Combined Revised Draft and Final Program Timberland Environmental Impact Report for Hearst Forests

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This document combines the draft PTEIR and final PTEIR and represents the certified PTEIR. It is intended for the use of CDF and The Hearst Corporation. As issued to the public, the PTEIR consists of a separate draft PTEIR and final PTEIR.

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Acronyms

ADF	annual daily flow
ADT	average daily traffic
BF	board foot
BMPs	best management practices
BOF	California Board of Forestry
CACTOS	California Conifer Timber Output Simulator
CATS	California Timber Supply model
CDF	California Department of Forestry and Fire Protection
CEG	certified engineering geologist
CEQA	California Environmental Quality Act
CFPRs	California Forest Practice Rules
cfs	cubic feet per second
CNPS	California Native Plant Society
CRHR	California Register of Historic Resources
CVRWQCB	Central Valley Regional Water Quality Control Board
CWE	cumulative watershed effect
dbh	diameter at breast height
DFG	California Department of Fish and Game
DMG	California Division of Mines and Geology
EHR	erosion hazard rating
EIR	environmental impact reports
ERA	equivalent roaded area
Forest Practice Act	Z'berg-Nejedly Forest Practice Act of 1973
Forest Service	U.S. Forest Service
FREIGHTS	Forest Resource Inventory, Growth, and Harvest Tracking System
FVS	Forest Vegetation Simulator
GFMP	general forest management plan
GIS	geographic information systems
Hearst	Hearst Corporation
LP	linear programming
LSMZ	late seral management zone
LTO	licensed timber operator
LTSY	long-term sustained yield
LWD	large woody debris
MAI	mean annual increment
MBF	thousand board feet
MMBF	million board feet
MOU	memorandum of understanding
MSP	maximum sustained production

NDDB	Natural Diversity Data Base
NSI	natural sensitivity index
PAI	periodic annual increment
PTEIR	program timberland environmental impact report
PTHP	program timber harvesting plan
PW	planning watersheds
QMD	quadratic mean diameter
RG	registered geologist
RPF	registered professional forester
SYP	sustained yield plan
THP	timber harvesting plan
TOC	threshold of concern
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
VESTRA	Vestra Resources
WHR	California Wildlife Habitat Relationship
WLPZ	watercourse and lake protection zone

Executive Summary

This executive summary presents key information contained in the draft program timberland environmental impact report (PTEIR) for Hearst Forests. It:

- summarizes the proposed project and alternatives to the proposed project,
- identifies the environmental impacts that would result from implementing the proposed project or an alternative,
- identifies which impacts are significant,
- summarizes mitigation measures to avoid or reduce the significance of impacts,
- identifies the environmentally superior alternative,
- discusses irreversible environmental changes that would result from project implementation, and
- discusses unresolved issues and known areas of controversy.

PROJECT DESCRIPTION SUMMARY

Hearst Forests comprises 60,801 acres in southern Siskiyou and northern Shasta Counties. The ownership is divided into the Wyntoon Tract and the Kosk Creek Tract. Hearst Forests has historically been managed for a variety of uses and amenities, including timber production, watershed protection, and enhancement of wildlife habitat and aesthetic quality. The Hearst Corporation (Hearst) proposes to continue to conduct timber operations on the property. Nearly all timber removals will consist of selective harvests. Future harvesting rates will maintain or increase the extent of late successional habitat over time and are expected to be similar to those achieved over the past 10 years.

Hearst has entered into agreements with the California Department of Fish and Game and the U.S. Fish and Wildlife Service that specify resource management standards to protect special-status wildlife species, including the northern spotted owl, the northern goshawk, and species listed as threatened or endangered under the California Endangered Species Act. A network of late seral management zones has been established throughout the landscape that will be managed to produce late successional habitat as rapidly as possible. In addition, the proposed timber harvesting schedule was developed to ensure that the extent of late successional habitat does not decline over the next 100 years.

Additional applicable resource protection standards include the California Forest Practice Rules (CFPRs) (except where alternative standards have been specified in this PTEIR) and a series of best management practices that Hearst has voluntarily adopted over the years. A major focus of these rules and practices is the protection of the beneficial uses of surface waters and maintenance of diversity of forest habitats for wildlife.

An ongoing resource monitoring program will be implemented to ensure that the key assumptions made in this EIR are valid, that applicable resource protection standards are being implemented, and that these standards are achieving their objectives.

SUMMARY OF ALTERNATIVES TO THE PROPOSED PROJECT

No-Project Alternative

Under the No-Project Alternative, no commercial timber harvesting would occur. The intensity of management of the ownership would be reduced to a custodial level.

Intensive Management Alternative

Under the Intensive Management Alternative, timber would be harvested at the maximum rate consistent with the CFPRs' requirements for maintaining maximum sustained production of high-quality timber products. Approximately 20% of the area harvested would receive regeneration harvests such as clearcutting. All resource protection standards applicable under the proposed project would apply, except that no late seral management zones would be established.

IMPACTS OF IMPLEMENTING THE PROPOSED PROJECT OR ALTERNATIVES

Environmental impacts of implementing the proposed project or alternatives are summarized in Table ES-1. This table identifies each impact, reports its significance, and summarizes mitigation measures to reduce significant impacts to a less-than-significant level.

Significant Impacts

Implementing either the proposed project or the Intensive Management Alternative could result in the following potentially significant impacts:

- cumulative watershed effects in watersheds outside the study area,
- channel effects of sedimentation resulting from cumulative disturbance in watersheds outside the study area,
- increased sedimentation of Class I streams,
- mortality of Scott Mountain phacelia or long-haired star tulip,
- damage to species acquiring special status,
- loss of an active nest,
- damage to identified archaeological or historical sites, and
- damage to previously unidentified archaeological or historical sites.

In addition, implementing the Intensive Management Alternative could result in the following potentially significant impacts:

- excessive cumulative watershed disturbance in the Wyntoon and Angel Creek planning watersheds,
- loss of timberland productivity because of excessive erosion,
- take of the northern spotted owl, and
- reduction of late seral habitat.

Cumulative Impacts

The only cumulative impacts that could result from implementing either the proposed project or the Intensive Management Alternative in conjunction with other past, present, or reasonably foreseeable future projects involve the potential for excessive sediment discharges to surface waters and related degradation of fish habitat.

IMPACT CONCLUSIONS REQUIRED BY THE CALIFORNIA ENVIRONMENTAL QUALITY ACT

The California Environmental Quality Act (CEQA) requires that an EIR identify the environmentally superior alternative, any irreversible environmental change that would be caused by the proposed project, and any unresolved issues or known areas of controversy involving the proposed project.

Environmentally Superior Alternative

The proposed project is the environmentally superior alternative. It would result in less watershed disturbance and less risk of significant cumulative watershed effects than the Intensive Management Alternative. The No-Project Alternative would result in greater risks of severe wildfires than the proposed project because fuel loads would accumulate more rapidly and fewer staff would be available to detect and respond to fires.

Irreversible Environmental Change

Minor irreversible changes would result from implementing the proposed project or the Intensive Management Alternative. These changes include depletion of fossil fuels associated with timber operations. No resources committed under the proposed project or any alternative are of notably limited supply or have strategic importance.

Unresolved Issues and Known Areas of Controversy

No highly controversial issues were raised during the public scoping process for this EIR. Although cumulative watershed effects are probably the resource issue considered that is least well understood, it is largely resolved in this draft EIR. Questions regarding the validity of assumptions used in this EIR and the effectiveness of the management practices and resource protection standards committed to in this EIR will be answered through the ongoing monitoring program to be implemented as part of the project. No unavoidable significant impacts were identified.

ES-1. Summary of Impacts and Mitigation Measures

Resource Topic	Proposed Project	Intensive Management Alternative
Watershed Assessment		
Impact	**Cumulative watershed effects in watersheds outside the study area**	
Level of significance	Potentially significant	Potentially significant
Mitigation required	Conduct a watershed assessment and watershed restoration as needed	Conduct a watershed assessment and watershed restoration as needed
Impact	**Potential channel effects of sedimentation resulting from cumulative disturbance in watersheds outside the study area**	
Level of significance	Potentially significant	Potentially significant
Mitigation required	Conduct a watershed assessment and watershed restoration as needed	Conduct a watershed assessment and watershed restoration as needed
Impact	**Excessive cumulative watershed disturbance**	
Level of significance	Less than significant	Significant
Mitigation required	None	Reduce rate of harvesting or extent of clearcutting
Impact	**Loss of timberland productivity**	
Level of significance	Less than significant	Potentially significant
Mitigation required	None	Reduce rate of harvesting or extent of clearcutting
Fisheries		
Impact	**Potential for increased sedimentation of Class I streams**	
Level of significance	Potentially significant	Potentially significant
Mitigation required	Implement adaptive aquatic management for Angel and Star City Creeks	Implement adaptive aquatic management for Angel and Star City Creeks

Table ES-1. Continued

Resource Topic	Proposed Project	Intensive Management Alternative
Vegetation		
Impact	**Potential mortality of Scott Mountain phacelia or long-haired star tulip**	
Level of significance	Potentially significant	Potentially significant
Mitigation required	Conduct reconnaissance surveys for suitable habitat and, if present, either avoid or conduct surveys for the species; if the species are found to be present, prepare and implement a protection plan	Conduct reconnaissance surveys for suitable habitat and, if present, either avoid or conduct surveys for the species; if the species are found to be present, prepare and implement a protection plan
Impact	**Potential damage to species acquiring special status**	
Level of significance	Potentially significant	Potentially significant
Mitigation required	Periodically review special-status species lists and protect additional species as needed	Periodically review special-status species lists and protect additional species as needed
Wildlife Resources		
Impact	**Potential loss of an active nest**	
Level of significance	Potentially significant	Potentially significant
Mitigation required	Conduct preharvest surveys for active nests of special-status species	Conduct preharvest surveys for active nests of special-status species
Impact	**Potential take of the northern spotted owl**	
Level of significance	Less than significant	Potentially significant
Mitigation required	None	Implement the no-take provisions for the northern spotted owl specified in the California Forest Practice Rules
Impact	**Reduction of late seral habitat**	
Level of significance	Less than significant	Potentially significant
Mitigation required	None	Retain late successional habitat

Table ES-1. Continued

Resource Topic	Proposed Project	Intensive Management Alternative
Cultural Resources		
Impact	**Potential damage to identified archaeological or historical sites**	
Level of significance	Potentially significant	Potentially significant
Mitigation required	Implement protection measures or determine significance of the site	Implement protection measures or determine significance of the site
Impact	**Potential damage to previously unidentified archaeological or historical sites**	
Level of significance	Potentially significant	Potentially significant
Mitigation required	Stop timber operations and implement protection measures or determine significance of the site	Stop timber operations and implement protection measures or determine significance of the site

Chapter 1. Introduction

PROJECT OVERVIEW

The Hearst Corporation (Hearst) owns and manages Hearst Forests, which comprises 60,801 acres in southern Siskiyou and northern Shasta Counties. Portions of these lands were roaded and harvested by previous owners beginning around 1900. The remainder of Hearst Forests was used primarily for recreation until 1952, when the property became a certified tree farm, and ongoing commercial harvesting and related road construction began. In 1965, the first woodlands manager was hired to supervise management of Hearst Forests. From 1967 to 1986 timber harvesting was conducted on Hearst Forests by an independent timber company under a long-term contract. Since 1986, management of the property's forest resources has been conducted entirely by Hearst's professional forestry staff.

A northern spotted owl management plan for Hearst Forests was approved by the U.S. Fish and Wildlife Service (USFWS) in 1993. Hearst proposes to continue conducting timber operations (i.e., commercial timber harvesting and incidental work such as construction and maintenance of roads, fuel breaks, stream crossings, skid trails, and landings), consistent with its northern spotted owl management plan, with the objectives of maintaining forest sustainability and health, maintaining soil productivity and water quality, enhancing the quality and diversity of wildlife and fish habitats, and enhancing the aesthetic quality of the landscape.

PURPOSE OF THE ENVIRONMENTAL IMPACT REPORT

The California Environmental Quality Act (CEQA) (Pub. Res. Code 21000 et seq.) requires state and local government agencies to consider the environmental consequences of projects over which they have discretionary authority before taking action on such projects. For projects that could have significant environmental impacts, environmental impact reports (EIRs) must be prepared. Timber harvesting on private lands in California is administered by the California Department of Forestry and Fire Protection (CDF), which has determined that implementing the proposed project could result in significant environmental impacts and is subject to review under CEQA. As a result, this EIR is being prepared, with CDF as the lead agency. The California Department of Fish and Game (DFG) and the Central Valley Regional Water Quality Control Board (CVRWQCB) are responsible agencies under CEQA.

The objectives of this EIR are to analyze and disclose to decision makers and the public the environmental effects of implementing the proposed project as described in Chapter 2, demonstrate to the public that the proposed project will protect the environment, identify mitigation measures to reduce or avoid significant environmental impacts that could result from project implementation, and evaluate a reasonable range of alternatives to the proposed project.

