5.5 Effects of Program/Alternative Implementation on Biologic Resources

5.5.1 Aquatic Resources

This section summarizes the impacts to aquatic biological resources due to implementing either the Proposed Program or any of the Alternatives. The aquatic species of concern and their habitat requirements are described in Section 4.5.1.

5.5.1.1 Significance Criteria

Based on the CEQA Guidelines, the Program and Alternatives could have a significant adverse impact to aquatic resources if they would:

a) Have a substantial adverse effect, either directly or through habitat modifications, on any species identified as a candidate, sensitive, or special status species in local or regional plans, policies, or regulations, or by the California Department of Fish and Game or U.S. Fish and Wildlife Service;

b) Have a substantial adverse effect on any riparian habitat or other sensitive natural community identified in local or regional plans, policies, and regulations or by the California Department of Fish and Game or US Fish and Wildlife Service;

c) Interfere with the movement of any resident or migratory fish or wildlife species or with established resident or migratory wildlife corridors, or impede the use of wildlife nursery sites;

d) Conflict with any City or County adopted General Plan policies or ordinances protecting biological resources, such as water quality regulations applicable to a particular stream system;

e) Conflict with the provisions of an adopted Habitat Conservation Plan, Natural Conservation Community Plan, or other approved local, regional, or state habitat conservation plan;

f) Cause a reduction in the quality of water by an increase in sediment, temperature, bacteria, or chemical contamination;

g) Modify existing vegetation so as to reduce future critical habitat development, including retention of woody species that will eventually comprise habitat elements;

h) Adversely or positively affect the input of large wood components into a stream system;

i) Reduce the quantity of water available to species of concern, by water withdrawal for project-related fire or dust control purposes;

j) Cause a decrease in the quantity or quality of botanical or animal food necessary to maintain a healthy and diverse biological component of a water body.

5.5.1.2 Determination Threshold

The following thresholds were used to determine whether a significant adverse impact to aquatic biological resources would result from implementation of vegetation treatments under the Program or any of the Alternatives:

The Proposed Program (or Alternative) would be considered to have a significant adverse impact on aquatic biological resources if it:

a) Violates any state or federal wildlife or plant protection law or

b) Contributes directly (through immediate mortality) or indirectly (through reduced productivity, survivorship, genetic diversity, or environmental carrying capacity) to a substantial, long-term reduction in the viability of any native species or subspecies at the state level.

5.5.1.3 Data and Assumptions

The annual acreage proposed for treatment within the VTP ranges from 47,000 acres in Alternative 1 to 216,910 acres for the Proposed Program and Alternatives 2 and 3, which is between 0.1% and 0.5% of the 37-million acre program area. This means that there will be very few projects spread over many acres, and the probability of numerous projects occurring in a single watershed is very low, even over 10 years. The treatment types, proportions by bioregion and percent of watersheds in varying disturbance classes are listed in Chapter 5.0 for the Program and Alternatives.

Assuming that the percent area treated in a watershed is proportional to the percent of stream miles directly affected in a watershed allows use of Table 5.0.7 to roughly estimate the proportion of stream channels directly affected from implementing the Program and Alternatives 2 and 3. On an annual basis, 88% of watersheds in the state receive no treatment and 99% of watersheds have less than 10% of their area (proportional to stream length) treated (see Chapter 5.0). On the other hand, Alternatives 1 and 4 treat even less area (Table 5.0.8).

The aquatic species most likely to be affected by VTP projects include 34 species or distinct populations of fish and 12 species or distinct populations of amphibians listed as Endangered or Threatened at the state or federal level (CA DFG, 2012) (Appendix B). Most species have evolved with disturbances of varying types and magnitudes, including fire, and are able to recover from them (Thode et al., 2006). All of the listed aquatic species are sensitive to changes in water quality, though their individual and population-level resilience differs between species. Temperature, sediment and peak flows are the primary water quality parameters affecting aquatic species that could be altered by VTP treatments. In addition to these changes in water quality characteristics, physical changes to riparian vegetation and in-stream habitat may also affect aquatic communities (Thode et al., 2006). The underlying assumption in the following analysis is that if changes to water quality, riparian habitat and in-stream physical habitat are not significant then adverse impacts to aquatic species are unlikely.

In order to analyze the potential effects of implementing the Program or Alternatives it was necessary to consider the types of treatments proposed, the extent of those treatments and the Landscape Constraints (LCs) and Minimum Management Requirements (MMRs) included in the VTP that are designed to moderate potential impacts to water quality (Section 2.2 and 2.3). See LC 1-5 and MMR 1, 2, 5, 12, 15 and 17.

