Appendix G

Conservation and Mitigation Best Management Practices (BMPs) and Guidelines for Avoiding and Reducing Potentially Adverse Impacts on Fishery Resources and Aquatic Habitat within Napa County

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Changes in land use activities that may occur under the General Plan update have the potential to significantly impact the quality and availability of aquatic habitat within Napa County. Surface waters within the county provide habitat for a diverse assemblage of resident and migratory fish species and other aquatic organisms. Several of the species, such as anadromous steelhead and Coho salmon, have been listed for protection under the California and/or federal Endangered Species Acts. Surface waters within the county also provide habitat for resident rainbow trout, largemouth bass, and other fish species that support recreational angling. To reduce the potential risk of significant adverse impacts to these aquatic resources Napa County, the North Coast Regional Water Quality Control Board, State Water Resources Control Board, California Department of Fish and Game, National Marine Fisheries Service, US Fish and Wildlife Service, US Environmental Protection Agency, and other state and federal resource and regulatory agencies have identified a number of best management practices (BMPs) for application within a watershed. The application of BMPs and other guidance provided by these agencies as part of routine project planning and ongoing land management under the direction of the General Plan update will also provide the fundamental basis for facilitating expedited permitting and environmental review in the future. Briefly outlined below are of the desired habitat conditions for sediment related indices within freshwater rivers, streams, lakes, and other surface waters as well as a brief discussion of the various BMPs that can be applied to achieving these desired conditions and avoiding adverse impacts to fishery habitat within the county.

Desired Habitat Conditions

The North Coast Regional Water Quality Control Board has identified desired habitat conditions for salmonids that provide general criteria for evaluating surface water conditions and the application of BMPs to reduce and avoid significant adverse impacts to aquatic habitats (North Coast Regional Water Quality Control Board 2006). The primary focus of these desired conditions relates to the impacts of excessive sediment deposition and erosion on habitat conditions as a result of land use changes. Sediment erosion and depositions may adversely impact habitat quality and availability for salmonid migration, spawning, reproduction, and juvenile rearing for species such as Coho salmon, Chinook salmon, steelhead, rainbow trout, and other freshwater species. In general the desired conditions, as outlined in the narrative objectives identified by the Regional Board include:

Suspended material: water shall not contain suspended material in concentrations that cause or adversely affect beneficial uses.

Settleable material: water shall not contain substances in concentrations that result in deposition of material that causes nuisance or adversely affect beneficial uses.

Sediment: the suspended sediment load and suspended sediment discharge rate of surface water shall not be altered in such a manner as to cause nuisance or adversely affect beneficial uses.

Turbidity: turbidity shall not be increased by more than 20% above naturally occurring background levels. Allowable zones of pollution within which higher percentages can be tolerated may be defined for specific discharges upon issuance of discharge permits or discharge waiver.

In addition to these general narrative objectives the Regional Board also has identify specific criteria for desirable conditions within surface waters as shown in Tables 1, 2, and 3. The application BMPs that protect and maintain desirable habitat conditions within surface waters of Napa County is intended to reduce and avoid impacts to a less than significant level. In addition to the desired conditions identified by the Regional Board, the California Department of Fish and Game, National Marine Fisheries Service, and State Water Resources Control Board have identified general guidelines for evaluating instream flows to support fishery habitat, guidelines for the design and operation of positive barrier fish screens, and other actions intended to protect fishery resources and their habitat. The following sections briefly describe BMPs that are applicable to reducing potentially significant impacts to fish and their habitat of projects within Napa County under the General Plan update to less than significant levels.

Best Management Practices for Reducing and Avoiding Impacts to Aquatic Habitats

The US Environmental Protection Agency (2004) has summarized the application of BMPs for reducing and avoiding potentially significant impacts to aquatic habitats. The general framework for identifying appropriate BMPs during the planning phase of a specific project, as well as implementation and long-term operations and maintenance of a project or site include:

- Reproduce, as nearly as possible, the natural hydrologic conditions in the stream prior to development.

- Remove, to the maximum extent practical, most urban and/or agricultural pollutants from surface water runoff to assist in maintaining desired water quality conditions and protect fish habitat.

- BMPs should be feasible and appropriate for a given site and project based on site-specific constraints opportunities.

