Negligible	Negligible	Negligible
Pond SE of Kettling Lakes	MR-09-01	E	5,945	4.7	16.1	—	S	L	Fish-low density	Fish-low density	Fish-low density	Fishless	Minor	Minor	Minor	Negligible
Quill, Lower	M-24-02	W	4,510	1.0	18.0		S	L	Fish-low density	Fishless	Fishless	Fishless	Minor	Negligible	Negligible	Negligible
Quill, Upper	M-24-01	W	4,510	1.2	10.0	20.0	S	L	Fish-low density	Fishless	Fishless	Fishless	Minor	Negligible	Negligible	Negligible
Rainbow	MR-14-01	E	5,630	15.5	107.6	13.1	R	H	Fish-high density	Fish-low density	Fish-low density	Fishless	Moderate	Minor	Minor	Negligible
Rainbow, Upper (North)	MR-13-01	E	5,900	0.6	7.2	15.7	FL	N	Fishless	Fishless	Fishless	Fishless	Negligible	Negligible	Negligible	Negligible
Rainbow, Upper (South)	MR-13-02	E	5,865	3.6	24.1	10.6	S	L	Fish-low density	Fishless	Fishless	Fishless	Minor	Negligible	Negligible	Negligible
Rainbow, Upper (West)	MM-11-01	E	6,473	3.5	27.6	13.4	S	L	Fish-low density	Fishless	Fishless	Fishless	Minor	Negligible	Negligible	Negligible
Redoubt	MC-11-01	W	5,300	18.4	45.9	9.3	FL	N	Fishless	Fishless	Fishless	Fishless	Negligible	Negligible	Negligible	Negligible
Reveille, Lower	MC-21-02	W	4,995	4.4	9.8	13.8	FL	N	Fishless	Fishless	Fishless	Fishless	Negligible	Negligible	Negligible	Negligible
Reveille, Upper	MC-21-01	W	4,995	3.4	16.4	8.0	FL	N	Fishless	Fishless	Fishless	Fishless	Negligible	Negligible	Negligible	Negligible
Ridley	HM-03-01	W	3,140	10.9	35.1	18.2	S	L	Fish-low density	Fish-low density	Fish-low density	Fishless	Minor	Minor	Minor	Negligible
Sky	EP-13-01	W	5,380	1.9	—	—	FL	N	Fishless	Fishless	Fishless	Fishless	Negligible	Negligible	Negligible	Negligible
Skymo	PM-03-01	W	5,277	10.8	20.0	11.1	M	H	Fish-high density	Fish-low density	Fishless	Fishless	Moderate	Minor	Negligible	Negligible
Sourdough	PM-12-01	W	4,623	27.6	107.0	14.7	M	VH	Fish-high density	Fishless	Fishless	Fishless	Moderate	Negligible	Negligible	Negligible
Sourpuss	ML-01-01	W	4,835	2.0	3.9	7.8	FL	N	Fishless	Fishless	Fishless	Fishless	Negligible	Negligible	Negligible	Negligible
Stiletto	MR-01-01	E	6,795	9.9	85.3	6.1	S	L	Fish-low density	Fishless	Fishless	Fishless	Major	Negligible	Negligible	Negligible
Stout[a]	EP-09-02	W	5,215	25.2	175.5	5.4	M	L	Fish-low density	Fish-low density	Fishless	Fishless	Minor	Minor	Negligible	Negligible
Stout, Lower	EP-09-01	W	5,190	1.0	8.2	13.2	R	L	Fish-low density	Fish-low density	Fishless	Fishless	Minor	Minor	Negligible	Negligible
Sweet Pea	ML-02-01	W	5,540	10.3	92.0	6.5	S	L	Fish-low density	Fish-low density	Fishless	Fishless	Minor	Minor	Negligible	Negligible
Talus Tarn	M-06-01	W	5,355	1.5	11.8	11.7	FL	N	Fishless	Fishless	Fishless	Fishless	Negligible	Negligible	Negligible	Negligible
Tapto, Lower	MC-17-03	W	5,700	0.4	—	—	FL	N	Fishless	Fishless	Fishless	Fishless	Negligible	Negligible	Negligible	Negligible
Tapto, Middle	MC-17-02	W	5,730	1.2	18.0	12.9	FL	N	Fishless	Fishless	Fishless	Fishless	Negligible	Negligible	Negligible	Negligible
Tapto, Upper	MC-17-01	W	5,750	10.2	43.0	—	FL	N	Fishless	Fishless	Fishless	Fishless	Negligible	Negligible	Negligible	Negligible
Tapto, West	MC-17-04	W	5,660	2.3	14.1	11.7	FL	N	Fishless	Fishless	Fishless	Fishless	Negligible	Negligible	Negligible	Negligible
Thornton, Lower	M-20-01	W	4,486	55.1	108.3	12.2	M	L	Fish-low density	Fish-low density	Fishless	Fishless	Minor	Minor	Negligible	Negligible
Thornton, Middle	M-19-01	W	4,700	11.9	78.7	8.2	S	L	Fish-low density	Fish-low density	Fishless	Fishless	Minor	Minor	Negligible	Negligible
Thunder	RD-02-01	W	1,350	6.8	24.6	15.3	FL	N	Fishless	Fishless	Fishless	Fishless	Negligible	Negligible	Negligible	Negligible
Tiny	MC-15-01	W	6,100	0.3	6.0	17.0	FL	N	Fishless	Fishless	Fishless	Fishless	Negligible	Negligible	Negligible	Negligible
Torment	ML-03-01	W	6,560	3.6	49.9	8.0	S	L	Fish-low density	Fishless	Fishless	Fishless	Minor	Negligible	Negligible	Negligible
Trapper[a]	GM-01-01	E	4,165	147.2	160.8	14.1	R	H	Fish-high density	Fish-low density	Fishless	Fishless	Moderate	Minor	Negligible	Negligible
Triplet, Lower	SM-02-01	E	6,331	2.2	7.2	17.5	R	H	Fish-high density	Fish-low density	Fish-low density	Fishless	Major	Minor	Minor	Negligible
Triplet, Upper	SM-02-02	E	6,551	2.3	12.5	19.7	R	H	Fish-high density	Fishless	Fishless	Fishless	Moderate	Negligible	Negligible	Negligible
Triumph	M-17-01	W	3,685	4.3	20.5	17.1	S	L	Fish-low density	Fish-low density	Fishless	Fishless	Minor	Minor	Negligible	Negligible
Unnamed	FP-01-01	W	5,140	13.5	—	—	FL	N	Fishless	Fishless	Fishless	Fishless	Negligible	Negligible	Negligible	Negligible
Unnamed	MR-11-01	E	6,111	2.9	28.9	14.6	S	L	Fish-low density	Fish-low density	Fish-low density	Fishless	Minor	Minor	Minor	Negligible

TABLE G-2: ASSESSMENT OF IMPACTS ON MACROINVERTEBRATES E (CONTINUED)