In Addition to the aforementioned Landscape Constraints and Minimum Management Requirements, Mitigations were developed in Section 5.7 (*Water Quality/Quantity*) that limit the area treated in each watershed, require protection for Class III streams, and specify BMPs for prescribed herbivory projects that protect watercourses from direct and indirect impacts of animal use.

Direct impacts to aquatic species that occur within saline and fresh emergent wetlands, lacustrine, riverine, and estuarine habitat types are unlikely because these habitat types are excluded from treatment (Table 2.1, Chapter 2). Riparian and upland vegetation types adjacent to these excluded vegetation types may be treated and indirect effects are possible. VTP treatments in wet meadows and/or grasslands that contain vernal pools are permitted under special circumstances- see Landscape Constraint 3.

5.5.1.4 Direct Effects Common to all Bioregions From Implementing the Program/ Alternatives

VTP treatments have the potential to affect aquatic species via impacts to water quality/quantity and modification of aquatic habitats directly and indirectly. Section 4.5 includes a discussion of the primary habitat elements and requirements of aquatic species, including: riparian function, headwater stream ecosystems, headwater habitat relationships, sources and recruitment methods for large woody debris (LWD), detritus (e.g., leaf litter) production, streambank stability, sediment control and transport, stream shading, and microclimate.

VTP treatments may have adverse effects on any of these elements at a local level; however the vast majority of VTP treatments are not expected to result in significant adverse impacts to these elements and, by extension, the species that rely on them. Section 5.7 (*Water Quality/Quantity*) concluded that no significant adverse impacts would occur from VTP projects causing elevated stream temperatures, increased sediment loads, fecal coliform contamination, or elevated peak flows. Table 5.5.1.1 summarizes the information from the balance of this subchapter on the effects of implementing the Program across the state by bioregion in terms of effects on aquatic resources.

Table 5.5.1.1
Summary of Effects 1/ on Aquatic Resources from Implementing the Proposed Program

Bioregion	Prescribed Fire	Mechanical	Hand	Herbivory
Klamath Northcoast	**NA**	**NA**	**NA**	**NA**
Modoc	**NA**	**NA**	**NA**	**NA**
Sacramento Valley	**NA**	**NA**	**NA**	**NA**
Sierra	**NA**	**NA**	**NA**	**NA**
Bay Area	**NA**	**NA**	**NA**	**NA**
San Joaquin	**NA**	**NA**	**NA**	**NA**
Central Coast	**NA**	**NA**	**NA**	**NA**
Mojave	**NA**	**NA**	**NA**	**NA**
South Coast	**NA**	**NA**	**NA**	**NA**
Colorado Desert	**NA**	**NA**	**NA**	**NA**

1/ Key to effects; adverse effects are those effects which degrade the diversity, structure, size, integrity, abundance or number of; or are outside the natural range of variability, for the resource at issue. Beneficial effects are those effects that improve the diversity, structure, size, integrity, abundance or number of; or are within the natural range of variability, for the resource at issue. SA/SB – significant adverse effects are those effects that are substantial, highly noticeable, at the watershed scale; and often irreversible. MA/MB - moderately adverse or beneficial effects - those effects that can be detected beyond the affected area, but are transitory and usually reversible. NA/NB - negligible adverse or beneficial effects - those effects that are imperceptible or undetectable.

Herbicide Effects

Effects to aquatic resources from herbicide use are discussed in Section 5.17.

Prescribed Fire Effects

The use of prescribed fire within riparian zones is permitted within the Program and Alternatives 2 and 4. Burning within the WLPZ of Class I and II watercourses would not normally be allowed in Alternative 3. For the Program and Alternatives 2 and 4, fire severity in riparian zones along Class I and II watercourses must be kept low enough not to disturb plants that provide shade to the stream channel (Section 2.2 - LC 1, 2). According to Rinne and Jacoby (2005) direct mortality of fish due to burning has only been documented in high severity fires that burned through small streams with high fuel loading. Similarly, Pilliod et al., (2003) noted that direct mortality of amphibians due to natural fire is rare due to timing and/or their ability to exploit refugia from fire. High severity fires resulting in mortality of aquatic species are very unlikely to occur under prescribed burning conditions. In fact, use of prescribed fire or other vegetation treatment techniques is intended to reduce the occurrence of high severity wildfires (Section 5.2).