- BMPs selected for implementation as part of a specific project should be reasonably cost-effective in comparison with other BMPs.

- BMPs should include long-term operations, maintenance, and monitoring is appropriate.

- Implementation of BMPs should avoid and reduce direct and indirect environmental impacts to the maximum extent practicable.

It should be recognized that several alternative BMPs may be available for addressing a site-specific issue and that several BMPs may be used in combination to achieve the desired objective. BMPs may include both source control as well as treatment alternatives depending on the specific opportunities and constraints of a particular site and project design. A brief description of a variety of BMPs are presented below to provide an initial starting point for the formulation and design of projects to be implemented within the framework provided by the General Plan update that will contribute to achieving the objective of reducing impacts to less than significant levels. Additional information regarding various BMPs can be found on the World Wide Web. Useful sites that provide information on BMPs include, but are not limited to, the following:

Desired Salmonid freshwater habitat conditions for sediment related indices:
http://www.swrcb.ca.gov/rwqcb1/programs/basinplan/110504/060728_Desired_Conditions_Report.pdf.

The use of best management practices in urban watersheds:
http://www.epa.gov/nrmrl/pubs/600r04184/600r04184.pdf

Municipal best management practices for controlling trash and debris in stormwater and urban runoff:
http://www.plasticdebris.org/Trash_BMPs_for_Munis.pdf

Erosion and sediment control best management practices:
http://www.cicacenter.org/bmps.html

Napa County Policies and Codes:
http://www.co.napa.ca.us/code2000data/TITLE18/index.html

National Marine Fisheries Service
http://www.nmfs.noaa.gov/

California Department of Fish and Game
http://www.dfg.ca.gov/fishing/

Public Education

Public education within both an urban setting and as part of agricultural operations within Napa County (e.g., fish friendly farming and vineyard development and operations) has been identified as an effective method for source control by reducing pollutant loading to a watershed, improving sensitivity regarding erosion control, and promoting involvement in stewardship within a watershed. Public education provides the opportunity to understand the problems and solutions within a watershed, promote community participation in watershed protection, and reduce the costs and demands of environmental protection. Public education can take a variety of forms including, but not limited to, public workshops, public announcements, brochures and materials describing BMPs and their application, signs noting that storm water drains discharge to local creeks and rivers, demonstration projects, and a variety of other approaches. As part of the General Plan update public education and outreach identifying BMPs that protect aquatic habitats and

reduce potential impacts to less than significant levels should be included as one element of an overall mitigation strategy.

Project Planning and Management

A key element in designing and implementing a successful project within the framework provided by the General Plan update relies on integration of BMPs into the initial project design that are targeted on reducing and avoiding specific environmental impacts. By integrating BMPs directly into project planning in the early stages of the project design potentially significant environmental impacts can be avoided or reduced to less than significant levels. Potential BMPs should be identified during the initial site-planning phase in project development and should be compatible with site constraints, opportunities, and compatibility with other land uses, BMPs, and management actions being implemented within a watershed. Opportunities for integrating BMPs into the initial project design include:

- Integrating BMPs into site designed and initial project planning
- Vegetation control and revegetation
- Sediment and erosion control
- Construction techniques
- Seasonal periods of construction activity
- Incorporation of buffer zones and project setbacks
- Evaluation of alternatives to identify the least environmentally damaging project features

- Incorporating a long-term maintenance and monitoring into the initial project design

Channel and Creek Maintenance

The successful application of BMPs requires periodic maintenance activities in order to enhance and maintain performance in achieving the objectives of reducing potential impacts to less than significant levels. BMP maintenance activities within the channel or creek may include sediment removal, vegetation management, periodic maintenance and repair of outlet structures, periodic replacement of filter material, regular inspections of the key features of a BMP to determine its proper functioning and maintenance or repair requirements. Elements of BMP maintenance within a channel or creek may include, but not be limited to, the following:

- Identifying and cleanup areas where debris accumulated

- Establish and maintain buffer zones along creeks

- Modified a storm channels to improve channel hydraulics, reduce channel erosion, increased pollutant removal, and enhance the aesthetics and habitat values within a watershed.