Program Environmental Impact Reports and Tiering

Program EIRs are prepared for an agency program or series of actions that are closely related, such as phased projects. The environmental impacts of the timber operations that constitute the proposed project are expected to be similar over an extended period and a wide range of locations. Consequently, Hearst has requested that a program EIR be prepared for the proposed project.

When subsequent activities requiring discretionary permits are proposed, a determination will be made on whether additional CEQA documents are needed if significant effects exist that were not examined in the program EIR. This concept, called "tiering", refers to the covering of general matters in broader (i.e., program) EIRs with subsequent environmental documents incorporating by reference the general discussions of impacts contained in the program EIR and concentrating on the issues of relevance to the site-specific action considered in the subsequent environmental analysis (State CEQA Guidelines Section 15385).

The proposed timber operations are analyzed at a relatively general level in this program EIR. Consequently, impacts identified and mitigation measures proposed for such operations are generally not site specific. Site-specific mitigation measures recommended in this EIR will be described in detail as needed and incorporated into environmental documents prepared for subsequent projects.

Timber Harvesting Planning

Timber harvesting plans (THPs) for proposed timber operations will be prepared, evaluated, and approved as specified in the Z'berg-Nejedly Forest Practice Act of 1973 (Forest Practice Act) and the California Forest Practice Rules (CFPRs). This process has been certified as functionally equivalent to CEQA (State CEQA Guidelines Section 15251). "Functional equivalence" implies that timber harvesting is exempt from CEQA requirements to prepare EIRs and negative declarations because an equivalent, alternative process for environmental assessment and protection has been established. The California Board of Forestry (BOF), however, has adopted a new type of THP (the program THP or PTHP) to be used in conjunction with and tiered to a certified program timberland EIR (PTEIR). Environmental assessment of proposed timber operations on Hearst Forests will thus follow CEQA guidelines regarding subsequent projects tiered to program EIRs.

Operations proposed in a PTHP will be reviewed to determine whether they are consistent with the project described in this EIR or could result in significant environmental impacts not covered in the program EIR. Consistency of proposed operations with the PTEIR will be evaluated through completion of a checklist (see Appendix J) as part of PTHP preparation. If the timber operations are found to be inconsistent with the project as described in the program EIR or could result in significant new environmental impacts, one of the following three options will be adopted:

- the proposed operations will be modified so they are consistent with the project as described in the EIR,
- a supplemental CEQA document will be prepared, or
- a conventional THP will be prepared.

Standard mitigation measures and best management practices (BMPs) to avoid significant environmental impacts are specified in this document and in Appendix C. The need for additional mitigation measures or refinements to standard BMPs to address site-specific resource concerns will be evaluated during PTHP preparation. If in the judgment of the Hearst registered professional forester (RPF), and with the approval of the CDF Director, such additional measures or refinements are needed, they will be incorporated into the PTHP. For example, the standard widths for heavy equipment exclusion zones specified in BMP 18.31 may be adjusted if needed to adequately protect watercourses.

SCOPE OF THE ENVIRONMENTAL IMPACT REPORT

CDF conducted a scoping process consistent with Section 15083 of the State CEQA Guidelines to identify issues to be analyzed in the EIR, determine the scope of the analysis of each issue, and identify alternatives to the proposed project. The scoping process involved distributing a notice of preparation for the EIR and requesting written comments from agencies and persons with interest in the proposed project. The scoping report presented in Appendix A summarizes the issues raised during the scoping process.

Based on comments received during the scoping process (see Appendix A) and on other information, CDF determined that the following topics were of concern and should be addressed in the EIR:

- watershed resources;
- water quality;
- fisheries;
- vegetation;
- wildlife;
- cultural resources;
- maximum sustained production (MSP) of high-quality timber products;
- traffic;
- visual resources; and
- fuels and fire safety.

Impact Assessment

The impact analysis for each resource chapter identifies and compares the probable impacts of each project alternative that are related to that resource topic. These comparative analyses highlight differences or similarities in predicted impacts among the alternatives. Direct, indirect, and cumulative impacts associated with each resource area are addressed in this EIR.

Levels of Impact Significance

This EIR considers the following levels of impacts:

- a beneficial impact is considered to cause a favorable change in the environment;
- a less-than-significant impact is considered to cause no substantial adverse change in the environment and requires no mitigation;
- a significant impact is considered to have a substantial adverse effect on the environment;
- a potentially significant impact is considered likely to have a substantial adverse impact on the environment, although existing information and knowledge are inadequate to warrant a significant impact conclusion; and
- a significant and unavoidable impact is considered to have a substantial adverse impact on the environment for which feasible mitigation measures are unavailable to reduce impacts to a less-than-significant level.

Baseline Conditions and the No-Project Alternative

The No-Project Alternative, combined with the description of the affected environment for each resource area, is the point of reference or baseline with which impacts of each project alternative are compared. Under the No-Project Alternative, no commercial timber harvesting would occur on Hearst Forests. Because it is used as the baseline for analysis of the proposed project and project alternative, analysis of the No-Project Alternative does not include levels of impacts and mitigation measures. The No-Project Alternative is described in more detail in Chapter 2, "Proposed Project and Alternatives".

Cumulative Impact Assessment

CEQA requires that an EIR contain a reasonable analysis of a project's significant cumulative impacts—that is, significant impacts resulting from the project in conjunction with other past, present, and reasonably foreseeable future projects. For example, significant cumulative impacts on fisheries could result from the interaction of elements of the proposed project with offsite timber operations and ongoing soil erosion and sedimentation. As discussed in Chapter 3, erosion and sedimentation are natural processes that occurred before human activity but have accelerated in many California watersheds over the past 150 years as a result of various land management activities.

Changes in erosion and sedimentation levels that would result from watershed disturbance due to proposed timber operations are considered to be direct effects. In contrast, the total levels of erosion and sedimentation, including the levels attributable to natural processes and historical disturbance, are considered as cumulative watershed impacts in Chapter 3. The principal baselines for assessing these impacts are the watershed conditions projected for the No-Project Alternative.

Mitigation Measures and Monitoring

Where the project alternatives could cause significant impacts, CEQA requires that the EIR must identify and discuss mitigation measures to avoid, reduce, or compensate for each such impact. The EIR should distinguish between measures proposed by the project proponent as opposed to those required by the lead agency and should identify responsibility for implementing each measure. To the extent possible, the EIR must describe the feasibility and effectiveness of the mitigation measures.

Under CEQA, agencies must adopt a program for reporting or monitoring mitigation measures identified in an EIR that were adopted or made conditions of project approval (Pub. Res. Code Section 21081.6). The purpose of the mitigation monitoring program is to ensure that mitigation measures incorporated into EIRs are complied with during project implementation and provide feedback to agency staff and decision makers about the effectiveness of their actions and opportunities for improving impact mitigation on future projects. The mitigation monitoring program for Hearst Forests will be described in the final EIR.

Additional Monitoring

Besides the mitigation monitoring program required by CEQA to address significant impacts identified in the EIR, Appendix B describes the monitoring plan that will be implemented to assess the validity of the planning assumptions upon which the analyses in this EIR were based, to determine whether the BMPs discussed in Chapter 2 and Appendix C are being implemented, and to assess whether the BMPs and the management practices and standards specified in Chapter 2 that are alternatives to those specified in the CFPRs are achieving their intended resource protection objectives.

ENVIRONMENTAL REVIEW PROCESS

This draft EIR is being circulated for a 45-day public review period, during which agencies and the public are encouraged to submit comments on the draft document. Comments should be addressed to:

Mr. Allen Robertson
California Department of Forestry and Fire Protection
1416 Ninth Street
Sacramento, CA 95814

Following the close of the public review period, CDF will summarize comments received on the draft EIR, prepare responses to all substantive environmental issues raised in such comments, and circulate those responses and any changes required to the draft EIR in a final EIR.

Under CEQA, the lead agency must circulate the final EIR to commenting agencies for at least 10 days before certifying the EIR. Along with certifying the final EIR, the lead agency must adopt a mitigation monitoring program (as described above) and Findings of Fact explaining how it has addressed each significant impact identified in the EIR. When the lead agency approves a project for which an EIR is prepared, a Notice of Determination must be filed. If the approved project includes any unavoidable significant impacts, a Statement of Overriding Considerations must be prepared explaining why the lead agency was willing to accept each significant impact.

Subsequent projects (i.e., timber operations on Hearst Forests) will undergo environmental analysis in the form of PTHPs tiered to the program EIR.

Chapter 2. Proposed Project and Alternatives

PROJECT DESCRIPTION

Background

Hearst owns and manages Hearst Forests, which comprises 60,801 acres located southeast of the unincorporated community of McCloud in southern Siskiyou and northern Shasta Counties (Figure 2-1). Hearst Forests consists of two adjacent tracts, the Wyntoon Tract in the northwest and the Kosk Creek Tract in the southeast. The property ranges in elevation from 2,800 to 6,000 feet above sea level, with geomorphology typical of the southern Cascade Mountains. Soils are predominantly of volcanic origin with slopes less than 60%.

Previous owners of the northwestern portion of Hearst Forests roaded and logged their holdings beginning around 1900. Until 1952, the Hearst ownership was used primarily for recreation, with no commercial timber harvesting and only limited road construction. In 1952, when the property became a certified tree farm, ongoing commercial harvesting and related road construction began, primarily in the Wyntoon Tract. Relatively less development has occurred in the Kosk Creek Tract. From 1967 to 1986, timber harvesting and road construction were conducted by an independent timber company under the supervision of the Hearst Forests woodlands manager. Since then, the property has been managed entirely by Hearst's forestry staff.

Hearst proposes to continue conducting timber operations (i.e., commercial timber harvesting and incidental work such as site preparation and construction and maintenance of roads, fuel breaks, stream crossings, skid trails, and landings) consistent with its northern spotted owl management plan, as discussed below, to achieve the following objectives:

- maintaining forest sustainability and health primarily through selective timber harvesting to promote development of uneven-aged stand structures;
- maintaining soil productivity and water quality by limiting the extent of annual timber harvesting and through proper design, construction, and maintenance of roads, skid trails, landings, and stream crossings;
- enhancing the quality and diversity of wildlife and fish habitats; and
- enhancing the aesthetic quality of the landscape.

Timber operations on private lands in California are regulated by the BOF and administered by CDF. CDF, the lead agency for this PTEIR, which assesses the environmental consequences of implementing the proposed timber operations; identifies mitigation measures to minimize, reduce, or avoid adverse environmental impacts; and evaluates a reasonable range of alternatives to the proposed project. CDF and the CVRWQCB are responsible agencies for the proposed project.

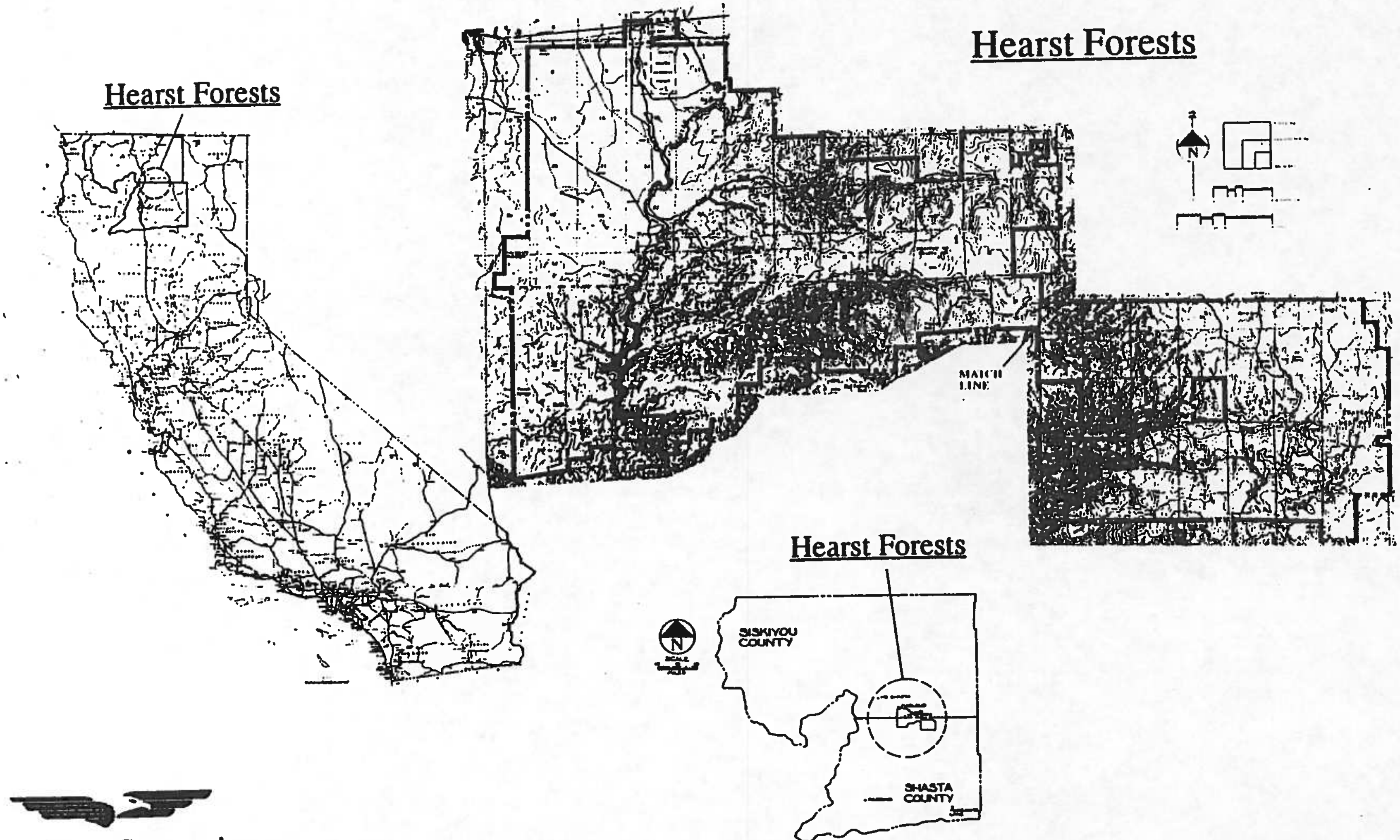
The use of program EIRs is encouraged by the CEQA Guidelines Section 15168 directing lead agencies to:

- "avoid duplicative reconsideration of basic policy considerations" and

- "consider programwide mitigation measures at an early time when the agency has greater flexibility to deal with basic problems or cumulative impacts".