Lake Name	NPS Lake Code	Zone	Elevation (ft)	Surface Area (acres)	Max. Depth (ft)	Water Temp (°C)	Fish Status	Fish Density	Management Action Fish Densities				Level of Impact			
									Alternative A	Alternative B	Alternative C	Alternative D	Alternative A	Alternative B	Alternative C	Alternative D
Unnamed	MR-16-01	E	6,230	1.9	6.6	—	R	L	Fish-low density	Fish-low density	Fish-low density	Fishless	Minor	Minor	Minor	Negligible
Vulcan	ML-04-01	W	5,180	8.2	25.2	10.7	FL	N	Fishless	Fishless	Fishless	Fishless	Negligible	Negligible	Negligible	Negligible
Wilcox/Lillie, Upper	EP-06-01	W	5,136	10.5	65.0	14.5	R	H	Fish-high density	Fishless	Fishless	Fishless	Moderate	Negligible	Negligible	Negligible
Wilcox/Sandie, Lower	EP-05-01	W	5,120	5.4	19.7	13.5	R	H	Fish-high density	Fish-low density	Fishless	Fishless	Major	Minor	Negligible	Negligible
Wild	MC-27-01	W	4,880	12.7	28.9	10.1	FL	N	Fishless	Fishless	Fishless	Fishless	Negligible	Negligible	Negligible	Negligible
Willow	HM-04-01	W	2,853	16.9	26.9	19.5	S	L	Fish-low density	Fish-low density	Fish-low density	Fishless	Minor	Minor	Minor	Negligible

Notes:

Zone: E = East side of Cascade Crest
W = West side of Cascade Crest

Fish Status: S = Stocked
S* = Stocked with reproducing fish. Limited reproduction in the past – needs verification.
R = Reproducing
M = Mixed reproducing and stocked
NF = No fish (historically stocked)
FL = No fish (historically fishless)

Fish Density: VH = Very high density of reproducing trout (> 220 fish/acre), typically brook trout.
H = Reproducing trout at >100 fish/acre, or reported high density trout population with poor condition index or high reproductive rate.
M = Reproducing population with documented density of 50 to 100 fish/acre or reported reproducing population with good numbers, size, growth, and condition factor.
L = Stocked population < 100 fish/acre or reproducing population < 50 fish.
N = No fish present.

Impacts:
See table 31 for impact thresholds.

a. The feasibility of complete removal of fish in these lakes would need to be evaluated.
b. In August 2004, a large fish kill was observed in Copper Lake, possibly due to disease. Further surveys are needed to confirm that the lake is fishless.
c. Remove all reproducing fish from Hanging Lake pending agreement with British Columbia.

TABLE G-4: ASSESSMENT OF IMPACTS ON AMPHIBIANS

Lake Name	NPS Lake Code	Zone	Index of Connectivity	Within Range of Distribution LTS	NWS	Fish Density	TKN ≥ 0.045 mg/L	Management Action Fish Densities				Level of Impact			
								Alternative A	Alternative B	Alternative C	Alternative D	Alternative A	Alternative B	Alternative C	Alternative D
Azure	MP-09-01	W	—	—		N	—	Fishless	Fishless	Fishless	Fishless	Negligible	Negligible	Negligible	Negligible
Battalion	MLY-02-01	E	0.0	X		H	N	Fish-high density	Fishless	Fishless	Fishless	Major (1)	Negligible (1)	Negligible (1)	Negligible
Bear[a]	MC-12-01	W	—	—		H	N	Fish-high density	Fish-low density	Fishless	Fishless	Negligible	Negligible	Negligible	Negligible
Berdeen[a]	M-08-01	W	—	—		H	—	Fish-high density	Fish-low density	Fishless	Fishless	Negligible	Negligible	Negligible	Negligible
Berdeen, Lower	M-07-01	W	0.4	X		H	N	Fish-high density	Fishless	Fishless	Fishless	Moderate	Negligible	Negligible	Negligible
Berdeen, Upper	M-09-01	W	—	—		H	—	Fish-high density	Fishless	Fishless	Fishless	Negligible	Negligible	Negligible	Negligible
Blum (Largest/Middle, No. 3)	M-11-01	W	0.3	X		H	U	Fish-high density	Fishless	Fishless	Fishless	Major (1)	Negligible	Negligible	Negligible
Blum (Lower/West, No. 4)	LS-07-01	W	0.2	X		VH	N	Fish-high density	Fish-low density	Fishless	Fishless	Major	Negligible	Negligible	Negligible
Blum (Small/North, No. 2)	MC-01-01	W	0.3	X		N	Y	Fishless	Fishless	Fishless	Fishless	Negligible	Negligible	Negligible	Negligible
Blum (Vista/Northwest, No. 1)	MC-02-01	W	0.3	X		N	N	Fishless	Fishless	Fishless	Fishless	Negligible	Negligible	Negligible	Negligible
Bouck, Lower	DD-04-01	W	—	—	X	H	—	Fish-high density	Fish-low density	Fish-low density	Fishless	Moderate	Minor	Minor	Negligible
Bouck, Upper	DD-05-01	W	0.2	X		L	Y	Fish-low density	Fishless	Fishless	Fishless	Minor	Negligible	Negligible	Negligible
Bowan	MR-12-01	E	0.4	X		L	Y	Fish-low density	Fishless	Fishless	Fishless	Negligible	Negligible	Negligible	Negligible
Coon	MM-10-01	E	-0.2	X		L	Y	Fish-low density	Fish-low density	Fish-low density	Fishless	Minor	Minor	Minor	Negligible
Copper[b]	MC-06-01	W	-1.4	X		L	N	Fish-low density	Fishless	Fishless	Fishless	Negligible	Negligible	Negligible	Negligible
Dagger	MR-04-01	E	0.5	X		H	Y	Fish-high density	Fishless	Fishless	Fishless	Moderate	Negligible	Negligible	Negligible
Dee Dee, Upper	MR-15-01	E	0.2	X		H	N	Fish-high density	Fishless	Fishless	Fishless	Major (1)	Negligible	Negligible	Negligible
Dee Dee/Tamarack, Lower	MR-15-02	E	0.2	X		L	N	Fish-low density	Fishless	Fishless	Fishless	Negligible	Negligible	Negligible	Negligible
Despair, Lower	M-14-01	W	—	—		N	—	Fishless	Fishless	Fishless	Fishless	Negligible	Negligible	Negligible	Negligible
Despair, Upper	M-13-01	W	—	—		N	—	Fishless	Fishless	Fishless	Fishless	Negligible	Negligible	Negligible	Negligible
Diobsud No. 1	LS-01-01	W	0.4	—	X	H	Y	Fish-high density	Fishless	Fishless	Fishless	Moderate	Negligible	Negligible	Negligible
Diobsud No. 2, Lower	LS-02-01	W	0.5	X		H	Y	Fish-high density	Fishless	Fishless	Fishless	Moderate	Negligible	Negligible	Negligible
Diobsud No. 3, Upper	LS-03-01	W	0.5	X		L	Y	Fish-low density	Fishless	Fishless	Fishless	Negligible	Negligible	Negligible	Negligible
Doubtful	CP-01-01	E	—	—		H	N	Fish-high density	Fish-low density	Fishless	Fishless	Negligible	Negligible	Negligible	Negligible
Doug's Tarn	M-21-01	W	—	—		H	N	Fish-high density	Fish-low density	Fishless	Fishless	Negligible	Negligible	Negligible	Negligible
East, Lower	MC-14-02	W	—	—		N	—	Fishless	Fishless	Fishless	Fishless	Negligible	Negligible	Negligible	Negligible
East, Upper	MC-14-01	W	—	—		N	—	Fishless	Fishless	Fishless	Fishless	Negligible	Negligible	Negligible	Negligible
Firn	MP-02-01	W	—	—		L	—	Fish-low density	Fish-low density	Fishless	Fishless	Negligible	Negligible	Negligible	Negligible
Green[a]	M-04-01	W	0.4	X		H	U	Fish-high density	Fishless	Fishless	Fishless	Moderate	Negligible	Negligible	Negligible
Green Bench	LS-04-01	W	—	—		N	—	Fishless	Fishless	Fishless	Fishless	Negligible	Negligible	Negligible	Negligible
Hanging[a,c]	MC-08-01	W	NA	X		H	U	Fish-high density	Fishless	Fishless	Fishless	Major (1)	Negligible	Negligible	Negligible
Hidden[a]	SB-01-01	W	—	—		L	—	Fish-low density	Fish-low density	Fishless	Fishless	Negligible	Negligible	Negligible	Negligible
Hidden Lake Tarn	EP-14-01	W	—	—		L	—	Fish-low density	Fishless	Fishless	Fishless	Negligible	Negligible	Negligible	Negligible
Hi-Yu	M-01-01	W	0.2	X		L	Y	Fish-low density	Fishless	Fishless	Fishless	Minor	Negligible (1)	Negligible	Negligible
Hozomeen[a]	HM-02-01	W	—	—	X	VH	Y	Fish-high density	Fishless	Fishless	Fishless	Moderate	Negligible	Negligible	Negligible
Ipsoot	LS-06-01	W	0.3	X		L	U	Fish-low density	Fish-low density	Fishless	Fishless	Minor (1)	Minor (1)	Negligible	Negligible
Jeanita	DD-01-01	W	-0.5	X		L	Y	Fish-low density	Fish-low density	Fishless	Fishless	Minor	Minor	Negligible	Negligible
Kettling	MR-05-01	E	0.5	X		H	Y	Fish-high density	Fishless	Fishless	Fishless	Moderate	Negligible	Negligible	Negligible
Kwahnesum	MC-07-01	W	-0.9	X		L	Y	Fish-low density	Fishless	Fishless	Fishless	Minor	Minor	Negligible	Negligible
McAlester	MR-10-01	E	0.7	X		H	Y	Fish-high density	Fishless	Fishless	Fishless	Moderate	Negligible	Negligible	Negligible
Middle, Lower	MC-16-02	W	—			N	—	Fishless	Fishless	Fishless	Fishless	Negligible	Negligible	Negligible	Negligible