Illegal Dumping Controls

Illegal dumping of material, including pesticides and herbicides as well as other materials associated with land use changes have the potential to significantly impact fish and their aquatic habitats. Elements of BMPs for controlling illegal dumping of potentially toxic contaminants include ordinances, public education programs, and enforcement measures

designed to reduce dumping of waste products that potentially enter surface waters. Increasing public awareness is a key element in the successful implementation of this BMP.

Storm Drain Stenciling

Storm drains frequently collect surface water run off from urban and agricultural areas that may contain contaminants and other constituents that are subsequently discharged into rivers and other surface waters. Storm drain stenciling is intended to educate the public and reduce dumping material into storm drains. Storm drain stenciling provides a highly visible source of information as part of a public outreach and educational program that may contribute to pollutant reductions within a watershed.

Storm Water Ponds

Incorporation of storm water ponds and collection/detention areas as part of initial project design contributes to reductions in sediment deposition within surface waters and limits downstream scour and a loss of aquatic habitat by reducing the peak flow rate and energy of storm water discharges into receiving waters. Storm water ponds can be designed to provide additional wetland benefits, serve to reduce sediment and pollutant loading to a surface water body, and reduce the potential impacts of land-use changes on aquatic habitats. Key elements in the successful application of storm water ponds as a BMP include integration of BMP features into the initial project design and planning phase, inclusion of long-term maintenance and sediment removal, and design and construction of the features based upon hydrologic conditions occurring at a particular site.

Constructed Wetlands

A variation on storm retention ponds includes constructed wetlands that are engineered and designed to provide water quality improvement functions, contain surface water runoff pollutants, and decrease loading of pollutants and sediments into a surface water. Constructed wetlands also provide recreational and aesthetic benefits as well as contribute to habitat benefits for wildlife. Key elements of the successful application of constructed wetlands as a BMP include initial sitting and design of the facilities, construction of the facilities to accommodate hydrologic conditions occurring within the site, vegetation planting, and long-term maintenance of the wetland.

Vegetation Buffers (Biofilters)

Vegetation buffer zones, including features such as grass swales, vegetative filter strips, buffer zones of riparian vegetation along streams and rivers, wetland vegetation, and other vegetated features that can be incorporated within a site to help reduce sediment erosion and provide filtering of contaminants from a site prior to discharge into surface water. Vegetated zones also provide aesthetic and wildlife values. Vegetated zones may include a variety of features and approaches including the avoidance of disturbance of existing vegetation within buffer zones, revegetation of sites disturbed by construction activity, or planting wetland and riparian vegetation. Key elements of the successful implementation of vegetation BMPs include design of the vegetation features as part of the initial project planning, selection of appropriate vegetation based on site-specific conditions such as slope and soil types, construction and maintenance of appropriate watering facilities, vegetation maintenance and control, selection of appropriate native plant species for a specific habitat and desired benefit, and inclusion of long-term maintenance and monitoring into the project plan.

Sediment and Erosion Control

Erosion of sediments, particularly from disturbed sites during storm water runoff, is a significant factor affecting habitat quality and availability for fish within the surface waters of Napa County. A number of BMPs have been developed to reduce and avoid sediment erosion and runoff both as part of initial project construction as well as part of long-term operations. These actions include, but are not limited to:

- Use of temporary cofferdams constructed of sheet pile, sand or gravel bags, plastic sheeting, or other structures to help isolate runoff from a project site from being discharged into surface waters.

- Use of temporary mats and materials to intercept and filter runoff from a site prior to entering the surface water which may include straw or hay bails, or other natural materials.

- Site stabilization using geotextiles, straw cover, or other materials to reduce surface erosion.

- Site revegetation using appropriate plant species.

- Application of bioengineering techniques, such as the use of boulders, large woody debris, riparian planting, and other techniques to reduce erosion along stream channels that also provide fishery and wildlife benefits.

Surface Water Improvements

On-stream surface water impoundments have been designed and constructed in the past to capture and retain water from a stream or river system that could subsequently be used for irrigation or other beneficial purposes. Construction of on-stream impoundments,

however, has resulted in the creation of barriers and impediments to fish migration and have precluded fish, particularly migratory species such as salmon and steelhead, from migrating upstream to otherwise suitable habitat for spawning, egg incubation, and juvenile rearing. To avoid these adverse impacts to fish migration, project planning should avoid, to the maximum extent possible, the design and construction of on-stream structures that impound water. Off-stream impoundments and reservoirs reduce or avoid impacts to migratory fish species and therefore would be a preferable alternative for water project development in the future. Decisions regarding the selection of on-stream versus off-stream impoundments should be based on a number of factors including, but not limited to, site-specific opportunities and constraints, the location of the other barriers to fish migration within a watershed, quality and availability of habitat upstream of the proposed impoundment location, consultation with a qualified fisheries biologist, and evaluation of permitting an environmental review requirements.