Private timber operations generally require the approval of a THP. The THP process has been certified by the California Secretary for Resources as being functionally equivalent to the CEQA process. The BOF recently adopted the PTHP to be used in conjunction with and tiered to a certified PTEIR. Environmental assessment of proposed timber operations on Hearst Forests would thus follow CEQA guidelines regarding subsequent projects tiered to program EIRs. The proposed timber operations would be reviewed to determine whether they are consistent with the project described in the PTEIR or could result in significant environmental impacts not covered in the PTEIR. If the timber operations are found to be inconsistent with the proposed project as described in the PTEIR or could result in significant environmental impacts, an additional CEQA document could be needed.

All proposed timber operations will conform with the Forest Practice Act, the operational guidelines and standards contained in BMPs listed in Appendix C, and all mitigation measures described in this PTEIR. They will also conform with the operational standards contained in the CFPRs, except where alternative measures specified in this PTEIR meet the intent of the CFPRs and will achieve the objective of avoiding significant impacts, as defined in the CEQA Guidelines. Such alternative measures, in conjunction with the resource monitoring program described below and in Appendix B are presumed to provide equal or better resource protection than would be afforded under the current CFPRs or future revisions to the CFPRs. If resource monitoring or similar evidence shows that the resource protection measures specified in this PTEIR are not consistent with avoidance of significant impacts or resource protection equal to or better than the CFPRs, more effective resource protection will be assured either by incorporating into subsequent PTHPs the operational standards specified in the CFPRs that are then current, or by revising the PTEIR. Such revisions could require additional CEQA analysis.



The Hearst Corporation
Hearst Forests

Jones & Stokes Associates, Inc.

Figure 2-1
Location of Hearst Forests

Related Plans and Agreements

Northern Spotted Owl Management Plan

The northern spotted owl was listed as threatened by USFWS in 1990. Although Hearst Forests is located within the range of the northern spotted owl, no active northern spotted owl nests have ever been observed on the property. Systematic northern spotted owl surveys initiated in 1990 have identified several northern spotted owls on or near the property. All northern spotted owls observed on the property, however, were concluded to be non-nesting transients. In 1993, the USFWS approved a northern spotted owl management plan for Hearst Forests (see Appendix I). This management plan is intended to ensure that timber operations do not result in the take of any individual northern spotted owls. This objective will be achieved on Hearst lands by:

- conducting annual northern spotted owl surveys consistent with the protocols specified in the northern spotted owl management plan for each THP submitted;
- protecting from disturbance related to timber operations all identified northern spotted owls and northern spotted owl nests;
- maintaining suitable northern spotted owl habitat in at least 40% of the coniferous timber area of each major drainage on the property; and
- managing a 9,452-acre network of late seral management zones (LSMZs) (Figure 2-2) to promote development and enhancement of suitable northern spotted owl habitat.

Consistent with the northern spotted owl management plan, Hearst submits annual reports to USFWS summarizing the year's survey results, noting locations and status of the year's timber operations, noting any observed responses by northern spotted owls to timber operations, and recommending changes to the plan as needed based on new information.

Northern Goshawk Adaptive Management Plan

The northern goshawk is classified by the BOF as a sensitive species. In 1993, Hearst and DFG signed a letter of understanding implementing a protection plan for, and an adaptive management study of, the northern goshawk on Hearst Forests. The protection plan requires Hearst to conduct goshawk surveys in all timber stands containing good goshawk nesting habitat scheduled to be harvested the following year. To avoid goshawk disturbance during the sensitive nest-building and egg-incubation periods (March-May), surveys are conducted during the June-October period. If goshawks are identified through the surveys, or through subsequent field checks to be conducted through initiation of timber operations, DFG will immediately be contacted and consulted in developing appropriate silvicultural prescriptions and mitigation measures to protect the goshawks and their nests. Applicable mitigation measures include establishment of 50-acre buffer zones surrounding nest trees wherein only commercial thinning, sanitation-salvage, selection, or similar harvest prescriptions will be implemented. These mitigation measures will continue to be implemented.

Goshawk nests located near harvest areas will be monitored for 3 years following harvest to observe the birds' response to the harvesting. Annual reports are submitted to DFG summarizing harvesting locations, survey locations and routes, silvicultural prescriptions designated for buffer zones, and locations of nests identified within 0.5 mile of a plan area.

Memorandum of Understanding with California Department of Fish and Game

Hearst and DFG have jointly signed a memorandum of understanding (MOU) constituting an agreement regarding procedures to avoid adverse impacts on wildlife species listed as threatened or endangered under the California Endangered Species Act that could occur on Hearst Forests (see Appendix F). Species addressed by the MOU are bald eagle, willow flycatcher, great gray owl, greater sandhill crane, wolverine, and Shasta salamander. The MOU specifies that Hearst will evaluate areas planned for timber harvesting and adjacent areas to determine whether listed species are present and whether the site provides suitable habitat for listed species. It also specifies mitigation measures Hearst will implement to avoid adverse impacts on listed species and their habitats.

The MOU specifies that DFG agrees that timber operations on Hearst Forests implemented consistent with the mitigation measures in the MOU are unlikely to adversely affect the listed species and that consultations with DFG pursuant to Section 2090 of the California Fish and Game Code are not warranted.

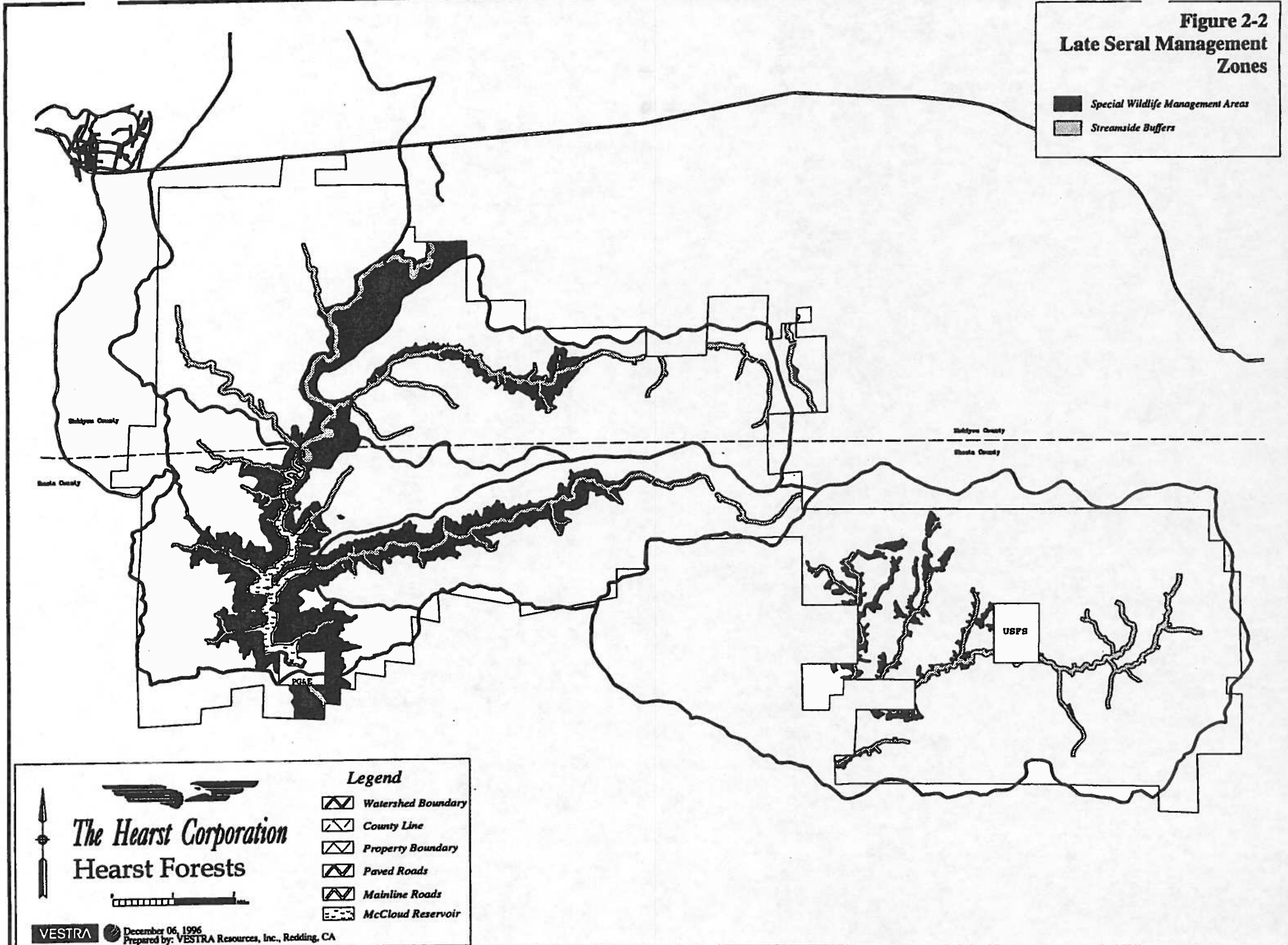
The MOU provides for annual updates of the MOU to account for changes in the status and habitats of the listed species, including revisions to the applicable mitigation measures, as needed.

Timber Harvesting

Hearst proposes to harvest timber on an average of approximately 2,000 acres each year, which is roughly equal to the average harvesting rate on the property over the past 11 years. The harvesting will consist primarily of various types of harvesting (e.g., selection, group selection, sanitation-salvage harvests, or alternative silvicultural prescriptions) to promote development of uneven-aged stand structures, where the post-harvest stand retains sufficient trees to meet the minimum stocking standards set by the Forest Practice Act and the CFPRs (14 CCR 1071). Group selection harvests can result in the removal of groups of trees of up to 2.5 acres. Other selection methods will result in the removal of individual trees or groups of trees of less than 0.25 acre. Stands will be reentered for harvesting on cycles ranging from 10 to 30 years.

Up to 5% of the proposed harvesting could consist of even-aged regeneration harvests (e.g., clearcutting, shelterwood, or seed-tree harvests). For example, such harvests could be implemented in stands damaged by fires, insects, or diseases. Even in areas receiving regeneration harvests,

Figure 2-2
Late Seral Management Zones



however, the long-term silvicultural objective will be to develop uneven-aged stand structures. Areas receiving even-aged regeneration harvests will be restocked within 5 years in conformance with the CFPRs (14 CCR 1071).

No timber harvesting is planned to occur in nontimberland areas or within the McCloud River Preserve surrounding Hearst's residential estate, except for the occasional removal of trees posing safety hazards. The ownership includes a total of 7,879 acres of nontimberland, including water bodies, meadows, rock outcroppings, and land supporting chaparral vegetation. The McCloud River Preserve, a 1,107-acre tract that is part of Hearst Forests' LSMZ system, will be managed to preserve existing forest resources and protect them from fire and other damaging agents.

Timber harvesting will be scheduled over time consistent with the requirements of the Forest Practice Act and the CFPRs (14 CCR 933.11) to achieve MSP of high-quality timber products for the entire ownership. MSP is analyzed in this EIR by simulation of growth of forest stands that have been classified into land-stratum types comprising polygons with similar land and timber attributes from throughout the ownership. Conformance with MSP will be demonstrated by showing that the proposed harvest schedule will result in balancing growth and harvest over time, maintaining a timber inventory capable of sustaining the long-term sustained yield (LTSY) for the ownership, and having the projected annual harvest level for all future rolling 10-year periods not exceed the LTSY.