In one of the few studies of prescribed burning in riparian systems in the Western U.S., Beche et al., (2005) found that low to moderate intensity fire ignited in the riparian zone had "minimal effects on a small stream and its riparian zone during the first year post-fire." Impacts from fire to riparian vegetation, LWD, fine sediment, water chemistry, periphyton (see Glossary) and macroinvertebrates were considered. The study was conducted in the Western Sierra Nevada Mountain Range on the Blodgett Forest Research Station. There were no significant changes in in-stream macroinvertebrate communities after the prescribed fire, which is important because macroinvertebrates are often used as an index of biological health for other aquatic species (Beche et al., 2005). In a more recent, but still similar study conducted on the Payette National Forest in Idaho, Arkle and Pilliod (2010) concluded, "Despite steep topography, erosion-prone soils, and sampling directly within the burned area, we found no immediate (1–3 month) or delayed (3 years) effects of the prescribed fire on the biotic and abiotic characteristics of the study stream."

It appears highly unlikely that prescribed fires used in VTP treatments in riparian areas and wet areas (see Glossary) will burn hot enough to directly harm aquatic species that live within the water column.

Mechanical Treatment Effects

Heavy equipment is excluded from watercourses and riparian buffers under the Proposed Program and Alternatives 2, 3 and 4. Servicing heavy equipment near streams, which could potentially introduce toxic substances, is also disallowed. Therefore, direct effects to aquatic species from mechanical treatments are unlikely.

Manual and Herbivory Treatment Effects

It is unlikely that manual treatments or prescribed herbivory treatments are *likely* to directly impact aquatic organisms. Direct contamination of the water column due to fecal runoff from prescribed herbivory treatments is unlikely to occur due to the requirement that Program participants follow Mitigation Measure 5.7-3.

5.5.1.5 Bioregion-Specific Direct Effects of Implementing the Program/Alternatives

The potential direct adverse impacts to aquatic resources are not likely to vary by bioregion for the same reasons as described above for the entire state, i.e. LC, MMR's, and low intensity of prescribed burns.

5.5.1.6 Indirect Effects of Implementing the Program/Alternatives

Most VTP treatments are essentially less intense versions of wildfire and timber harvest, and the potential types of indirect impacts are considered to be similar. However, due to lack of monitoring of fuel management treatments and little focus by researchers on this topic, the indirect impacts of these treatments on aquatic ecosystems is largely unknown (Thode et al., 2006). Thus, much of the analysis in this chapter is via inference from effects of wildfire or timber harvest in comparable environmental settings.

In reference to wildfire Rinne and Jacoby (2005) listed the primary indirect impacts to fish (including listed salmonids) in watercourses as: changes in stream temperature due to understory and overstory plant removal, ash-laden slurry flows, increases in flood peak flows, and sedimentation due to increased landscape erosion. Shaffer and Laudenslayer (2006) noted that significant impacts to salmonids after fires are "generally linked to changes in watershed hydrology after a large proportion of a drainage is burned and little vegetation or woody debris remains on the landscape." There has been less research regarding effects from fire on lakes or small ponds, but the available information indicates minimal impacts to fish or amphibians following wildfire (Shaffer and Laudenslayer, 2006). Murphy (1995) listed the following indirect mechanisms by which timber harvest has impacted anadromous salmonids: decreased shade, decreased supply of LWD, addition of slash to streams, streambank erosion, altered streamflow, increased erosion, increased nutrients, barriers to migration, and inputs of fine organic and inorganic sediment. BLM (2005) described potential impacts to fish from fire as follows:

> *"The short-term effects of fire on fish populations are a function of both the degree and duration of fire-caused changes in water quality and quantity, and the proportion of each inhabited stream network affected by burning. An isolated or fragmented fish population would recover far more slowly from any adverse effects of burning than would a population inhabiting a widespread and well-connected stream system."*

The water quality/quantity impacts described (above) for wildfires and timber harvest may occur sporadically at the local level due to VTP treatments. However, analysis in Section 5.7 indicates that the potential impacts are not likely to be significant at the state or bioregional scale due to the smaller scale (fewer treatments over time and space) and lower intensity of VTP treatments compared to wildfires and timber harvest. In most cases, VTP treatments are relatively small in area (average treatment size is 260 acres) and do not affect a large proportion of any stream network - unlike some wildfires or extensive timber harvest. Table 5.0.7 indicates that under the Proposed Program 85% of watersheds in the state would have less than 10% of their area treated after 10 years and Mitigation Measure 5.7-1 limits the percent of a watershed that can be treated to 2% ERA before site specific analyses of potential water quality impacts are required (Section 5.7). The relative isolation of specific populations of fish or other aquatic species would have to be considered at the

site-specific level, and specific protection measures devised, if significant impacts to water quality or habitat were expected.