Fish Passage Facilities

On-stream structures that results to the blockage or delay in upstream or downstream migration by fish within a watershed should be equipped with appropriate fish passage facilities. Fish passage facilities may include construction and operation of a well designed fish ladder, stepped weir, bypass channel, or the seasonal removal of a structure during fish migration periods. Fish passage facilities should be designed based on site-specific opportunities and constraints and should comply with the basic design and operational criteria established by the California Department of Fish and Game and National Marine Fisheries Service. Fish passage facilities should be designed in consultation with a qualified fisheries biologist and engineer familiar with alternative fish passage facilities. The design of fish passage facilities should include provisions for long-term operations, maintenance, and repair of the facilities to ensure their continued performance.

Positive Barrier Fish Screens

The diversion of water from a river, stream, lake, or other surface waters may result in the entrainment and mortality of various sizes and species of fish. Diversions through an unscreened intake structure from surface waters that provide habitat for resident or migratory fish species should not be permitted in the future. The California Department of Fish and Game and National Marine Fisheries Service have developed guidelines for the design and operations of positive barrier fish screens that provide protection for fish inhabiting both lakes and rivers. Fish screen design criteria include consideration of the approach velocities to the screen, sweeping velocities across the screen surface, the type of material used in constructing the screen, screen open area, and requirements for intake screen cleaning and maintenance.

Seasonal Bypass Flows

The depletion of surface water flows within a river or stream as a result of diversions and impoundments may significantly impact the quality and availability of habitat for various fish and other aquatic organisms. Diversions from a river or stream to an impoundment or storage facility are typically regulated based upon the seasonal timing of diversions relative to fish migration periods, periods of the year when no diversions to storage are permitted, as well is the rate and magnitude of permitted diversions. The diversion of water and associated potential risk of adverse impacts to fish and aquatic habitat is affected by a variety of factors including the magnitude of other water diversions within a watershed, seasonal hydrologic conditions within the watershed, quality and availability of fish habitat upstream and downstream of the point of diversion, and other factors. To provide guidance on establishing initial bypass flow requirements for water diversions the National Marine Fisheries Service and California Department of Fish and Game have identified to general guidelines which include:

- Bypass flows during the diversion season should, at a minimum, be equal to the February median unimpaired flow.

- To the extent possible the hydrograph should retain natural seasonal characteristics for a given watershed.

The State Water Resources Control Board, working in conjunction with state and federal resource agencies, has established a general framework for identifying and evaluating flow impairment within a watershed as a result of the incremental and cumulative effects of existing and proposed water diversions. The estimated magnitude of the cumulative flow impairment at a specific diversion location determines the level of environmental review and evaluation that would be required as part of CEQA environmental review and project permitting.

Coordinated Diversion Operations

In an effort to reduce and avoid potential significant impacts of individual and cumulative water diversions and water project operations within a watershed efforts are being developed for coordinated diversion operations. Coordinated diversion operations typically include installation and maintenance of instream flow gauge within the stream or river that can provide real-time telemetered information on streamflows. Through coordination among water users within a watershed schedules for water diversion operations can then be established based upon actual streamflows and bypass flow requirements for maintaining minimum instream flows for fish migration and habitat. As part of the General Plan update Napa County would promote and facilitate the development of watershed management approaches to coordinated diversion operations as well as other habitat protection and enhancement measures.

Watershed Management

Opportunities exist within Napa County to promote and facilitate development of watershed based collaborative efforts to facilitate more comprehensive planning and management of habitat protection and restoration actions compatible with the BMPs identified above and the overall planning framework provided by the General Plan update. The watershed collaboratives provide a forum for the integration of habitat management and enhancement among a variety of stakeholders and interested parties, facilitate coordinated operations, provide integration of habitat features among various landowners, and can facilitate future project planning and, in many cases, obtain funding for habitat enhancement projects. Napa County, within the framework established by the General Plan update, would promote and facilitate the development and active participation by watershed collaboratives. These efforts would specifically focus on identifying appropriate management actions that would serve to reduce and avoid potentially significant adverse impacts to less than significant levels, provide mitigation for unavoidable impacts, and promote the protection and enhancement of watershed habitats to benefit aquatic and wildlife resources at a regional planning scale.