In some cases, alternative prescriptions (as described in 14 CCR 933.6) will be applied to enhance the species distribution, stand structure, and growth of low basal-area stands dominated by trees of low vigor or undesirable species. Such alternative prescriptions could result in residual stands that do not meet the after-harvest stocking standard for the standard silvicultural system most appropriate or feasible for use in a specific stand. The use of alternative prescriptions resulting in substandard after-harvest stocking levels will be limited in that they will be applied only if it is demonstrated in the PTHP that they would result in either an increase in long-term sustained yield relative to the most nearly appropriate or feasible standard method, or an increase in yield over the subsequent 20 years relative to the no-harvest alternative.

Road Construction, Reconstruction, Maintenance, and Abandonment

Hearst Forests' existing road network comprises approximately 473 miles of roads and is nearly complete; only about 10 additional miles of roads will be constructed over the next 20 years. This mileage does not include replacement roads as discussed below.

Approximately 30-40 miles of existing roads will receive major reconstruction during the next 20 years. This estimate is based on Hearst foresters' knowledge of the condition of roads in areas planned for harvest during this period and their past experience regarding the need for road reconstruction to facilitate harvesting in similar areas. Road segments will be selected for reconstruction based primarily on the need to access harvest areas and to conform with best management practices (BMPs) addressing road reconstruction (see Appendix C). Major road reconstruction includes outsloping of roads that currently drain inward, construction of rolling dips, replacement of culvert stream crossings with bridges, installation of oversized culverts, and removal of unstable fills. The main objective of major reconstruction is to reduce the potential for roads to concentrate runoff and cause erosion.

The entire road network is maintained periodically, with maintenance often scheduled in conjunction with timber harvesting. Roads generally receive maintenance at least once every 15 years. Maintenance activities include opening of roads closed by encroaching brush, fallen trees, or erosion; repair of drainage structures; replacement of obsolete culverts; and minor realignment. As described in BMPs 4.3-4.6, Hearst will conduct annual road inventories to identify damaged structures and related soil and sedimentation hazards. Repairs to main haul roads will generally be accomplished during the year in which the damages occur; repairs to secondary roads will be accomplished on an ongoing basis in conjunction with timber operations.

In some cases, roads in the lower portions of watersheds used in conjunction with tractor skidding will be replaced by midslope or ridgetop roads used with cable yarding. Such replacements will be implemented primarily where the lower roads are contributing sediment to streams and where cable yarding is technically and economically feasible. Most roads that are replaced will be abandoned consistent with the CFPRs; they will be left impassible with functioning erosion controls that need little or no maintenance. In a few such cases, however, the lower roads will be maintained in the road network for administrative use, including periodic log hauling.

Borrow pits from which road surfacing materials are excavated will be managed in conformance with applicable regulations of the Surface Mining and Reclamation Act of 1975. Specifically, surface runoff from such pits will be controlled to protect surrounding land and water resources from erosion, sedimentation, and contamination, and the slope stability of quarry faces will be suitable for safe use of the area following closure of each pit.

Watershed Hazard Assessment and Remediation

A registered geologist (RG) or certified engineering geologist (CEG) will review existing geologic data and supplement such data with additional available data and field reconnaissance to enhance the map of known unstable and eroded areas shown in Chapter 3 to a level of accuracy and completeness suitable for programmatic environmental compliance. No timber operations will be conducted in a planning watershed (PW) under this PTEIR unless such mapping for the specified PW has been completed by a RG or CEG. Based on this review and mapping, the RG or CEG will develop mitigation measures to avoid significant impacts resulting from disturbance of unstable areas. Such mitigation measures will be incorporated into PTHPs that include unstable areas. Until such mitigation measures have been developed, all timber operations involving unstable areas will meet the applicable resource protection standards specified in the CFPRs.

Hearst will conduct an ownership-wide inventory of major watershed hazards over the next 2 years to identify conditions such as unstable areas, sensitive watercourses, perched sediment stores, and stream crossings with high diversion potential (i.e., crossings where culvert failure and subsequent diversion of a stream are likely to cause gullying) that constitute substantial hazards of erosion and stream sedimentation (see attachment to Appendix C). Based on this inventory, hazardous areas will be evaluated to determine the feasibility of hazard remediation projects, and the cost-effectiveness of feasible projects. A schedule will then be developed for implementation of cost-effective remediation projects.

Following the initial inventory, watershed ~~Watershed~~ hazards will continue to be inventoried on an ongoing basis as part of the normal work responsibilities of the Hearst forestry staff. ~~be reinventoried each decade. Hazard inventories will also be conducted following the occurrence of storm events with a return interval of at least 50 years.~~ (Culverts and other drainage structures on the ownership are generally designed to accommodate a 50-year storm.)

Fuel Management

Hearst will continue its program of managing forest fuels by treating (i.e., lopping, chipping, or burning) logging slash in all harvest units, and by harvesting and chipping small trees in dense stands as market conditions allow.

Best Management Practices

Best management practice (BMP) is a term taken from the federal Clean Water Act referring to management practices and standards designed to protect the beneficial uses of water from impairment resulting from nonpoint pollution sources. Hearst has developed a set of BMPs designed to protect soil and habitat resources, in addition to water quality; they are presented in Appendix C. The BMPs consist primarily of:

- selected operational CFPRs;
- standards consistent with, and in some cases in exceedance of, the CFPRs that have been implemented on Hearst Forests historically and have consistently performed successfully from the standpoint of both operational effectiveness and resource protection;
- alternative or in-lieu practices that have historically been implemented on Hearst Forests and have consistently performed successfully; and
- additional alternative practices with which Hearst has relatively little experience, but which could be applied in the future and therefore were identified and analyzed in this EIR.

Alternative and In-Lieu Practices

The CFPRs recognize the impossibility of prescribing within a single body of regulation all management practices and standards constituting the best means to accomplish a wide range of objectives throughout the state or even a forest practice district. The CFPRs expressly allow timberland owners to propose alternative or in-lieu practices and standards to accomplish most of the resource protection objectives of the Forest Practice Act and other applicable laws, so long as the alternative approaches are explained and justified and would not result in significant environmental impacts. Hearst has repeatedly incorporated several alternative and in-lieu practices into its THPs in the past that are similar to those proposed for use in the future (see Table G-1). Nearly all of these practices involved construction or use of facilities (roads, skid trails, or landings) either within watercourse and lake protection zones (WLPZs), or in or adjacent to Class III watercourses. In all cases, such practices were determined to have accomplished the relevant resource protection objectives, either through interagency preharvest inspections or through CDF's work completion reporting process.

Table G-2 lists in-lieu or alternative practices that could be used in site-specific situations in the future. The CFPRs addressing PTEIRs require alternative practices that are to be implemented as part of a proposed project to be identified and analyzed in the EIR to demonstrate that such practices would not result in significant environmental impacts and would provide resource protection equal to or better than the standard practices. Most of these practices are similar to those that have been successfully implemented in the past; Hearst's record of performance indicates that use of the proposed in-lieu and alternative practices will not result in significant environmental impacts. Mitigation measures that would be implemented in conjunction with these practices to ensure that no significant impacts would result are also shown in these tables. In most cases, in-lieu or alternative practices will be used only where use of a standard practice (e.g., relocating facilities outside of a WLPZ) would, in the judgment of the RPF based on direct onsite assessment, result in greater impacts than the proposed in-lieu or alternative practice. Satisfactory performance of such practices will be ensured through the adaptive management process incorporated into the monitoring plan for Hearst Forests (see Appendix B). If monitoring shows that a WLPZ road cannot be used without causing substantial erosion and sedimentation, for example, the road will be abandoned.

In addition to ongoing monitoring of in-lieu and alternative practices and their corresponding mitigation measures, the Hearst RPF will consider the need for additional mitigation measures not specified in this PTEIR to address site-specific resource concerns in the context of project-level PTHPs. If, in the judgment of the Hearst RPF and the CDF forest practice inspector, additional measures are needed to provide resource protection at least equal to that provided by the standard practices, such measures will be described in the PTHP and implemented as part of the subsequent timber operations.

Implementing some of these practices could affect watershed resources; these effects are discussed in Chapter 3, "Watershed Assessment". No other resources are expected to be substantially affected by their use.

Resource Monitoring

An important part of Hearst's resource management program is ongoing monitoring to determine whether management practices are being implemented in conformance with applicable standards and whether such practices are achieving their objectives regarding resource protection. Applicable management standards include all operational aspects of the CFPRs (except for the in-lieu and alternative practices discussed above) and Hearst's internal policies and guidelines, including those specified in its northern spotted owl management plan and the BMPs specified in Appendix C. The resource protection objectives to be achieved by meeting these standards include the objectives specified above under "Background"; CEQA's goals regarding environmental protection (CEQA Guidelines Section 15002 [a][3]); and the CFPRs' goals regarding harvesting practices and erosion control (14 CCR 934), site preparation (14 CCR 935), watercourse and lake protection (14 CCR 936), and wildlife protection (14 CCR 939).

The Hearst Forests resource monitoring program is described in Appendix B. It includes the following elements:

- validation monitoring to determine whether the key assumptions in this EIR are correct,
- compliance monitoring to determine primarily whether Hearst is appropriately implementing the BMPs described in Appendix C, and
- effectiveness monitoring to evaluate primarily the effectiveness of the in-lieu and alternative practices described in Appendix G in protecting soil resources and the beneficial uses of surface water.

POTENTIAL IMPACTS CONSIDERED TO BE LESS THAN SIGNIFICANT

Potential impacts of the proposed project and alternatives on air and recreation resources would be less than significant and are not analyzed in the program EIR.

Air Resources

Small airborne particulates (i.e., PM10 [particulate matter smaller than 10 microns in diameter] and PM2.5 [particulate matter smaller than 2.5 microns in diameter]) are generated by operation of heavy equipment and by burning, including wildfires, broadcast burning of harvest units, and burning of slash piles. Although Siskiyou and Shasta Counties are designated by the California Air Resources Board as nonattainment areas for PM10, air quality is generally very high in the project vicinity. For example, no exceedances of state standards for airborne particulates have been detected at Mount Shasta, the particulate monitoring station nearest to Hearst Forests. All prescribed burning on Hearst Forests will be conducted pursuant to permits issued by the Siskiyou or Shasta County Air Pollution Control District or other authorized permitting agency.

Recreation

Hearst Forests is available for recreational use exclusively by members of the Hearst family and their guests. Recreational use within the property by the general public is restricted to driving on public roads, boating and fishing in McCloud Reservoir, and noncommercial rafting on the McCloud River. Implementing the proposed project or one of the alternatives would not affect recreational opportunities or use.

ALTERNATIVES TO THE PROPOSED PROJECT

CEQA requires that EIRs evaluate a range of feasible alternatives that meet the basic project objectives, focusing on alternatives capable of reducing the proposed project's significant environmental impacts. This program EIR evaluates two alternatives to the proposed project, the No-Project Alternative and the Intensive Management Alternative.

No-Project Alternative

Under the No-Project Alternative, Hearst Forests would receive minimal custodial management, including maintenance of the road network and surveillance to minimize wildfire, theft, and vandalism. No commercial timber harvesting, construction projects incidental to timber harvesting, or fuel management would be undertaken.

Intensive Management Alternative

Under this alternative, timber harvesting and incidental construction would occur at the maximum rate consistent with the CFPRs, including the provisions addressing MSP (14 CCR 933.10). Although most harvesting would involve partial cutting, regeneration harvests of up to 20 acres resulting in even-aged stand structures would be implemented where appropriate. The northern goshawk adaptive management plan, the MOU between Hearst and DFG, and the BMPs discussed above as part of the proposed project would also be implemented under this alternative. The northern spotted owl management plan, including the LSMZ system described above, however, would not be implemented.

Chapter 3. Watershed Assessment

ENVIRONMENTAL SETTING

Study Area Overview

Hearst Forests consists of the Wyntoon Tract, within the McCloud River basin, and the Kosk Creek Tract, within the Pit River basin. In conformance with direction specified in the CFPRs for preparation of sustained yield plans (SYPs), this watershed assessment is based on analysis of planning watersheds (PWs) constituting subunits of the McCloud and Pit River basins. A PW is the contiguous land base and associated watershed system that forms a fourth-order watershed or other watershed typically between 3,000 and 10,000 acres in extent. (A fourth-order watershed is the drainage area associated with a fourth-order stream. Stream order is determined by the stream's tributary structure. A first-order stream has no tributaries; a second-order stream is downstream of a confluence involving a first-order stream. A fourth-order stream is downstream of a confluence involving a third-order stream.)

CDF has divided California into a system of PWs called the Calwater watersheds that are suitable units for watershed assessment in SYPs. This assessment was based on Calwater watersheds except for two cases in which modifications to Calwater boundaries were made, primarily to increase physiographic uniformity and hydrologic connectivity within PWs. These modifications to the Calwater boundaries were made in consultation with a CDF hydrologist (Cafferata pers. comm.). They were:

- formation of the McCloud Reservoir PW primarily from the Tarantula Gulch and Lick Creek subbasins of the Wyntoon PW and the Battle Creek, Panther Creek, and Lizard Creek subbasins of the Skunk Hill PW, plus a small acreage from the Star City Creek PW adjacent to the reservoir (Figure 3-1), and

- combination of the Curtis and Devils Canyon PWs into a single PW (Figure 3-1).