TABLE G-4: ASSESSMENT OF IMPACTS ON AMPHIBIANS (CONTINUED)

Lake Name	NPS Lake Code	Zone	Index of Connectivity	Within Range of Distribution LTS	NWS	Fish Density	TKN ≥ 0.045 mg/L	Management Action Fish Densities				Level of Impact			
								Alternative A	Alternative B	Alternative C	Alternative D	Alternative A	Alternative B	Alternative C	Alternative D
Middle, Upper	MC-16-01	W	—			N	—	Fishless	Fishless	Fishless	Fishless	Negligible	Negligible	Negligible	Negligible
Monogram[a]	M-23-01	W	0.9	X		H	N	Fish-high density	Fish-low density	Fishless	Fishless	Negligible	Negligible	Negligible	Negligible
Monogram Tarn	M-23-11	W	0.8	X		L	U	Fish-low density	Fishless	Fishless	Fishless	Negligible	Negligible	Negligible	Negligible
Nert	M-05-01	W	0.2	X		L	Y	Fish-low density	Fishless	Fishless	Fishless	Minor	Negligible	Negligible	Negligible
Noisy Creek, Upper	LS-14-01	W	—		X	N	—	Fishless	Fishless	Fishless	Fishless	Negligible	Negligible	Negligible	Negligible
No Name	PM-01-01	W	—			L	N	Fish-low density	Fish-low density	Fishless	Fishless	Negligible	Negligible	Negligible	Negligible
Panther Potholes, Lower	RD-05-02	W	—		X	L	Y	Fish-low density	Fishless	Fishless	Fishless	Minor	Negligible	Negligible	Negligible
Panther Potholes, Upper	RD-05-01	W	—		X	N	Y	Fishless	Fishless	Fishless	Fishless	Negligible	Negligible	Negligible	Negligible
Pegasus	EP-10-01	W	—			N	—	Fishless	Fishless	Fishless	Fishless	Negligible	Negligible	Negligible	Negligible
Pond SE of Kettling Lakes	MR-09-01	E	0.7	X		L	N	Fish-low density	Fish-low density	Fish-low density	Fishless	Negligible	Negligible	Negligible	Negligible
Quill, Lower	M-24-02	W	0.0	X		L	U	Fish-low density	Fishless	Fishless	Fishless	Minor (1)	Minor (1)	Negligible	Negligible
Quill, Upper	M-24-01	W	0.0	X		L	U	Fish-low density	Fishless	Fishless	Fishless	Minor (1)	Negligible	Negligible	Negligible
Rainbow	MR-14-01	E	0.5	X		H	Y	Fish-high density	Fish-low density	Fish-low density	Fishless	Moderate	Negligible	Negligible	Negligible
Rainbow, Upper (North)	MR-13-01	E	0.4	X		N	Y	Fishless	Fishless	Fishless	Fishless	Negligible	Negligible	Negligible	Negligible
Rainbow, Upper (South)	MR-13-02	E	0.4	X		L	N	Fish-low density	Fishless	Fishless	Fishless	Negligible	Negligible	Negligible	Negligible
Rainbow, Upper (West)	MM-11-01	E	—			L	N	Fish-low density	Fishless	Fishless	Fishless	Negligible	Negligible	Negligible	Negligible
Redoubt	MC-11-01	W	—			N	Y	Fishless	Fishless	Fishless	Fishless	Negligible	Negligible	Negligible	Negligible
Reveille, Lower	MC-21-02	W	—			N	N	Fishless	Fishless	Fishless	Fishless	Negligible	Negligible	Negligible	Negligible
Reveille, Upper	MC-21-01	W	—			N	N	Fishless	Fishless	Fishless	Fishless	Negligible	Negligible	Negligible	Negligible
Reveille, Lower	MC-21-02	W	—			N	N	Fishless	Fishless	Fishless	Fishless	Negligible	Negligible	Negligible	Negligible
Reveille, Upper	MC-21-01	W	—			N	N	Fishless	Fishless	Fishless	Fishless	Negligible	Negligible	Negligible	Negligible
Ridley	HM-03-01	W	—		X	L	Y	Fish-low density	Fish-low density	Fish-low density	Fishless	Minor (1)	Minor (1)	Minor (1)	Negligible
Sky	EP-13-01	W	—			N	—	Fishless	Fishless	Fishless	Fishless	Negligible	Negligible	Negligible	Negligible
Skymo	PM-03-01	W	0.5	X		H	N	Fish-high density	Fish-low density	Fishless	Fishless	Moderate	Negligible	Negligible	Negligible
Sourdough	PM-12-01	W	-0.5	X		VH	U	Fish-high density	Fishless	Fishless	Fishless	Major (1)	Negligible (1)	Negligible	Negligible
Sourpuss	ML-01-01	W	—			N	N	Fishless	Fishless	Fishless	Fishless	Negligible	Negligible	Negligible	Negligible
Stiletto	MR-01-01	E	—			L	Y	Fish-low density	Fishless	Fishless	Fishless	Negligible	Negligible (1)	Negligible	Negligible
Stout[a]	EP-09-02	W	—			L	—	Fish-low density	Fish-low density	Fishless	Fishless	Negligible	Negligible	Negligible	Negligible
Stout, Lower	EP-09-01	W	—			L	N	Fish-low density	Fish-low density	Fishless	Fishless	Negligible	Negligible	Negligible	Negligible