Literature Cited and Useful References

Muthukrishnan, S., B. Madge, A. Selvakumar, R. Field, and D. Sullivan. 2004. The use of best management practices (BMPs) in urban watersheds. Prepared for US Environmental Protection Agency. Report EPA/600/R-04/184. September 2004

North Coast Regional Water Quality Control Board. 2006. Desired salmonid freshwater habitat conditions for sediment-related indices. July 2006.

Desired Salmonid freshwater habitat conditions for sediment related indices: http://www.swrcb.ca.gov/rwqcb1/programs/basinplan/110504/060728_Desired_Conditions_Report.pdf.

The use of best management practices in urban watersheds:

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http://www.plasticdebris.org/Trash_BMPs_for_Munis.pdf

Erosion and sediment control best management practices:

http://www.cicacenter.org/bmps.html

Napa County Policies and Codes:

http://www.co.napa.ca.us/code2000data/TITLE18/index.html

National Marine Fisheries Service

http://www.nmfs.noaa.gov/

California Department of Fish and Game

http://www.dfg.ca.gov/fishing/

Table 1
Salmonid Freshwater Habitat Desired Conditions for Sediment-Related Indices

Parameter	Desired Condition Value	Applicability	Monitoring/Sampling Notes
The following parameters are direct measurements of sediment in a stream channel.			
Embeddedness	Increasing trend in the number of locations where gravels and cobbles are ≤ 25% embedded.	All wadeable streams and rivers.	Monitoring should occur according to the protocols found in the *California Salmonid Stream Habitat Restoration Manual, Third Edition* by Flosi et al. (2004).
Substrate Composition – % fines	≤ 14% fines < 0.85 mm in diameter. ≤ 30% fines < 6.40 mm in diameter.	Wadeable streams and rivers with a gradient < 3%.	Monitoring should use a McNeil sediment core sampler similar to the specifications found in *Success of Pink Salmon Spawning Relative to Size of Spawning Bed Materials* by McNeil and Ahnell (1964), except the diameter of the sampler's core should be at least 2-3 times larger than the largest substrate particle usually encountered. Monitoring should occur according the protocols found in *Stream Substrate Quality for Salmonids: Guidelines for Sampling, Processing, and Analysis* by Valentine (1995), and use the methodology for the redd or pool/riffle break sampling universe. A 0.85 mm and a 6.40 mm sieve should be used during sample processing. The wet volumetric method is recommended with the use of the wet volumetric method and the dry gravimetric method on 10% of the samples.
V*	≤ 0.21 (21%)	3rd order streams with slopes between 1% and 4% that drain watersheds geologically composed of the Franciscan Formation.	Monitoring should occur according to the protocols found in *Measuring the Fraction of Pool Volume Filled with Fine Sediment* by Hilton & Lisle (1993).
The following parameters measure the impacts of sediment on habitat features.			
Large Woody Debris (LWD)	See Table 2 for the indices.	Streams and rivers with a bankfull channel width from 1m to 100m that drain watersheds predominately vegetated with forests of redwood and/or Douglas fir.	Monitoring should occur according to the protocols found in the *California Salmonid Stream Restoration Manual, Third Edition* by Flosi et al. (2004) or in the Washington State *Method Manual for the Large Woody Debris Survey* by Shuett-Hames et al. (1999b).
	Increasing trend in the volume and frequency of LWD and key pieces of LWD.	Streams and rivers that drain watersheds not predominately vegetated with forests of redwood and/or Douglas fir and all streams and rivers with bankfull channel widths < 1m.	Monitoring should occur according to the protocols found in the *California Salmonid Stream Restoration Manual, Third Edition* by Flosi et al. (2004) or in the Washington State *Method Manual for the Large Woody Debris Survey* by Shuett-Hames et al. (1999b).
Pools – Backwater Pool Distribution	Increasing trend in the number of backwater pools.	Wadeable streams and rivers with a channel morphology that supports the development of backwater pools. Steep, v-shaped valleys with little floodplain connection generally do not exhibit this type of habitat and are exempt.	Monitoring should occur periodically during the low-flow period and after a heavy winter storm according to the protocols found in the *California Salmonid Stream Restoration Manual, Third Edition* by Flosi et al. (2004).