The McCloud Reservoir PW was formed as an analysis unit primarily to separate the relatively steep southern portion of the Wyntoon PW from its flatter northern portion, which is part of the area known as McCloud Flats. The northern portion of the Skunk Hill PW (including the Battle Creek, Panther Creek, and Lizard Creek subbasins) was included in the McCloud Reservoir PW because it is tributary to McCloud Reservoir and almost entirely within the Hearst ownership. The extreme southern portion of the Skunk Hill PW, including 955 acres of the ownership, is tributary to the McCloud River downstream of the reservoir.

The Curtis and Devils Canyon PWs were combined because they are highly connected hydrologically in that they jointly constitute the majority of the Kosk Creek watershed. The earlier division of the Kosk Creek watershed into its Devils Canyon and Curtis subbasins within the Calwater system had been motivated primarily by the objective of forming PWs that did not substantially exceed 10,000 acres, rather than by hydrologic or other physical criteria.

The study area for this watershed assessment includes the Wyntoon, McCloud Reservoir, Curtis-Devils Canyon, Angel Creek, and Star City Creek PWs, including the portions of these PWs outside the Hearst ownership (Figure 3-1). These five PWs include a total of 55,960 acres of Hearst Forests, or 92% of the entire ownership (Table 3-1). Among these five PWs, the portion of the PW under Hearst ownership ranges from 64% (for the Curtis-Devils Canyon PW) to 98% (for the Star City Creek PW).

In cases in which SYP submitters own a small percentage of a PW, CDF has indicated that the submitter has the option of conducting low-intensity watershed analysis of such PWs in the SYP, provided that additional assessment of cumulative watershed effects is conducted as part of subsequent THPs (Munn pers. comm.). Based on this direction, 13 additional PWs, small portions of which are in the Hearst ownership, were excluded from this assessment (Figure 3-1). The Hearst-owned portions of these 13 PWs total 4,633 acres, or 8% of the ownership, and the proportion of these watersheds owned by Hearst ranges from less than 1% to 21% (Table 3-1).

Objectives

The main objective of this watershed assessment is to determine whether proposed timber operations would, in conjunction with other past, present, or foreseeable future activities, result in cumulative watershed effects (CWEs) that would impair the beneficial uses of the study area's surface waters. Making such determinations requires information on the existing conditions of the study area watersheds, including the beneficial uses of waters and areas where key watershed processes (e.g., erosion, hydrology, or riparian function) have been substantially affected by natural disturbances or management activities, and on the capability of the watersheds to accommodate future disturbance without incurring substantial adverse effects on watershed function or beneficial uses. The results of the assessment are intended to identify conditions under which significant CWEs could result from timber operations, indicate whether the BMPs identified in Chapter 2 and Appendix C are adequate to prevent the occurrence of significant CWEs, and describe situations in which additional mitigation measures should be implemented to prevent or minimize such impacts.

Methodology

Phases of Analysis and the Watershed Assessment Model

The proposed approach to watershed management on Hearst Forests encompasses three phases of analysis, the first of which is embodied in this watershed assessment, and the latter two

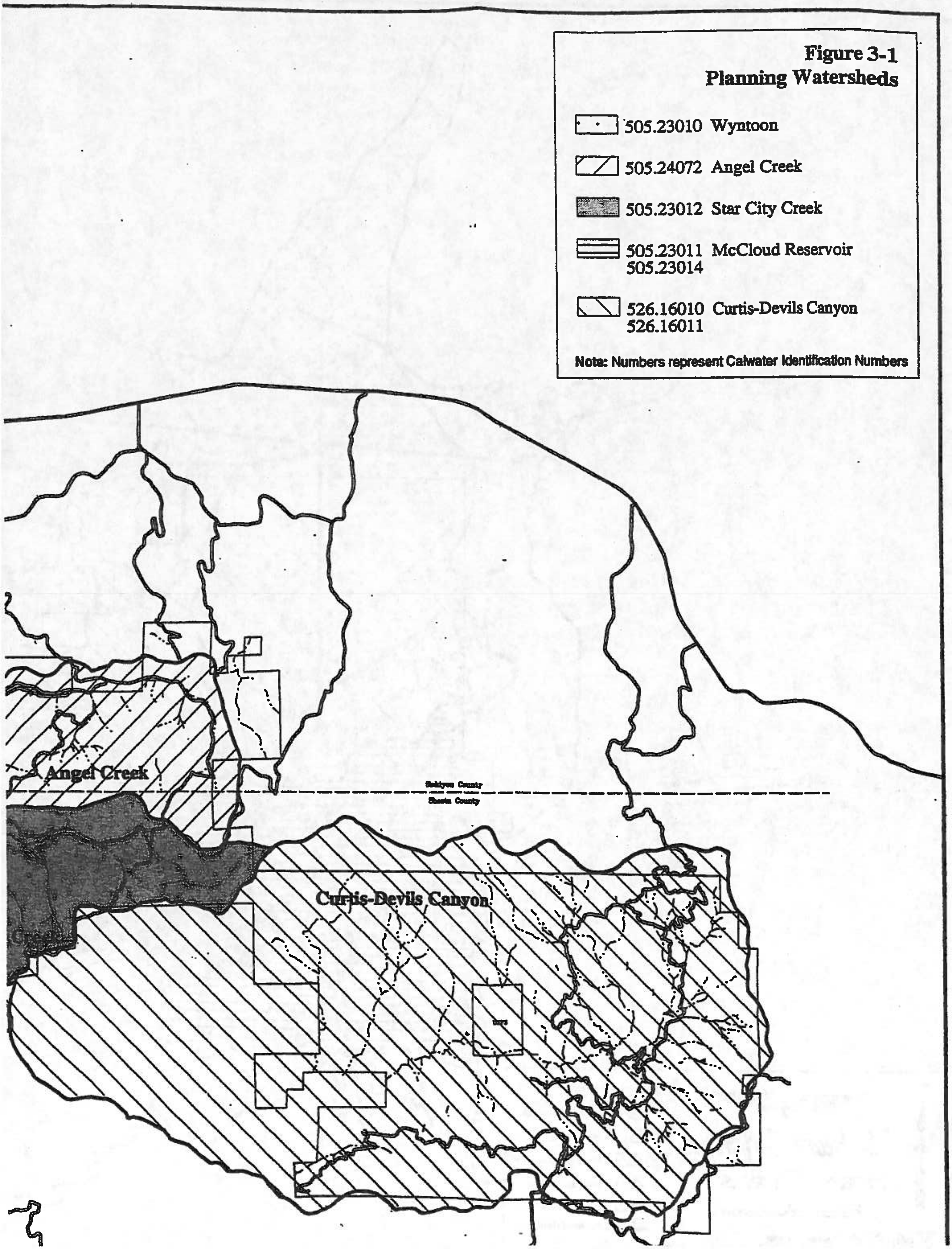


Figure 3-1
Planning Watersheds

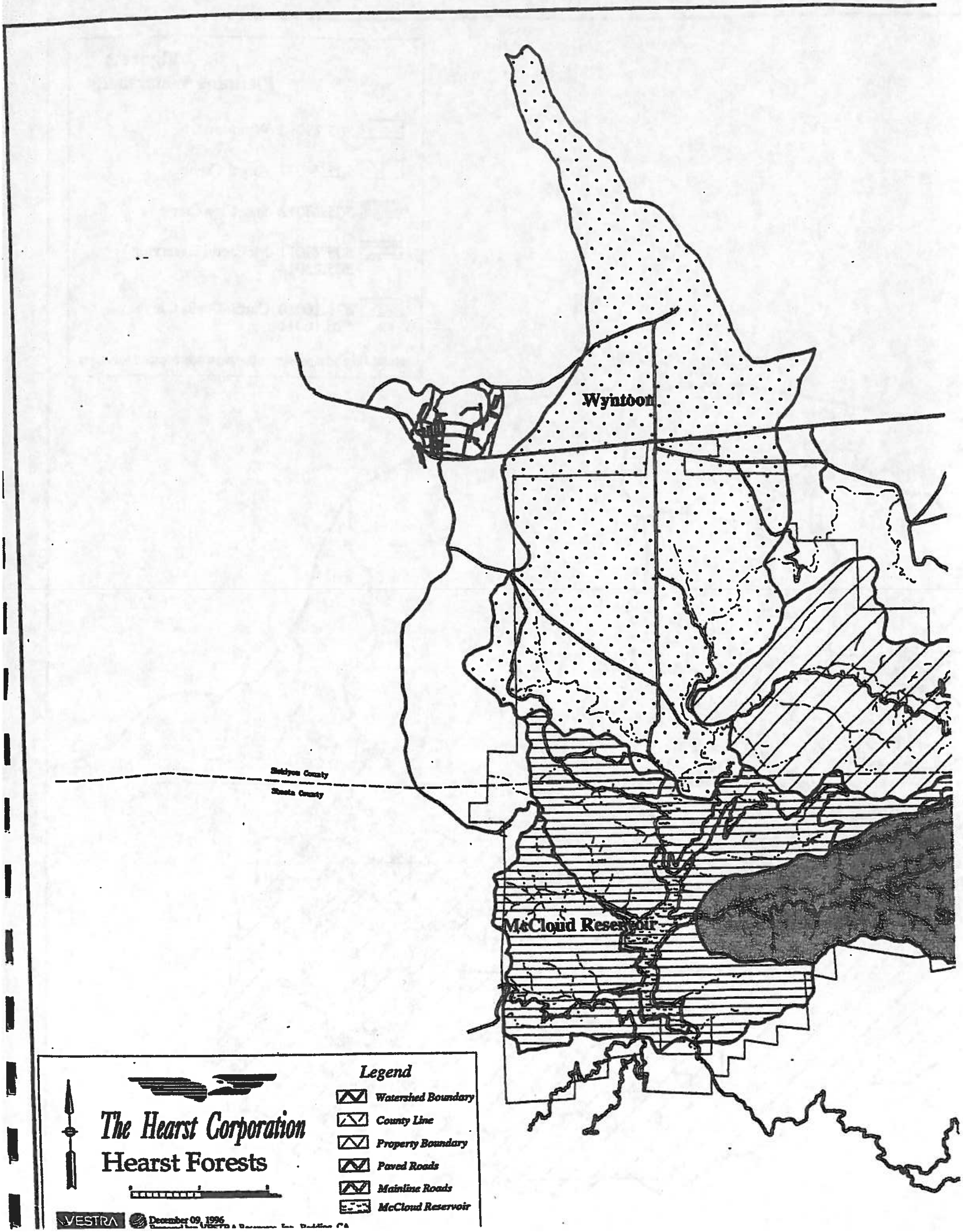

Wyntoon
Siskiyou County
Shasta County
McCloud Reservoir
The Hearst Corporation
Hearst Forests
Legend
Watershed Boundary
County Line
Property Boundary
Paved Roads
Mainline Roads
McCloud Reservoir
VESTRA
December 09, 1996

Table 3-1. Planning Watershed Acreages

Planning Watershed	Total Acres	Hearst Acres	Percentage Owned by Hearst
Wyntoon	17,533	9,643	55
McCloud Reservoir	10,521	10,134	96
Angel Creek	10,640	10,036	94
Star City Creek	8,113	7,979	98
Curtis-Devils Canyon	28,674	18,168	64
Ladybug Creek	10,294	298	3
Hawkins Creek	11,392	429	4
Skunk Hill	4,450	955	21
Tate Creek	9,212	1,083	12
Fowler Falls	15,044	916	6
Nelson Creek	13,621	120	9
Clark Creek	12,491	435	3
Rock Creek	11,292	183	2
Kemp	8,732	62	0.7
Upper Squaw Valley Creek	13,442	727	5
Middle Squaw Valley Creek	9,993	87	0.9
Racoon Creek	15,525	5	0.03
Stump Creek	11,246	17	0.2

of which depend on the results of this assessment and will be conducted in conjunction with implementation of the proposed project. This phasing of the watershed analysis is consistent with the tiering of subsequent activities (i.e., project-level timber operations) to this program EIR, as provided for by the State CEQA Guidelines. The first phase of analysis is based in part on the Cumulative Offsite Watershed Effects Analysis Process developed by the Eldorado National Forest (Carlson and Christiansen 1993) and on making the maximum possible use of available resource information. If this phase of analysis indicates that insufficient baseline resource information is available to adequately describe the condition or sensitivity of a watershed, or that a specific watershed is particularly sensitive to disturbance and thus requires more detailed, site-specific analysis, additional analysis (the second phase) will be conducted during implementation of the proposed project. The third analysis phase will consist of ongoing resource monitoring to validate the key assumptions underlying this assessment, assess compliance of timber operations with BMPs specified in this EIR, and assess the effectiveness of the BMPs in meeting their resource-protection objectives.

The Eldorado National Forest's CWE Analysis Process (Carlson and Christiansen 1993) is based on the following process:

1. Calculate the natural sensitivity index (NSI), threshold of concern (TOC), and equivalent roaded area (ERA) for each PW, and compare the TOC to the ERA.

2. Based on the ratio of ERA to TOC, evaluate the reliability of the information that was used to calculate the NSI and ERA.