Sweet Pea	ML-02-01	W	—			L	N	Fish-low density	Fish-low density	Fishless	Fishless	Negligible	Negligible	Negligible	Negligible
Talus Tarn	M-06-01	W	0.2	X		N	N	Fishless	Fishless	Fishless	Fishless	Negligible	Negligible	Negligible	Negligible
Tapto, Lower	MC-17-03	W	—			N	—	Fishless	Fishless	Fishless	Fishless	Negligible	Negligible	Negligible	Negligible
Tapto, Middle	MC-17-02	W	—			N	N	Fishless	Fishless	Fishless	Fishless	Negligible	Negligible	Negligible	Negligible
Tapto, Upper	MC-17-01	W	—			N	N	Fishless	Fishless	Fishless	Fishless	Negligible	Negligible	Negligible	Negligible
Tapto, West	MC-17-04	W	—			N	N	Fishless	Fishless	Fishless	Fishless	Negligible	Negligible	Negligible	Negligible
Thornton, Lower	M-20-01	W	-0.3	X		L	Y	Fish-low density	Fish-low density	Fishless	Fishless	Minor	Negligible	Negligible	Negligible
Thornton, Middle	M-19-01	W	—			L	N	Fish-low density	Fish-low density	Fishless	Fishless	Negligible	Negligible	Negligible	Negligible
Thunder	RD-02-01	W	—		X	N	Y	Fishless	Fishless	Fishless	Fishless	Negligible	Negligible	Negligible	Negligible
Tiny	MC-15-01	W	—			N	—	Fishless	Fishless	Fishless	Fishless	Negligible	Negligible	Negligible	Negligible
Torment	ML-03-01	W	—			L	N	Fish-low density	Fishless	Fishless	Fishless	Negligible	Negligible	Negligible	Negligible
Trapper[a]	GM-01-01	E	—			H	N	Fish-high density	Fish-low density	Fishless	Fishless	Negligible	Negligible	Negligible	Negligible
Triplet, Lower	SM-02-01	E	-0.2	X		H	Y	Fish-high density	Fish-low density	Fish-low density	Fishless	Major (1)	Minor	Minor	Negligible
Triplet, Upper	SM-02-02	E	—			H	N	Fish-high density	Fishless	Fishless	Fishless	Negligible	Negligible	Negligible	Negligible
Triumph	M-17-01	W	0.0	X		L	U	Fish-low density	Fish-low density	Fishless	Fishless	Minor (1)	Minor (1)	Negligible	Negligible
Unnamed	FP-01-01	W	—			N	—	Fishless	Fishless	Fishless	Fishless	Negligible	Negligible	Negligible	Negligible

TABLE G-4: ASSESSMENT OF IMPACTS ON AMPHIBIANS (CONTINUED)

Lake Name	NPS Lake Code	Zone	Index of Connectivity	Within Range of Distribution LTS	NWS	Fish Density	TKN ≥ 0.045 mg/L	Management Action Fish Densities				Level of Impact			
								Alternative A	Alternative B	Alternative C	Alternative D	Alternative A	Alternative B	Alternative C	Alternative D
Unnamed	MR-11-01	E	0.4	X		L	Y	Fish-low density	Fish-low density	Fish-low density	Fishless	Negligible	Negligible	Negligible	Negligible
Unnamed	MR-16-01	E	0.2	X		L	Y	Fish-low density	Fish-low density	Fish-low density	Fishless	Minor	Negligible	Negligible	Negligible
Vulcan	ML-04-01	W	—			N	N	Fishless	Fishless	Fishless	Fishless	Negligible	Negligible	Negligible	Negligible
Wilcox/Lillie, Upper	EP-06-01	W	—			H	N	Fish-high density	Fishless	Fishless	Fishless	Negligible	Negligible	Negligible	Negligible
Wilcox/Sandie, Lower	EP-05-01	W	—			H	N	Fish-high density	Fish-low density	Fishless	Fishless	Negligible	Negligible	Negligible	Negligible
Wild	MC-27-01	W	—			N	N	Fishless	Fishless	Fishless	Fishless	Negligible	Negligible	Negligible	Negligible
Willow	HM-04-01	W	—		X	L	Y	Fish-low density	Fish-low density	Fish-low density	Fishless	Minor (1)	Minor (1)	Minor (1)	Negligible

Notes:

Zone: E = East side of Cascade Crest

W = West side of Cascade Crest

Index of Connectivity: An Index of Connectivity (IOC) based on weighted calculations of potential salamander breeding lake (lakes within range of salamander distribution and having appropriate habitat) density (lakes/acre) within a target lake's basin (major tributary basin). Documented salamander breeding Lakes within 6 km (maximum colonization distance) of target lake, and number of potential salamander lakes with 0.6 km (maximum dispersal distance) of target lake. Lakes with an IOC = 0.7–0.9 have high connectivity, lakes with a IOC of 0.4–0.6 have moderate connectivity, lakes with an IOC of 0–0.3 have poor connectivity, and lakes with an IOC of < 0.0 can be considered isolated. Dash (-) indicates outside the range of long-toed salamanders (LTS) and TKN not determined.