Parameter	Desired Condition Value	Applicability	Monitoring/Sampling Notes
Pools – Lateral Scour Pool Distribution	Increasing trend in the number of lateral scour pools.	Wadeable streams and rivers with a channel morphology that supports the development of backwater pools. Steep, v-shaped valleys with little floodplain connection generally do not exhibit this type of habitat and are exempt.	Monitoring should occur during the low-flow period, after a heavy winter storm, and once every five to ten years according to the protocols found in the *California Salmonid Stream Restoration Manual, Third Edition* by Flosi et al. (2004).
Pools – Primary Pool Distribution	Increasing trend in the number of reaches where the length of the reach is composed of ≥ 40% primary pools.	2nd, 3rd, and 4th order wadeable streams and rivers.	Monitoring should occur once every five to ten years during the low-flow period and after a heavy winter storm according to the protocols found in the *California Salmonid Stream Restoration Manual, Third Edition* by Flosi et al. (2004). Reported data should include length and depth of pools, and the number of primary pools.
Thalweg Profile	Increasing variation in the thalweg elevation around the mean thalweg profile slope.	Streams and rivers with slopes ≤ 2%.	Monitoring should occur during the low-flow period, after a heavy winter storm, once every five to ten years. The monitored stream segments should be at least 20, but usually 30 to 40 times as long as the average bankfull channel width. Points that should be surveyed include the thalweg, all breaks-in-slope, riffle crests, maximum pool depths, tails of pools, and surface water elevation. Acceptable monitoring protocols include the Channel Geometry Survey of *Water in Environmental Planning* by Dunne and Leopold (1978).
The following parameter measures the impacts of sediment on a salmonid food source and water quality in general.			
Benthic Macroinvertebrate Assemblage	≥ 18 Index Score per the Russian River Index of Biological Integrity (IBI). See Table 3 for the Russian River IBI.	1st, 2nd, and 3rd order wadeable streams and rivers.	Monitoring and calculation should occur in the spring according to the protocols found in the *California Stream Bioassessment Procedure* by the CA Department of Fish and Game (2003).

Table 2
Large Woody Debris Indices

	Bankfull Channel Width (m)	Index (per 100 m of channel length)
LWD Frequency	1 to 6	> 38 pieces
	> 6 to 30	> 63 pieces
	>30 to 100	> 209 pieces
LWD Volume	1 to 30	> 72 m^3
	> 30 to 100	> 317 m^3
Key Piece Frequency	1 to 10	> 11 pieces
	> 10 to 100	> 4 pieces

Table 3
Russian River Index of Biological Integrity

Biological Metric	Score			How to use the Russian River Index of Biological Integrity
	5	3	1	
Taxa Richness	> 35	35-26	< 26	Obtain a sample of benthic macroinvertebrates following the state standard procedures in *California Stream Bioassessment Procedure. Protocol Brief for Biological and Physical/Habitat Assessment in Wadeable Streams* by CA Dept. of Fish and Game dated 2003. There must be at least three replicate samples collected at each monitoring location. The samples should be processed by a professional bioassessment laboratory using the Level 3 Taxonomic Effort. Determine the mean values for the six listed biological metrics, compare them to the values in the columns, and add the scores listed in the column headings. The total score will be between a low of 6 and a high of 30. Determine biotic condition of the monitoring location from the following categories:
% Dominant Taxa	< 15	15-39	> 39	
EPT Taxa	> 18	18-12	< 12	
Modified EPT Index	> 53	53-17	< 17	
Shannon Diversity	> 2.9	2.9-2.3	< 2.3	
Tolerance Value	< 3.1	3.1-4.6	> 4.6	Excellent 30-24 / Good 23-18 / Fair 17-12 / Poor 11-6

* from *Measuring the Health of California Streams and River. A Methods Manual for: Water Resource Professionals, Citizen Monitors, and Natural Resources Students* by Harrington & Born (1999).