3. Using resource information independent of that used in Step 1, evaluate the condition of hill slopes and stream channels in the watershed.

4. If inadequate independent information is available to reliably assess hill slope and channel conditions, conduct additional site-specific analysis as needed.

5. Based on the results of Steps 1-4, design and implement projects incorporating adequate resource protection to avoid significant CWEs.

The CWE analysis process involves compiling data for each PW to characterize its natural sensitivity to disturbance (NSI). This sensitivity evaluation considers factors related to runoff processes, precipitation regime, sediment delivery processes, and drainage basin and channel morphology. It also calculates a cumulative disturbance index (ERA), which represents a summation of historical and projected disturbances by type and extent of disturbance and its year of occurrence. Except for permanent features such as roads and landings, disturbances related to timber operations (e.g., timber harvesting and use of skid trails) are assumed to gradually recover over time so that, after a period of at least 10 years has elapsed, the watershed functions approximately as it did before the disturbance. For this assessment, information on historical disturbances was compiled for the past period 1985-1996. Earlier disturbance was not taken into account in the ERA assessments because no evidence of ongoing sediment discharge related to older logging was observed during the 1995-1996 surveys of Angel and Star City Creeks or the reconnaissance surveys conducted for this EIR, because the cumulative impact assessment guidelines in the CFPRs reference a 10-year period for analysis of past projects, and because consistent data on areas harvested before 1985 were not available. NSI and ERA assessments for each of the study area PWs are summarized in Table 3-2 and in Appendix D.

Although the formulas used to calculate the NSIs and TOCs for this assessment were obtained from a model developed for the Eldorado National Forest located in the central Sierra Nevada, they are applicable to the southern Cascades because:

- the Eldorado National Forest's model is an application of the U.S. Forest Service's (Forest Service's) Cumulative Off-Site Watershed Effects Analysis Process, which has been adopted throughout the Pacific Southwest Region (California);

- the Eldorado National Forest's model is better documented than comparable models for any other national forest in the region;

- most of the soils on Hearst Forests are similar to those on the Eldorado National Forest; and

- as discussed below for specific planning watersheds, NSI and TOC results obtained by applying the Eldorado National Forest's model to Hearst Forests are similar to those that the Shasta National Forest obtained by applying its version of the analysis process to fifth-order watersheds adjacent to Hearst Forests.

Watersheds gradually recover from most forms of disturbance. Precise rates of recovery of montane watersheds from various types of disturbance are not generally known, however, and are not known for the study area. The Forest Service model used for this watershed analysis uses the assumption that recovery from timber harvesting with tractor yarding approximates a logarithmic curve, which asymptotically approaches a limit corresponding to the proportion of the landscape allocated to permanent skid trails. Rather than allowing the user to specify the acreage allocated to skid trails (as it does for roads and landings), the model accounts for skid-trail disturbance through its recovery-rate assumptions. It also assumes that a specified amount of new skid-trail construction accompanies each acre of tractor logging, regardless of whether new skid trails are in fact needed. Not only are skid trails assumed never to recover, but new skid trails are assumed to be constructed during every cutting cycle.

In reality, nearly all lands yarded by tractor on Hearst Forests have been harvested repeatedly, have a complete skid trail system in place, and will be harvested in the future with little or no construction of new skid trails. The tractor-logging recovery assumptions in the Forest Service model are thus highly conservative; they substantially underestimate watershed recovery and overstate ERA. This result is indicated in Appendix D for the Wyntoon PW under the No-Project Alternative, where disturbance related to historical tractor logging is estimated to result in disturbance equivalent to 510.5 acres of roads 20 years following the last harvest.

Independent information used in Step 3 included published and unpublished technical reports primarily on study area aquatic habitats; aerial photographs and topographic maps used to assess stream channel types and sensitivities and riparian-zone canopy densities and structures; channel

Table 3-2. Natural Sensitivity Index, Threshold of Concern, and Equivalent Roaded Area by Planning Watershed

			Equivalent Roaded Area							
			Existing Condition		No-Project Alternative (2016 condition)		Proposed Project (2016 condition)		Intensive Management Alternative (2016 condition)	
Planning Watershed	Natural Sensitivity Index	Threshold of Concern Percentage	Acres	Fraction of Threshold of Concern	Acres	Fraction of Threshold of Concern	Acres	Fraction of Threshold of Concern	Acres	Fraction of Threshold of Concern
Wyntoon	13	19	916	0.28	753	0.23	1,936	0.58	3,131	0.94
McCloud Reservoir	96	13	431	0.31	359	0.26	882	0.64	1,028	0.75
Angel Creek	54	15	793	0.43	634	~~0.25~~ 0.35	1,369	0.76	1,533	0.85
Star City Creek	94	13	388	0.37	303	0.29	708	0.67	703	0.67
Curtis-Devils Canyon	71	15	393	0.09	315	0.07	1,564	0.36	1,996	0.46

surveys of Angel and Star City Creeks; locations and descriptions of unstable areas and eroded areas mapped by professional geologists and foresters; and reconnaissance surveys conducted for this EIR.

One of the principal weaknesses in the Forest Service model is that it attributes relative disturbance impact (i.e., ERA) to roads and other disturbances irrespective of their location in the watershed. In reality, disturbances located near streams typically have substantially greater potential to cause CWEs than disturbances located upslope from streams (McGurk and Fong 1995). To test the potential for bias to result from the implicit assumption that ERA is independent of location in the watershed, a sensitivity analysis was conducted whereby ERA was recalculated for each PW based on assigning a weight of 3.0 to roads located within 328 feet (100 meters) of a Class I or Class II stream and a weight of 0.5 to roads more than 328 feet from such streams.

Results of this sensitivity analysis indicated virtually no potential bias from the Forest Service model's assumption that ERA is independent of road location in the watershed. Differences in total ERA (expressed as a percentage of the PW acreage) between the base (unweighted road ERA) case and the sensitivity-analysis (weighted road ERA) case were minimal, not exceeding 0.4% of the watershed acreage for any PW. This sensitivity analysis indicates that the conclusions of the ERA analysis are not sensitive to road locations relative to stream channels and confirms the robustness of the Forest Service model as applied to Hearst Forests.

Additional potential weaknesses of the Forest Service model include insufficient consideration of:

- the impacts of old forest practices, such as tractor logging prior to implementation of the CFPRs in 1974;
- stream channel conditions, which sometimes reflect sedimentation from timber operations that occurred more than 40 years ago; and
- the impacts of additional land use activities, such as mining, grazing, and recreation.

For the application of the Forest Service model to Hearst Forests for this EIR, however, these potential weaknesses are minor because:

- relatively good information on the effects of old logging practices and stream conditions was available and was analyzed independent of the ERA calculations, as discussed above and
- livestock grazing is the only additional land use that could have substantially affected watershed resources on Hearst Forests; no grazing has occurred on the property for more than 5 years, and no impacts of past grazing were observed during surveys conducted for this EIR.

Disturbance History Overview

Logging and related construction of roads, landings, and skid trails have been the principal sources of watershed disturbance on the Hearst ownership. In addition, a few wildfires have disturbed portions of the ownership over the past 50 years. Within the Wyntoon Tract, most of the Wyntoon and McCloud Reservoir PWs were in other ownerships prior to the consolidation of Hearst Forests in 1958-1960. Logging occurred extensively within these PWs beginning around 1900. Logs were transported by horses, oxen, "donkeys" (steam-driven engines that dragged logs overland), and railroads. Logging emphasized removing the most valuable trees (i.e., large pines and Douglas-firs) and leaving behind the less valuable trees.

Commercial cattle grazing occurred historically on Hearst Forests. Cattle numbers were gradually decreased during the 1980s and the remaining cattle were removed around 1990. No impacts of grazing were observed, however, during surveys conducted for this EIR.

No harvesting occurred in the remaining portions of the Wyntoon Tract (including Angel Creek and Star City Creek) or in the Kosk Creek Tract until 1953. Over the next 15 years, trees were logged selectively with the use of crawler tractors and rubber-tired skidders for log yarding; such harvesting was confined to slopes less than 60%. Around 1968, the selection prescription shifted from the objective of leaving approximately 20%-30% of the preharvest timber volume to a diameter limit based on leaving trees less than 20 inches in diameter at breast height (dbh).

Also around 1968, cable yarding systems (e.g., skyline and high-lead yarders) were first used to remove timber from steeper slopes. Because of the difficulty of avoiding damage to residual trees during cable operations, the clearcutting silvicultural method was usually used in conjunction with cable yarding.

Before 1973, logs were frequently skidded down, across, or along stream channels, as was standard industry practice. Such operations substantially affected many stream channels and their associated riparian and aquatic habitats and resulted in large deposits of unconsolidated sediments within the floodplains of several streams. Passage of the Forest Practice Act in 1973 and subsequent implementation of the practices that eventually became Hearst's BMPs (see Appendix C) provided for substantially improved protection of watercourses and adjacent lands.

Forest road networks constructed in California during the 1950s and 1960s were designed primarily to accommodate tractor skidding. They typically included many roads located close to streams. The road network that serves Hearst Forests and other study area timberlands includes a total of 114 miles of roads located within 328 feet (100 meters) of Class I and II streams. Such roads can be a major source of stream sedimentation, particularly if they are not properly maintained. Assuming that road prisms in streamside areas average approximately 40 feet in width (including all cut and fill areas), of approximately 11,900 acres of the Hearst-owned portion of the study area located within 328 feet of Class I or II streams, approximately 550 acres (4.7% of the affected area) consist of road prisms.

Many study area stream crossings consist of culverts, which have greater potential to fail than bridges. Where an approach to a culverted crossing slopes downward away from the crossing, the crossing has high diversion potential because failure (plugging) of the culvert is likely to cause the stream to be diverted down the road and result in large gullies or landslides (Weaver and Hagans 1994). Although no information is currently available on the number or locations of study area crossings with high diversion potential, such information will be compiled over the next 2 years through an ownership-wide baseline watershed hazard assessment (see attachment to Appendix C).

Overview of Unstable Areas, Inner Gorges, and Eroded Areas

Unstable areas located within areas proposed for timber operations are required to be identified, described, and mapped in THPs. Most of the Hearst ownership has been mapped for unstable areas over the past 15 years through the THP process. Such mapping is frequently reviewed by registered geologists on the staff of the California Division of Mines and Geology (DMG). Professional geologists have also conducted extensive field surveys within the ownership to analyze unstable areas in the context of THP preparation, particularly in the Kosk Creek drainage (Earth Science Consultants Associated 1978, Schlosser pers. comm., Miller pers. comm.). Inner gorges were identified as areas immediately adjacent to Class I or II streams with hill slopes exceeding 65%. No site-specific information is available on unstable or eroded areas within the study area but outside the Hearst ownership.

Figure 3-2 shows geomorphically unstable and eroded areas that have been identified in the study area by registered geologists and by Hearst's RPFs. A RG or CEG will review existing geologic data and supplement such data with additional available data and field reconnaissance to revise Figure 3-2 to ensure that its accuracy and completeness are suitable for programmatic environmental compliance. Until such work has been completed for a PW, no timber operations will be conducted in that PW. Classes of unstable and eroded areas mapped on Hearst Forests were based on DMG (Hauge 1977, Manson and Sowma-Bawcom 1992, Schlosser pers. comm.) and CFPR definitions and are described below.

Stabilized Ancient Landslide. Such areas feature hummocky topography as a result of being underlain by massive rotational landsliding (e.g., the Montgomery Creek Formation) that occurred over the past several thousand years but typically support straight mature trees (as opposed to leaning, jackstrawed, or pistol-butted trees), which indicates the absence of mass movement over the past 50 years or longer.

Active Rotational Landslide. Such features are slides in which shearing takes place on a well-defined, concave surface, producing a backward rotation in the displaced mass, often indicated by the presence of leaning, jackstrawed, or pistol-butted trees.

Active Debris Flow. Such features consist of long stretches of bare, generally unstable stream channel banks scoured and eroded by the rapid movement of water-laden debris, commonly triggered by debris sliding in the upper part of a drainage during high-intensity storms.

Active Debris Slide. Such features consist of unconsolidated rock, colluvium, and soil that have moved downslope along a relatively steep, shallow failure plane, forming steep, unvegetated scars prone to raveling in the head region and often forming hummocky deposits in the toe region.

Inner Gorge. Such features consist of oversteepened stream banks extending from the stream channel to the first break in slope above the channel, with slope generally exceeding 65%, formed by mass wasting and erosion caused by the undercutting force of streamflow.

Natural Erosion. Such areas are undisturbed by human activity but feature substantial erosion of rocks and soil resulting from natural processes.

Accelerated Erosion. Such areas feature erosion at a greater rate than natural erosion as a result of human activities that have disturbed soil cover, thus reducing the water infiltration rate and the resistance of the land surface to soil displacement.

Mitigation measures to protect unstable areas from excessive disturbance during timber operations will be developed by a RG or CEG based on a review of unstable areas in Hearst Forests. Such mitigation measures could include the management guidelines for specific types of landslides in forested terrain recommended by the California Division of Mines and Geology (California Department of Conservation 1997). Until such measures have been developed, all timber operations involving unstable areas will conform with all applicable CFPRs. Additional mitigation measures will be adopted as needed to protect unstable areas, based on a site-specific evaluation during timber harvesting planning.