Fish Density: H or High = > 50 trout/acre of reproducing trout or > 100 trout/acre of stocked trout; L or Low = < 50 trout/acre of reproducing trout or ≤ 100 trout/acre of stocked trout, with a total fish density of no more than 100 trout/acre; N or No Fish = No fish present in lake.

Within Range of Distribution: X - lake is within distribution range of long-toed salamander (LTS) or Northwestern salamander (NWS) and has suitable aquatic and terrestrial habitat for all life stages.

TKN ≥ 0.045 mg/l: (Total Kjeldahl Nitrogen) Y =Yes, TKN ≥0.045 mg/L; N = No, TKN <0.045 mg/L. U = unknown concentration. Dash = outside range of salamanders.

Fishless: Initial management action would result in a fishless lake. Depending upon the results of further evaluation, the lake may be stocked with a low density of trout.

Level of Impact: See table 31 for impact thresholds. Where a (1) follows a Negligible impact determination, additional evaluation or management actions may result in a Minor impact. Where a (1) follows a Minor, Moderate, or Major impact determination, a conservative assessment was performed in view of an absence of data for one or more factors (e.g., IOC is unknown), and additional evaluation or management actions may result in a reduction of the impact by one level (e.g., reduce Major to Moderate).

a. The feasibility of complete fish removal in these lakes would need to be evaluated.

b. In August 2004, a large fish kill was observed in Copper Lake, possibly due to disease. Further surveys are needed to confirm that the lake is fishless.

c. Remove all reproducing fish from Hanging Lake pending agreement with British Columbia.

TABLE G-5: ASSESSMENT OF IMPACTS ON NATIVE FISH

Drainage Basin	NPS Lake Code	Lake Name	Side of Cascade Crest	Surface Inlet or Outlet	Trout Present, Historically Present, or Scheduled for Stocking in Lake									Management Action Fish Densities					Level of Impact			
					Brook Trout	Westslope Cutthroat	Coastal Cutthroat	Yellowstone Cutthroat	Rainbow/ Cutthroat Hybrids	Rainbow Trout	Mt. Whitney Rainbow	Ross Lake Rainbow	Rainbow Subspecies	Alternative A	Alternative B	Alternative C	Alternative D	Alternative A	Alternative B	Alternative C	Alternative D
Skagit	MP-09-01	Azure	W	Yes										Fishless	Fishless	Fishless	Fishless	Negligible	Negligible	Negligible	Negligible
Stehekin	MLY-02-01	Battalion	E	Yes						X	X			Fish-high density	Fishless	Fishless	Fishless	Moderate	Negligible	Negligible	Negligible
Chilliwack	MC-12-01	Bear[a]	W	Yes		X					*			Fish-high density	fish-low density	Fishless	Fishless	Minor	Negligible	Negligible	Negligible
Skagit	M-08-01	Berdeen[a]	W	Yes		X					X			Fish-high density	Fish –low density	Fishless	Fishless	Minor	Negligible	Negligible	Negligible
Skagit	M-07-01	Berdeen, Lower	W	Yes		X								Fish-high density	Fishless	Fishless	Fishless	Minor	Negligible	Negligible	Negligible
Skagit	M-09-01	Berdeen, Upper	W	Yes		X								Fish-high density	Fishless	Fishless	Fishless	Minor	Negligible	Negligible	Negligible
Baker	M-11-01	Blum (Largest/Middle, No. 3)	W	Yes						X	*			Fish-high density	Fishless	Fishless	Fishless	Moderate	Negligible	Negligible	Negligible
Baker	LS-07-01	Blum (Lower/West, No. 4)	W	Yes	X						X			Fish-high density	Fish-low density	Fishless	Fishless	Moderate	Negligible	Negligible	Negligible
Baker	MC-01-01	Blum (Small/North, No. 2)	W	No										Fishless	Fishless	Fishless	Fishless	Negligible	Negligible	Negligible	Negligible
Baker	MC-02-01	Blum (Vista/Northwest, No. 1)	W	No										Fishless	Fishless	Fishless	Fishless	Negligible	Negligible	Negligible	Negligible
Skagit	DD-04-01	Bouck, Lower	W	Yes		X					X			Fish-high density	Fish-low density	Fish-low density	Fishless	Minor	Negligible	Negligible	Negligible
Skagit	DD-05-01	Bouck, Upper	W	Yes									X	Fish-low density	Fishless	Fishless	Fishless	Negligible	Negligible	Negligible	Negligible
Stehekin	MR-12-01	Bowan	E	Yes							X			Fish-low density	Fishless	Fishless	Fishless	Minor	Negligible	Negligible	Negligible
Stehekin	MM-10-01	Coon	E	Yes		X								Fish-low density	Fish-low density	Fish-low density	Fishless	Negligible	Negligible	Negligible	Negligible
Chilliwack	MC-06-01	Copper[b]	W	Yes			X				*			Fish-low density	Fishless	Fishless	Fishless	Negligible	Negligible	Negligible	Negligible
Stehekin	MR-04-01	Dagger	E	Yes		X								Fish-high density	Fishless	Fishless	Fishless	Negligible	Negligible	Negligible	Negligible
Stehekin	MR-15-01	Dee Dee, Upper	E	Yes						X	*			Fish-high density	Fishless	Fishless	Fishless	Moderate	Negligible	Negligible	Negligible
Stehekin	MR-15-02	Dee Dee/Tamarack, Lower	E	Yes							X			Fish-low density	Fishless	Fishless	Fishless	Minor	Negligible	Negligible	Negligible
Skagit	M-14-01	Despair, Lower	W	Yes										Fishless	Fishless	Fishless	Fishless	Negligible	Negligible	Negligible	Negligible
Skagit	M-13-01	Despair, Upper	W	Yes										Fishless	Fishless	Fishless	Fishless	Negligible	Negligible	Negligible	Negligible
Skagit	LS-01-01	Diobsud No. 1	W	Yes		X								Fish-high density	Fishless	Fishless	Fishless	Minor	Negligible	Negligible	Negligible
Skagit	LS-02-01	Diobsud No. 2, Lower	W	Yes		X					*			Fish-high density	Fishless	Fishless	Fishless	Minor	Negligible	Negligible	Negligible
Skagit	LS-03-01	Diobsud No. 3, Upper	W	Yes							X			Fish-low density	Fishless	Fishless	Fishless	Negligible	Negligible	Negligible	Negligible
Stehekin	CP-01-01	Doubtful	E	Yes		X			X	X				Fish-high density	Fish-low density	Fishless	Fishless	Moderate	Negligible	Negligible	Negligible
Skagit	M-21-01	Doug's Tarn	W	Yes		X								Fish-high density	Fish-low density	Fishless	Fishless	Minor	Negligible	Negligible	Negligible
Ross	MC-14-02	East, Lower	W	Yes										Fishless	Fishless	Fishless	Fishless	Negligible	Negligible	Negligible	Negligible
Ross	MC-14-01	East, Upper	W	Yes										Fishless	Fishless	Fishless	Fishless	Negligible	Negligible	Negligible	Negligible
Ross	MP-02-01	Firn	W	Yes		X					*			Fish-low density	Fish-low density	Fishless	Fishless	Minor	Minor	Negligible	Negligible
Skagit	M-04-01	Green[a]	W	Yes		X			X	X	*			Fish-high density	Fishless	Fishless	Fishless	Minor	Negligible	Negligible	Negligible
Skagit	LS-04-01	Green Bench	W	No										Fishless	Fishless	Fishless	Fishless	Negligible	Negligible	Negligible	Negligible
Chilliwack	MC-08-01	Hanging[a,c]	W	Yes						X				Fish-high density	Fishless	Fishless	Fishless	Minor	Negligible	Negligible	Negligible
Skagit	SB-01-01	Hidden[a]	W	Yes						X	X		X	Fish-low density	Fish-low density	Fishless	Fishless	Minor	Minor	Negligible	Negligible
Skagit	EP-14-01	Hidden Lake Tarn	W	Yes							X			Fish-low density	Fishless	Fishless	Fishless	Negligible	Negligible	Negligible	Negligible
Skagit	M-01-01	Hi-Yu	W	No							X			Fish-low density	Fishless	Fishless	Fishless	Negligible	Negligible	Negligible	Negligible
Ross	HM-02-01	Hozomeen[a]	W	Yes	X									Fish-high density	Fishless	Fishless	Fishless	Moderate	Negligible	Negligible	Negligible
Baker	LS-06-01	Ipsoot	W	No				X						Fish-low density	Fish-low density	Fishless	Fishless	Negligible	Negligible	Negligible	Negligible
Skagit	DD-01-01	Jeanita	W	Yes									X	Fish-low density	Fish-low density	Fishless	Fishless	Negligible	Negligible	Negligible	Negligible