The non-water quality/quantity related impacts potentially caused by timber harvest and wildfire (above) include input of slash to streams, decreased supply of LWD, and creation of migration barriers. Because of the stream protection, LCs, and MMRs included in the VTP, there should be no input of slash into streams from treatments. Slash created during VTP treatments is typically left in place, chipped, or piled and burned- not placed in streams. Road building and construction/reconstruction of stream crossings are not funded activities within the VTP, so crossings will not be impacted positively or negatively, and unplanned installation of fish migration barriers in stream channels (e.g., from poorly installed culverts) should not occur under the Program or Alternatives.

Supplies of LWD from streamside recruitment zones will not be significantly impacted by VTP treatments because overstory trees are neither subject to removal nor to high mortality rates from prescribed fire. LWD within stream channels will not be burned up during prescribed fires or removed during mechanical treatments. Beche (2005) noted that only 4.4% of trees ranging in size from 11.7 to 40.4 cm DBH were killed due to prescribed burning in riparian forests and the prescribed burn did not change the amount or movement of LWD in the channel. Minor amounts of overstory tree mortality due to prescribed burning could be viewed as a benefit to aquatic species, because it provides a moderately accelerated recruitment mechanism for LWD.

Changes to physical characteristics of streams, such as width, depth and bank stability are also unlikely to be affected by VTP treatments. Direct impacts to bank stability related to overgrazing from prescribed herbivory treatments or use of heavy machinery that could break down banks and/or reduce soil root strength will be avoided through the use of streamside buffers and BMPs for herbivory (Section 5.7). Furthermore, the type of prescribed herbivory treatments described in the VTP are concentrated on browsing to maintain fuel breaks in upland areas, rather than grazing herbaceous material in riparian areas and wet areas, i.e., goats on hillsides not cows in streams.

Large inputs of sediment and elevated peak flows are often responsible for changes in channel configuration such as increased width/depth ratios, filling of pools with fine sediment, scouring of LWD from channels, and increased bank erosion. However, neither of these is expected from VTP treatments (Section 5.7). Arkle and Pilliod (2010) reported no significant changes to in-stream habitat variables (including sediment composition, pool filing with fine sediments, habitat types, etc.) due to prescribed fire immediately or 3 years after treatment.

Beche (2005) observed that percent bare ground increased from 3.5% (+/- 8.2%) pre-fire to 34.2% (+/- 21.8%) post-fire due to a prescribed fire in a riparian zone. However, fine sediment in pools adjacent to the burned riparian areas and wet areas as measured by V* (the average residual pool volume of fine sediment), did not significantly change post-fire. The author also measured sediment composition (percent finer than 11.3 mm) as well as longitudinal and cross section surveys of channel morphology. None of the sediment or channel morphology metrics indicated a change due to the prescribed fire in the riparian zone. The author attributed this to the fact that the fire only removed surface vegetation from 70% of the total area burned, which was only 14% (18 ha) of the total watershed area (129 ha). The prescribed burn retained a considerable amount of litter and

surface vegetation on site, which would reduce surface erosion. A wildfire would likely affect a larger percentage of a given watershed, and leave relatively less litter and surface vegetation in place.

Mechanical and prescribed fire treatments in crown fire regime vegetation types tend to result in low vegetative cover and high extent of bare ground after treatment, both of which can lead to increased sediment delivery rates and higher peak flows (Table 5.0.3). Also, the lack of an overstory tree canopy in the riparian zone in crown fire regime vegetation types means that reductions in riparian vegetation density due to treatment have a higher likelihood of altering the riparian microclimate, i.e. decreased humidity and increased air temperatures. However, changes in riparian microclimate conditions are not likely to change water column temperatures because the overwhelming determinant of water temperature is direct solar exposure, not ambient air temperature (Beschta et al., 1987). For further discussion of impacts of riparian vegetation changes on amphibians that inhabit riparian areas and wet areas see Section 5.5.2, *Wildlife*. Mitigation Measure 5.7-1 will limit impacts to water quality in crown fire regime vegetation types because the more intense effects of treatments in this vegetation type will result in the disturbance threshold of the watershed (2% ERA) being reached with fewer acres treated than in surface fire regime vegetation types. In order to exceed the 2% ERA threshold site specific analyses must be conducted that could account for unique conditions at the project level.