Soils Overview

Soil resource information for this assessment was obtained from the Pondosa area soil and vegetation survey (California Department of Forestry and Fire Protection and U.S. Soil Conservation Service 1992) and the soil survey of the Shasta-Trinity Forest area (U.S. Forest Service and U.S. Soil Conservation Service n.d.). Because the Pondosa soil survey delineated soil units at a higher order than the Shasta-Trinity soil survey, the Pondosa soil survey was generally relied on for areas with overlapping coverage. The Pondosa soil survey provided soils coverage for all areas inside the external boundaries of Hearst Forests within the five PWs constituting the study area, and the Shasta-Trinity soil survey coverage was used for areas outside the Hearst ownership.

Both soil surveys used for this assessment mapped soil units at the complex level, meaning that polygons delineated on maps were assigned to soil complexes that are assumed to be made up of specified proportions of component soil series. For example, as shown in Appendix H, the Kindig-Neuns (30%-50% slope) complex is assumed to be composed of Kindig, Neuns, Kettlebelly, and Neer soil series in the following areal proportions: 45%, 35%, 10%, and 10%. A soil series consists of a soil type associated with a specified slope class. Specific locations of individual soil series within polygons were not delineated on the soil survey maps.

The key soil attribute relevant to the assessment of watershed impacts of timber operations is erodability. Two approaches were used to assess the erosion hazard rating (EHR) for study area soils. The first approach is based on the BOF's procedure for estimating surface soil EHR in THPs as specified in Technical Rule Addendum Number 1 to the CFPRs (California Board of Forestry 1981). This procedure assigns numerical ratings to factors, including physical soil characteristics (i.e., texture, depth, and percent cover of coarse surface fragments), slope, vegetative cover, and

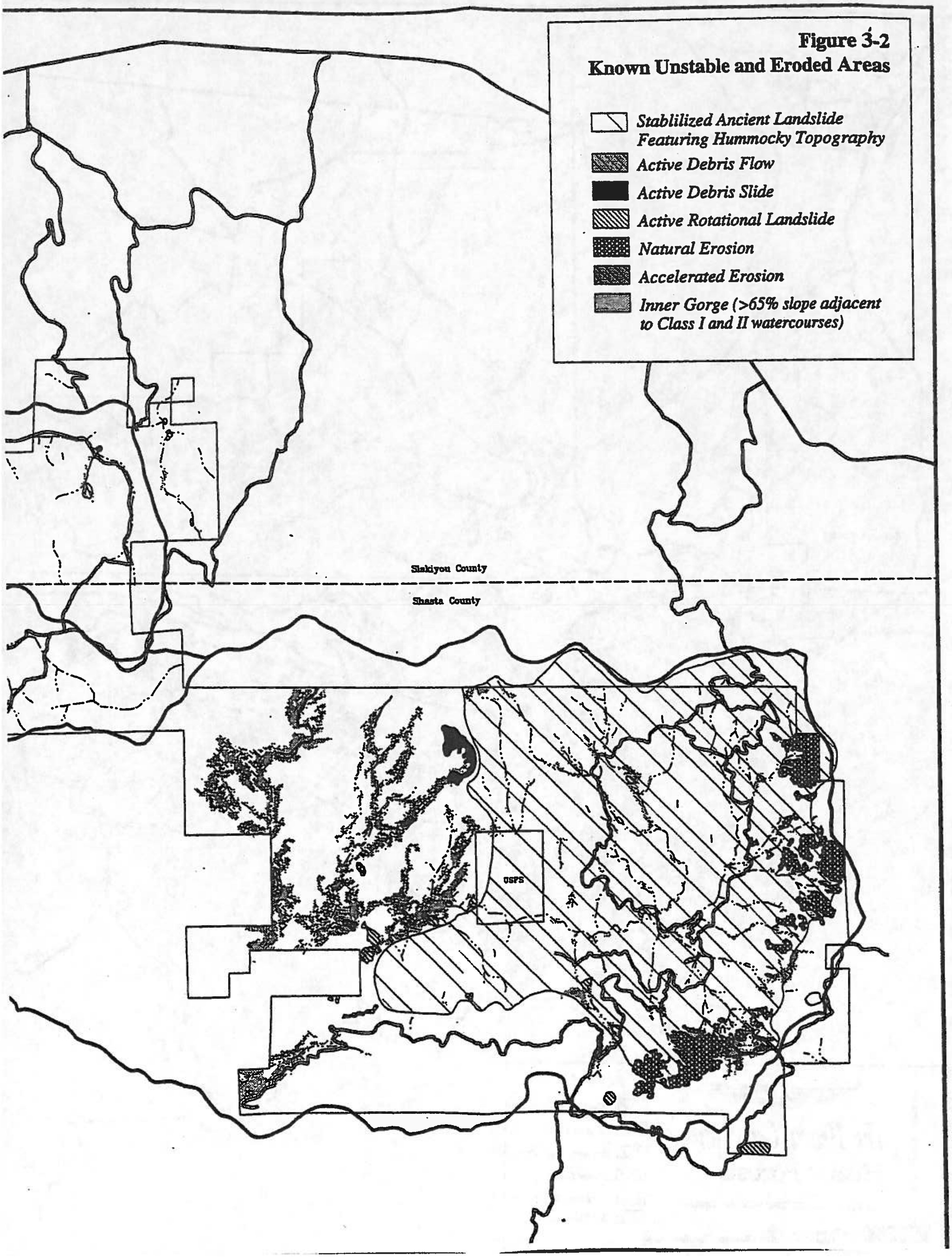
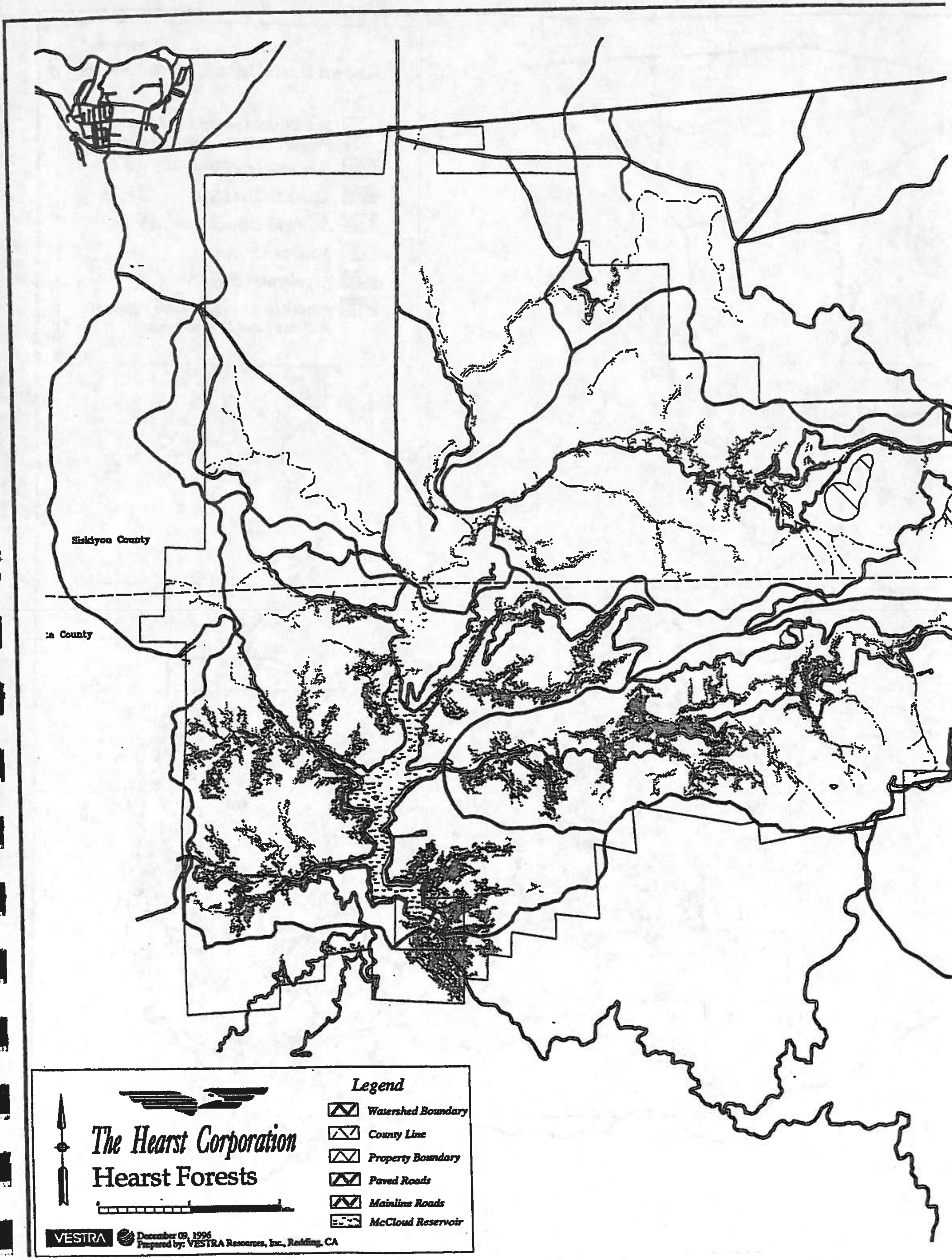


Figure 3-2
Known Unstable and Eroded Areas
Stablilized Ancient Landslide Featuring Hummocky Topography
Active Debris Flow
Active Debris Slide
Active Rotational Landslide
Natural Erosion
Accelerated Erosion
Inner Gorge (>65% slope adjacent to Class I and II watercourses)
Siskiyou County
Shasta County
USFS


Siskiyou County
a County
Legend
Watershed Boundary
County Line
Property Boundary
Paved Roads
Mainline Roads
McCloud Reservoir
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Hearst Forests
VESTRA
December 09, 1996
Prepared by: VESTRA Resources, Inc., Redding, CA

precipitation regime. EHRs were assessed for each mapped soil complex by assignment of a numerical rating for each factor to each soil series within the complex, and by calculation of a weighted-average rating for each factor based on the relative extent of each soil series present in the complex. Factor-specific ratings were then summed to obtain the total score for the complex, which determined the qualitative EHR (low, moderate, high, or extreme) to be assigned to the complex. This analysis was conducted only for soil complexes that are found on the Hearst ownership; results of the analysis are depicted in Figure 3-3.

The second approach to assessing EHR is based on the procedure used by the Forest Service in Region 5 (California). This procedure is based exclusively on physical soil characteristics and is applied to specific soil series. Because the Forest Service procedure assigns EHRs to specific soil series, the locations of which were not delineated in the soil resource inventory, they cannot be mapped. Similarly, because the Forest Service procedure results in a non-numerical, qualitative EHR (low, moderate, high, or very high), EHRs for soil series cannot be averaged to derive EHRs for soil complexes, as was done using the BOF procedure. Total areas within EHR classes were estimated for each PW, however, based on the total polygon acreage in each soil complex and the proportionate composition of each complex by its component soil series (Appendix H). EHRs based on this procedure were assigned to all soil series found within the five-PW study area, including lands both on and off the Hearst ownership.

The results of the EHR analysis based on the Forest Service procedure (i.e., the extent of lands with high and very high EHR) were used in assessing the NSI of each PW in applying the CWE analysis process in this watershed assessment. A comparison of the results of applying the two EHR procedures to the study area shows that the Forest Service approach is substantially more conservative than the BOF procedure in that the proportion of each PW determined to have a high or very high EHR based on use of the Forest Service procedure is much higher than the proportion determined to have a high or extreme EHR based on use of the BOF procedure (Table 3-3).

Table 3-3. Comparison of Erosion Hazard Rating for the Study Area Watersheds Using the Forest Service and Board of Forestry Procedures

	Percentage of Watershed			
	Forest Service Procedure		Board of Forestry Procedure	
Planning Watershed	High EHR[a]	Very High EHR[a]	High EHR[b]	Extreme EHR[b]
Wyntoon	0.7	2.2	0	0
McCloud Reservoir	0	42.1	6.4	0
Angel Creek	0.6	31.4	0	0
Star City Creek	6.3	44.0	16.8	0
Curtis-Devils Canyon	16.7	27.4	17.9	0.3
Total Study Area	7.3	20.5	11.8	0.1

[a] Based on U.S. Forest Service procedure; percentages refer to entire planning watershed.
[b] Based on California Board of Forestry procedure; percentages refer to Hearst-owned portion of watershed.

Reasons for the comparatively low EHRs resulting from use of the BOF procedure are the relatively high ratings for vegetative cover and low ratings for slope typical of Hearst lands. One reason for the relatively high EHRs resulting from use of the Forest Service procedure is that this system assumes that soils are bare of vegetation whereas, in fact, the ownership supports nearly continuous forest cover; the assumption of bare soils thus results in a major overstatement of EHR. Another reason for the high EHRs with the Forest Service procedure is that many soil series were classified by the soil resource inventory as having "high/very high" EHR. In all such cases, the conservative assumption was made that the series' EHR was very high. The analysis of the natural sensitivity of watersheds (i.e., the NSI module of the CWE analysis process), which used the Forest Service EHR system, is thus highly conservative and tends to underestimate TOC.