TABLE G-5: ASSESSMENT OF IMPACTS ON NATIVE FISH (CONTINUED)

Drainage Basin	NPS Lake Code	Lake Name	Side of Cascade Crest	Surface Inlet or Outlet	Trout Present, Historically Present, or Scheduled for Stocking in Lake									Management Action Fish Densities					Level of Impact			
					Brook Trout	Westslope Cutthroat	Coastal Cutthroat	Yellowstone Cutthroat	Rainbow/ Cutthroat Hybrids	Rainbow Trout	Mt. Whitney Rainbow	Ross Lake Rainbow	Rainbow Subspecies	Alternative A	Alternative B	Alternative C	Alternative D	Alternative A	Alternative B	Alternative C	Alternative D
Stehekin	MR-05-01	Kettling	E	Yes		X	X		X	X				Fish-high density	Fishless	Fishless	Fishless	Moderate	Negligible	Negligible	Negligible
Chilliwack	MC-07-01	Kwahnesum	W	Yes							X			Fish-low density	Fishless	Fishless	Fishless	Negligible	Negligible	Negligible	Negligible
Stehekin	MR-10-01	McAlester	E	Yes										Fish-high density	Fishless	Fishless	Fishless	Major	Negligible	Negligible	Negligible
Ross	MC-16-02	Middle, Lower	W	Yes										Fishless	Fishless	Fishless	Fishless	Negligible	Negligible	Negligible	Negligible
Ross	MC-16-01	Middle, Upper	W	Yes										Fishless	Fishless	Fishless	Fishless	Negligible	Negligible	Negligible	Negligible
Skagit	M-23-01	Monogram[a]	W	Yes		X					X			Fish-high density	Fish-low density	Fishless	Fishless	Minor	Negligible	Negligible	Negligible
Skagit	M-23-11	Monogram Tarn	W	No		X								Fish-low density	Fishless	Fishless	Fishless	Negligible	Negligible	Negligible	Negligible
Baker	M-05-01	Nert	W	Yes							X			Fish-low density	Fishless	Fishless	Fishless	Negligible	Negligible	Negligible	Negligible
Baker	LS-14-01	Noisy Creek, Upper	W	No										Fishless	Fishless	Fishless	Fishless	Negligible	Negligible	Negligible	Negligible
Ross	PM-01-01	No Name	W	Yes							X			Fish-low density	Fish-low density	Fishless	Fishless	Negligible	Negligible	Negligible	Negligible
Skagit	RD-05-02	Panther Potholes, Lower	W	No			X							Fish-low density	Fishless	Fishless	Fishless	Negligible	Negligible	Negligible	Negligible
Skagit	RD-05-01	Panther Potholes, Upper	W	No										Fishless	Fishless	Fishless	Fishless	Negligible	Negligible	Negligible	Negligible
Skagit	EP-10-01	Pegasus	W	Yes										Fishless	Fishless	Fishless	Fishless	Negligible	Negligible	Negligible	Negligible
Stehekin	MR-09-01	Pond SE of Kettling Lakes	E	No							X			Fish-low density	Fish-low density	Fish-low density	Fishless	Negligible	Negligible	Negligible	Negligible
Skagit	M-24-02	Quill, Lower	W	No						X	X			Fish-low density	Fishless	Fishless	Fishless	Negligible	Negligible	Negligible	Negligible
Skagit	M-24-01	Quill, Upper	W	No						X	X			Fish-low density	Fishless	Fishless	Fishless	Negligible	Negligible	Negligible	Negligible
Stehekin	MR-14-01	Rainbow	E	Yes						X	X			Fish-high density	Fish-low density	Fish-low density	Fishless	Moderate	Negligible	Negligible	Negligible
Stehekin	MR-13-01	Rainbow, Upper (North)	E	Yes										Fishless	Fishless	Fishless	Fishless	Negligible	Negligible	Negligible	Negligible
Stehekin	MR-13-02	Rainbow, Upper (South)	E	Yes							X			Fish-low density	Fishless	Fishless	Fishless	Minor	Negligible	Negligible	Negligible
Stehekin	MM-11-01	Rainbow, Upper (West)	E	Yes							X			Fish-low density	Fishless	Fishless	Fishless	Minor	Negligible	Negligible	Negligible
Chilliwack	MC-11-01	Redoubt	W	Yes										Fishless	Fishless	Fishless	Fishless	Negligible	Negligible	Negligible	Negligible
Chilliwack	MC-21-02	Reveille, Lower	W	Yes										Fishless	Fishless	Fishless	Fishless	Negligible	Negligible	Negligible	Negligible
Chilliwack	MC-21-01	Reveille, Upper	W	Yes										Fishless	Fishless	Fishless	Fishless	Negligible	Negligible	Negligible	Negligible
Ross	HM-03-01	Ridley	W	Yes							X	X		Fish-low density	Fish-low density	Fish-low density	Fishless	Negligible	Negligible	Negligible	Negligible
Skagit	EP-13-01	Sky	W	Yes										Fishless	Fishless	Fishless	Fishless	Negligible	Negligible	Negligible	Negligible
Ross	PM-03-01	Skymo	W	Yes		X					X			Fish-high density	Fish-low density	Fishless	Fishless	Minor	Negligible	Negligible	Negligible
Ross	PM-12-01	Sourdough	W	Yes	X						X			Fish-high density	Fishless	Fishless	Fishless	Moderate	Negligible	Negligible	Negligible
Ross	ML-01-01	Sourpuss	W	Yes										Fishless	Fishless	Fishless	Fishless	Negligible	Negligible	Negligible	Negligible
Stehekin	MR-01-01	Stiletto	E	Yes							X			Fish-low density	Fishless	Fishless	Fishless	Minor	Negligible	Negligible	Negligible
Skagit	EP-09-02	Stout[a]	W	Yes		X	X							Fish-low density	Fish-low density	Fishless	Fishless	Minor	Minor	Negligible	Negligible
Skagit	EP-09-01	Stout, Lower	W	Yes		X					*			Fish-low density	Fish-low density	Fishless	Fishless	Minor	Minor	Negligible	Negligible
Ross	ML-02-01	Sweet Pea	W	Yes							X			Fish-low density	Fish-low density	Fishless	Fishless	Negligible	Negligible	Negligible	Negligible
Skagit	M-06-01	Talus Tarn	W	Yes							X			Fishless	Fishless	Fishless	Fishless	Negligible	Negligible	Negligible	Negligible
Chilliwack	MC-17-03	Tapto, Lower	W	Yes										Fishless	Fishless	Fishless	Fishless	Negligible	Negligible	Negligible	Negligible
Chilliwack	MC-17-02	Tapto, Middle	W	Yes										Fishless	Fishless	Fishless	Fishless	Negligible	Negligible	Negligible	Negligible
Chilliwack	MC-17-01	Tapto, Upper	W	Yes										Fishless	Fishless	Fishless	Fishless	Negligible	Negligible	Negligible	Negligible
Chilliwack	MC-17-04	Tapto, West	W	Yes										Fishless	Fishless	Fishless	Fishless	Negligible	Negligible	Negligible	Negligible
Skagit	M-20-01	Thornton, Lower	W	Yes		X					X			Fish-low density	Fish-low density	Fishless	Fishless	Minor	Minor	Negligible	Negligible
Skagit	M-19-01	Thornton, Middle	W	Yes							X		X	Fish-low density	Fish-low density	Fishless	Fishless	Negligible	Negligible	Negligible	Negligible
Skagit	RD-02-01	Thunder	W	No										Fishless	Fishless	Fishless	Fishless	Negligible	Negligible	Negligible	Negligible