Proposed Program Effects and Goals

Research indicates that high intensity wildfire has the potential to indirectly harm aquatic life through impacts to water quality, peak flows and stream channel morphology (see discussion above). The Proposed Program would help to reduce the detrimental environmental effects of wildfire to watersheds and thus to aquatic lifeforms (Goal 6) by helping reduce fire severity across the landscape, particularly in watersheds where 35% or more of the watershed is treated which helps to reduce wildfire extent and severity.

Alternatives Effects and Goals

Implementation of Alternative 2 would meet Goal 6 at approximately the same rate and to the same extent as the Proposed Program. Alternative 3 would initially meet Goal 5 at approximately the same rate and to the same extent as the Proposed Program. However over the long term, Alternative 3 only treats about 13.7 million acres with prescribed fire and a mechanical treatment which is only about 40% of the acres that would be treated under the Program, thus, this Alternative over the long term would not meet Goal 6 as effectively as the Proposed Program. Alternative 1 would not meet Goal 6 at the same rate or to the same extent as the Proposed Program since it would treat so few acres and substantially more acres would likely burn at high intensity. Alternative 4, like Alternative 1 would not meet Goal 6 at the same rate or to the same extent as the Proposed Program since it would treat so few acres and substantially more acres would likely burn at high intensity.

5.5.1.7 Bioregion-Specific Indirect Effects of Implementing the Program/Alternatives

The potential indirect adverse impacts to aquatic resources are higher in bioregions where impacts to water quality are more likely. Section 5.7 indicated that the Sacramento Valley, San Joaquin, South Coast, Colorado Desert and, to a lesser extent, Central Coast bioregions were at greatest risk of water quality impacts (Table 5.7.4 and 5.7.5). The presence of small planning

watersheds (<5,000 acres) and high proportion of crown fire regime vegetation types in these bioregions made them more vulnerable to water quality impacts.

The results from the bioregional analysis of potential impacts to water quality from VTP projects (noted above) indicates little overlap with bioregions designated by the State as the "high priority landscape[1]" for water quality (CAL FIRE, 2010). The high priority landscape includes the Northcoast/Klamath bioregion, and selected watersheds in the Sierra and South Coast bioregions (CAL FIRE, 2010). Thus, the additional potential risk attributable to VTP projects will not occur in watersheds already deemed by the state to be high quality and at elevated risk of impairment to water quality. Similarly, the CAL FIRE (2010) assessment identified high and medium priority landscapes for wildlife habitat (including aquatic species) at risk of damage from wildfire; most high and medium priority landscapes occur in the Northcoast/Klamath, Sierra and Modoc bioregions. Again, the bioregions at elevated risk of water quality impairment due to VTP projects do not occur within the high and medium priority landscapes for wildlife (CAL FIRE, 2010).

5.5.1.8 Determination of Significance

It is possible that implementation of the Program could have adverse effects to aquatic resources, particularly where multiple VTP projects occur in a single watershed (Section 5.7). However, with the application of the standard practices described above (MMRs and LCs), as well as application of the Mitigation Measures described in Section 5.7, neither the proposed program nor any of the Alternatives are likely to cross the following thresholds of significance: a) violate any state or federal wildlife protection law regarding aquatic species, or b) contribute directly (through immediate mortality) or indirectly (through reduced productivity, survivorship, genetic diversity, or environmental carrying capacity) to a substantial, long-term reduction in the viability of any native aquatic species or subspecies at the state level. Therefore, after mitigations, it is unlikely that the Program or Alternatives are likely to cause significant adverse impacts to aquatic resources.

5.5.1.9 Similar Effects Described Elsewhere

Other species that inhabit the riparian zone or make use of aquatic ecosystems are included in Wildlife (Section 5.5.2). Descriptions of potential impacts to water quality and peak flows, along with mitigations, are described in Water Quality and Quantity (Section 5.7).

[1] According to CAL FIRE (2010), "The high priority landscape (HPL) identifies watersheds that support a broad range of beneficial uses and coincide with high threats to water quality. The analysis highlights areas where stewardship projects have the highest potential to protect and enhance water quality."