TABLE G-5: ASSESSMENT OF IMPACTS ON NATIVE FISH (CONTINUED)

Drainage Basin	NPS Lake Code	Lake Name	Side of Cascade Crest	Surface Inlet or Outlet	Trout Present, Historically Present, or Scheduled for Stocking in Lake									Management Action Fish Densities					Level of Impact			
					Brook Trout	Westslope Cutthroat	Coastal Cutthroat	Yellowstone Cutthroat	Rainbow/ Cutthroat Hybrids	Rainbow Trout	Mt. Whitney Rainbow	Ross Lake Rainbow	Rainbow Subspecies	Alternative A	Alternative B	Alternative C	Alternative D	Alternative A	Alternative B	Alternative C	Alternative D
Ross	MC-15-01	Tiny	W	Yes										Fishless	Fishless	Fishless	Fishless	Negligible	Negligible	Negligible	Negligible
Ross	ML-03-01	Torment	W	Yes							X			Fish-low density	Fishless	Fishless	Fishless	Negligible	Negligible	Negligible	Negligible
Stehekin	GM-01-01	Trapper[a]	E	Yes		X					*			Fish-low density	Fish-low density	Fishless	Fishless	Negligible	Negligible	Negligible	Negligible
Stehekin	SM-02-01	Triplet, Lower	E	Yes		X					X			Fish-high density	Fish-low density	Fish-low density	Fishless	Negligible	Negligible	Negligible	Negligible
Stehekin	SM-02-02	Triplet, Upper	E	Yes		X								Fish-high density	Fishless	Fishless	Fishless	Negligible	Negligible	Negligible	Negligible
Skagit	M-17-01	Triumph	W	Yes							X			Fish-low density	Fish-low density	Fishless	Fishless	Negligible	Negligible	Negligible	Negligible
Skagit	FP-01-01	Unnamed	W	Yes										Fishless	Fishless	Fishless	Fishless	Negligible	Negligible	Negligible	Negligible
Stehekin	MR-11-01	Unnamed	E	Yes							X			Fish-low density	Fish-low density	Fish-low density	Fishless	Minor	Negligible	Negligible	Negligible
Stehekin	MR-16-01	Unnamed	E	Yes		X					*			Fish-low density	Fish-low density	Fish-low density	Fishless	Minor	Minor	Minor	Negligible
Skagit	ML-04-01	Vulcan	W	Yes										Fishless	Fishless	Fishless	Fishless	Negligible	Negligible	Negligible	Negligible
Skagit	EP-06-01	Wilcox/Lillie, Upper	W	Yes		X			X	X				Fish-high density	Fishless	Fishless	Fishless	Minor	Negligible	Negligible	Negligible
Skagit	EP-05-01	Wilcox/Sandie, Lower	W	Yes		X				X	X			Fish-high density	Fish-low density	Fishless	Fishless	Minor	Minor	Negligible	Negligible
Skagit	MC-27-01	Wild	W	Yes										Fishless	Fishless	Fishless	Fishless	Negligible	Negligible	Negligible	Negligible
Ross	HM-04-01	Willow	W	Yes			X							Fish-low density	Fish-low density	Fish-low density	Fishless	Negligible	Negligible	Negligible	Negligible

Notes:

Trout Present or Scheduled for Stocking in Lake: There are 9 columns for the 9 species, subspecies, or strains of trout reproducing, stocked, or currently scheduled to be stocked in mountain lakes. Management actions for some lakes in alternatives B and C include, or may include after a period of evaluation, stocking nonreproductive trout at low densities to replace or supplement current populations of trout. These lakes are indicated with an asterisk (*) under the column for Mt. Whitney Rainbow, which would be the preferred stock of currently available hatchery trout for stocking.

Level of Impact: Refer to table 31 in the "Environmental Consequences" chapter.

a. The feasibility of complete removal of fish in these lakes would need to be evaluated.

b. In August 2004, a large fish kill was observed in Copper Lake, possibly due to disease. Further surveys are needed to confirm that the lake is fishless.

c. Remove all reproducing fish from Hanging Lake pending agreement with British Columbia.

REFERENCES
CITED IN APPENDIX G

Adams, S.B., C.F. Frissell, and B.E. Reiman
2001 "Geography of invasion in mountain streams: Consequences of headwater lake fish introductions." Ecosystems 4(4):296-307.

Aubry, K.B. and P.A. Hall
1991 "Terrestrial amphibian communities in the southern Washington Cascade Range." *Wildlife and vegetation of unmanaged Douglas-fir forests.* L.F. Ruggiero, K.B. Aubry, A.B. Carey, M.H. Huff eds. U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station, General Technical Report PNW-GTR-285, Portland, OR.

Behnke, R.J.
1992 Native trout of western North America. Monograph 6. American Fisheries Society, Bethesda, MD.

Bilton, D.T., J.R. Freeland, and B. Okamura
2001 "Dispersal in freshwater invertebrates." *Annual review of Ecology and Systematics* 32:159-181.

Bohonak, A.J., and D.G. Jenkins
2003 Ecological and evolutionary significance of dispersal by freshwater invertebrates. Ecol. Letters 6: 783-796.

Brett, M.T., K. Wiackowski, F.S. Lubnow, A. Mueller-Solger, J.J. Elser, and C.R. Goldman
1994 "Species-dependent effects of zooplankton on planktonic ecosystem processes in Castle Lake, California." *Ecology* 76:2243-2254.

Chess, D.W., F. Gibson, A.T. Scholz, and R.J. White
1993 "The introduction of lahontan cutthroat trout into a previously fishless lake: feeding habits and effects upon the zooplankton and benthic community." *Journal of Freshwater Ecology* 8:215-225.

Donald, D.B, R.D. Vinebrooke, R.S. Anderson, J. Syrgiannis, and M.D. Graham
2001 "Recovery of zooplankton assemblages in mountain lakes from the effects of introduced sport fish." *Canadian Journal of Fisheries and Aquatic Sciences* 58:1822-1830.

Donald, D.B., R.S. Anderson, and D.W. Mayhood
1994 "Coexistence of fish and large *Hesperodiaptomus* species (Crustacea: Calanoida) in subalpine and alpine lakes." *Canadian Journal of Zoology* 72:259-261.

Drake, D.C. and R.J. Naiman
2000 "An evaluation of restoration efforts in fishless lakes stocked with exotic trout." *Conservation Biology* 14(6):1807-1820.

Dvornich, K.M., K.R. McAllister, and K.B. Aubry
1997 Amphibians and reptiles of Washington State: Location data and predicted distributions, Volume 2 in Washington State Gap Analysis - Final Report, (K.M. Cassidy, C.E. Grue, M.R. Smith and K.M. Dvornich, eds.), Washington Cooperative Fish and Wildlife Research Unit, University of Washington, Seattle. 146 pp.

Elser, J.J., C. Luecke, M.T. Brett, and C.R. Goldman
1995 "Effects of food web compensation after manipulation of rainbow trout in an oligotrophic lake." *Ecology* 76:52-69.

Hoffman, R.L. and G.L. Larson
1999 "*Ambystoma gracile* (northwestern salamander). Predation and Cannibalism." Natural History notes in *Herpetological Review* 30(3):159.

Hoffman, R.L., G.L. Larson, and B.J. Brokes
2003 "Habitat segregation of *Ambystoma gracile* and *Ambystoma macrodactylum* in mountain ponds and lakes, Mount Rainier National Park, Washington, USA." *Journal of Herpetology* 37(1):24-34.

Knapp R.A.
1996 "Non-Native Trout in Natural Lakes of the Sierra Nevada: An Analysis of Their Distribution and Impacts on Native Aquatic Biota". Chapter 8 in, *Sierra Nevada Ecosystem Project: Final Report to Congress, Vol. II, Assessments and scientific basis for management options.* University of California, Davis, Centers for Water and Wildland Resources.

Leavitt, P.R., D.E. Schindler, A.J. Paul, A.K. Hardie, and D.W. Schindler
1994 "Fossil pigment records of phytoplankton in trout-stocked alpine lakes." *Canadian Journal of Fisheries and Aquatic Sciences* 51:2411-2423.

Liss, W.J., G.L. Larson, E.K. Deimling, R. Gresswell, R. Hoffman, M. Kiss, G. Lomnicky, C.D. McIntire, R. Truitt, and T. Tyler
1995 Ecological Effects of Stocked Trout in Naturally Fishless High Mountain Lakes: North Cascades National Park Service Complex, WA, USA. Technical Report NPS/PNROSU/NRTR-95-03. USDI National Park Service, Pacific Northwest Region, Science and Technology. Seattle, WA. 285 pp.

Liss, W.J., G.L. Larson, and R.L. Hoffman, eds.
2002 *Ecological Impact of Introduced Trout on Native Aquatic Communities in Mountain Lakes: Phase III Final Report.* Prepared for the USDI National Park Service, Pacific Northwest Region, North Cascades National Park Service Complex by USGS Forest and Rangeland Ecosystem Science Center. Corvallis, OR. 102 pp.

Liss, W.J., G.L. Larson, T.J. Tyler, L. Ganio, R. Hoffman, E.A. Deimling, G. Lomnicky, C.D. McIntire, and R. Truitt
1999 Ecological Effects of Stocked Trout in Naturally Fishless High Mountain Lakes: North Cascades National Park Service Complex, WA, USA: Phase II. Technical Report NPS/CCSSOOSU/NRTR-98/01. USDI National Park Service, Pacific Northwest Region, Science and Technology. Seattle, WA. 133 pp.

Luecke, C.
1990 "Changes in abundance and distribution of benthic macroinvertebrates after introduction of cutthroat trout into a previously fishless lake." *Transactions of the American Fisheries Society* 119:1010-1021.

Marnell, L.F.
1997 "Herpetofauna of Glacier National Park." *Northwestern Naturalist* 78:17-33.

Parker, B.R., D.W. Schindler, D.B. Donald, and R.S. Anderson
2001 "The effects of stocking and removal of a nonnative salmonid on the plankton of an alpine lake." *Ecosystems* 2001(4):334-345.

Parker, B.R., F.M. Wilhelm, and D.W. Schindler
1996 "Recovery of *Hesperodiaptomus arcticus* populations from diapausing eggs following elimination by stocked salmonids." *Canadian Journal of Zoology* 74:1292-1297.

Petranka, J.W.
1998 *Salamanders of the United States and Canada.* Smithsonian Institution Press, Washington, DC.

Semlitsch, R.D.
1983 "Burrowing ability and behavior of salamanders of the genus *Ambystoma*." *Canadian Journal of Zoology* 61: 616-620.

Verschuren, D., and L.F. Marnell
1997 Fossil zooplankton and the historical status of Westslope cutthroat trout in a headwater lake of Glacier National Park. Trans. Amer. Fish. Soc. 126(1): 21-34.

Walters, C.J. and R.E. Vincent
1973 "Potential productivity of an alpine lake as indicated by removal and reintroduction of fish." *Transactions of the American Fisheries Society* 102:675-697.