None of the soil series in the study area are classified by the Forest Service as prone to gully erosion, a factor considered in calculating NSIs (Van Susteren pers. comm.).

Standard mitigation measures to protect highly erodible areas from disturbance during timber operations are specified below under "Impacts and Mitigation Measures". Additional mitigation measures will be adopted as needed to protect erodible areas, based on a site-specific evaluation during timber harvesting planning.

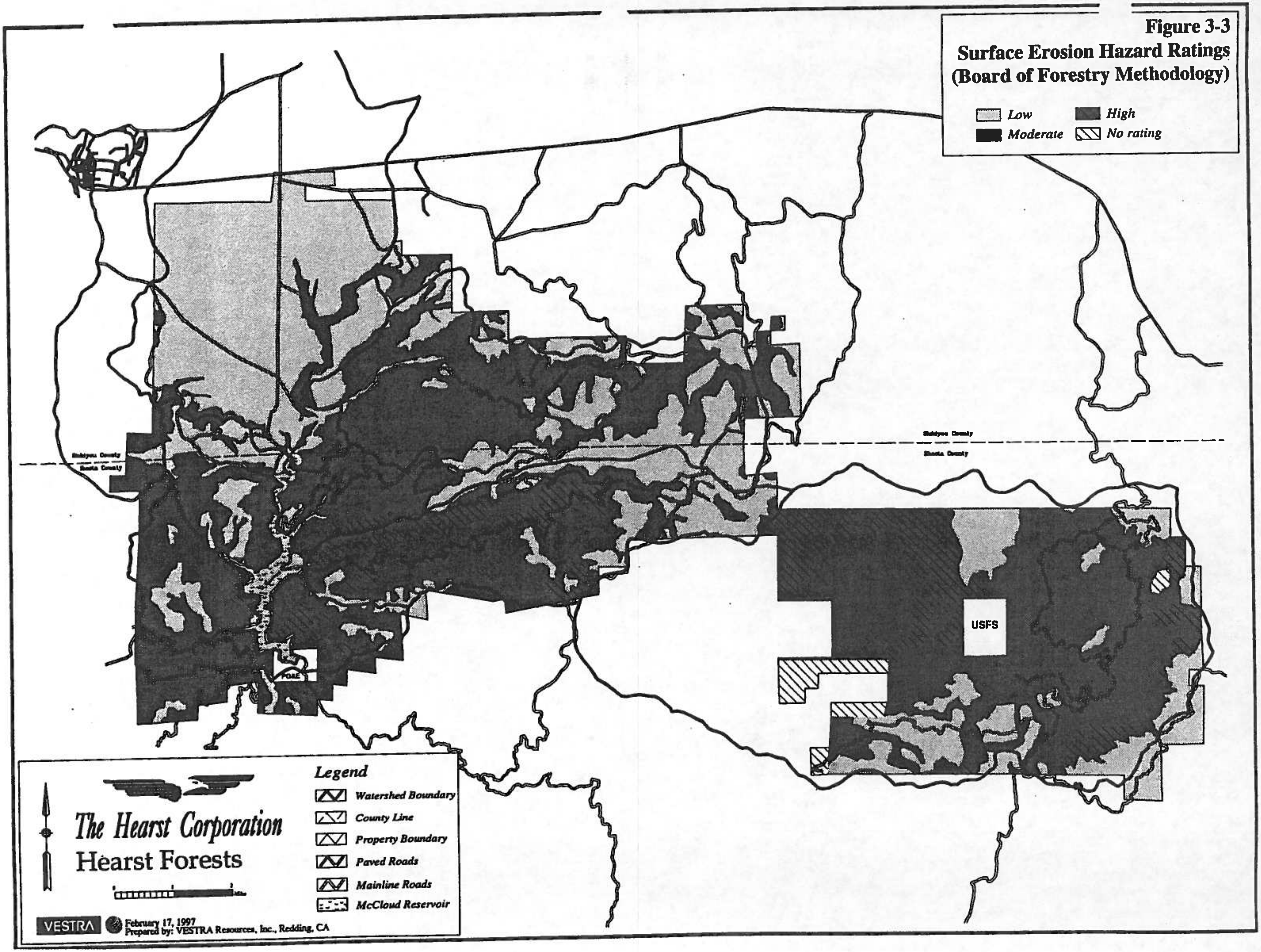
Figure 3-3
Surface Erosion Hazard Ratings
(Board of Forestry Methodology)
Low
High
Moderate
No rating
Siskiyou County
Shasta County
USFS
Legend
Watershed Boundary
County Line
Property Boundary
Paved Roads
Mainline Roads
McCloud Reservoir
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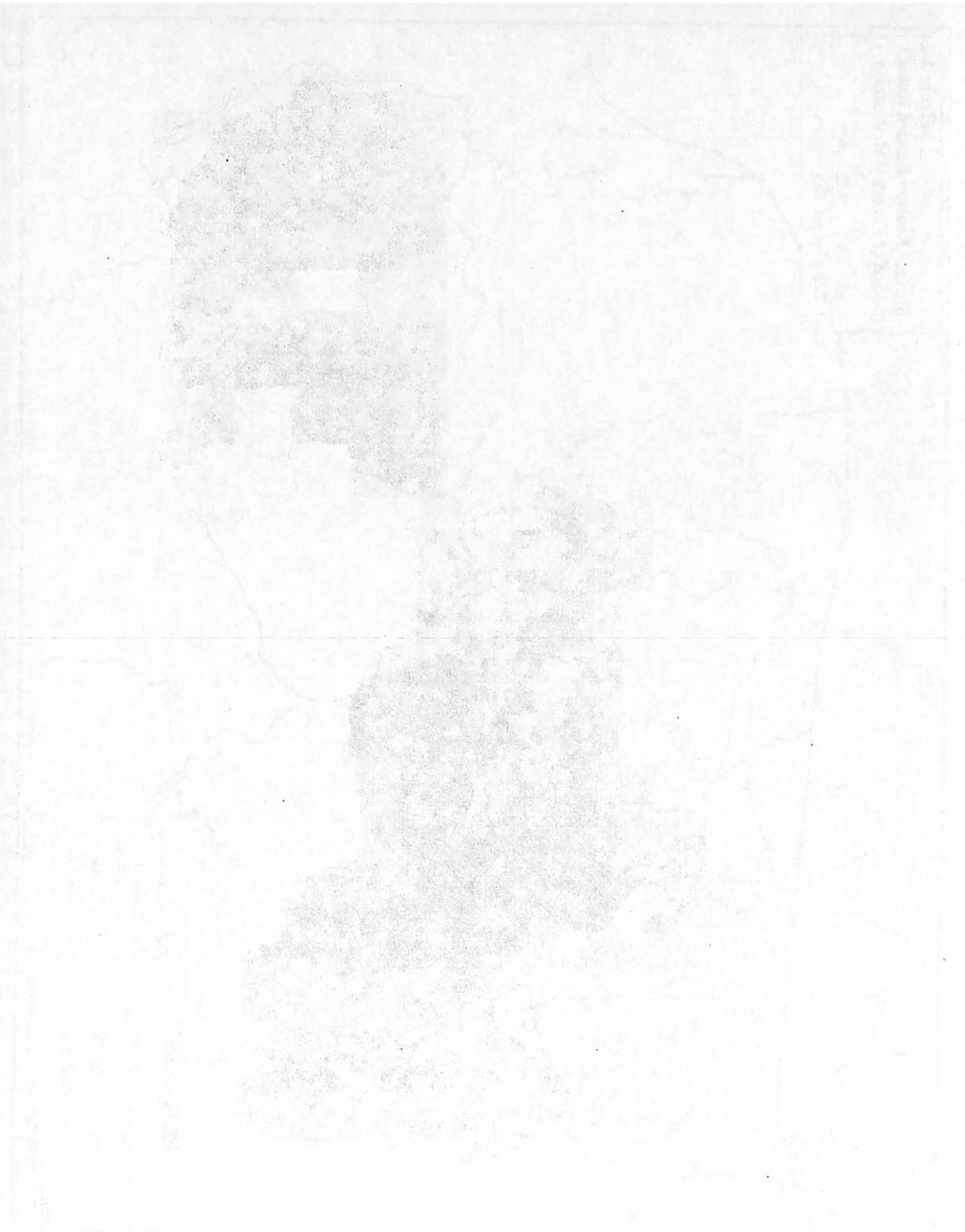
Hearst Forests
VESTRA
February 17, 1997
Prepared by: VESTRA Resources, Inc., Redding, CA



Hydrology Overview

Throughout the study area, approximately 85% of the annual precipitation occurs between October and March (National Oceanographic and Atmospheric Administration 1995), and the average 2-year, 1-hour rainfall intensity (i.e., the expected maximum rainfall during a 1-hour storm in any specified 2-year period) is 1.0 inch (California Department of Water Resources 1976).

Floods are primary causes of changes in stream channel morphology and aquatic habitat quality. Major flood events in the study area usually occur during winter or spring as a result of intense rainstorms falling on and melting large snowpacks.

The flood history of the area is indicated by the historic maximum daily streamflow levels for the McCloud River shown in Figure 3-4. Over the past 63 years, the highest maximum daily flows in the McCloud River (measured just downstream of the Angel Creek confluence) have been approximately 10,000 cubic feet per second (cfs) in 1970 and 1974. The flow associated with a 100-year flood event was estimated at 14,800 cfs (Waananen and Crippen 1977). As indicated by Figure 3-4, the McCloud River is not highly susceptible to extreme peaks in flow in that maximum daily flows were less than 2,000 cfs in approximately half of the years of record, and the highest maximum daily flows on record exceeded the stream's dry-season base flow (roughly 750 cfs) by a factor of less than 3. The stability of the McCloud River flow relative to that of most California rivers is due primarily to the uniformity of the discharge of Big Springs (upstream of the Angel Creek confluence), which accounts for most of the river's flow. Tributaries that drain basins to the east (e.g., Angel and Star City Creeks), for which snowmelt runoff is a more important source of flow, are more likely to experience extreme peaks in flow and flooding damage than the McCloud River.

One of the largest flood events ever recorded in the Sierra-Cascade region of California occurred on January 1, 1997. On that date, the McCloud River flow at the Angel Creek confluence was measured at 15,500 cfs, which exceeds the flow estimated for a 100-year flood event (Schiffer pers. comm.).

In addition to precipitation regime, several other key factors that affect a watershed's natural flooding potential were considered in the NSI calculations summarized in Table 3-2 and Appendix D. They include acreage of rock outcrops and relatively impermeable soils, which determine the propensity of water (rain or snowmelt) to run off as opposed to infiltrating the soil, and the relief ratio (average slope) of the basin, which determines the speed or efficiency with which runoff reaches stream channels.

Soil permeability and runoff efficiency can also be affected by management activities. Reduced transpiration due to logging and soil compaction due to use of heavy equipment and construction of roads and landings cause runoff rates and peak streamflows to increase. Similarly, construction of midslope roads and skid trails can divert and concentrate natural runoff patterns, particularly if the drainage structures associated with such facilities are poorly designed, too widely spaced, or unmaintained. Concentrated runoff can also increase flooding.

ERA is a measure of the extent to which human disturbance and wildfire have reduced soil permeability and increased runoff rates. The CWE analysis process assigns coefficients to all types of disturbance that have occurred or will occur in a watershed. For example, unsurfaced forest roads receive an ERA of 1.0; thus, the watershed impact of all other types of disturbance is assessed relative to that associated with road construction. As shown in Table 3-2 and Appendix D, the ERA for the Wyntoon PW is 916 acres, or 5.2% of the watershed. This means that the cumulative watershed disturbance associated with past management and wildfires has had an estimated effect on watershed processes (e.g., runoff and erosion) approximately equal to that associated with constructing a total of 916 acres of unsurfaced roadways within the same watershed in an otherwise undisturbed condition.

Areas that receive rain while a snowpack is present and that support immature vegetation are relatively susceptible to increased runoff, because such areas often accumulate large volumes of snow that melts rapidly during rainstorms. Substantial portions of the Angel Creek, Star City Creek, and Curtis-Devils Canyon PWs are in elevation ranges that receive a permanent snowpack and where rain-on-snow events are relatively common. As discussed in Chapters 5, "Vegetation", and 6, "Wildlife Resources", however, a large majority of Hearst Forests supports relatively dense, mature vegetation. This condition is the result of limited clearcutting and wildfire over the past 25 years.

Less than 1,100 acres (2% of the ownership) have been burned by wildfire during the past 30 years. Approximately 53,000 acres (87% of the ownership) support forest vegetation, of which only about 2,800 acres (5%) consists of stands classified as seedlings or saplings (California Wildlife Habitat Relationship [WHR] size classes 1 or 2). Nearly all of these immature stands are located in the Angel Creek and Star City Creek PWs, where they account for less than 16% of these PWs. Nearly all of the nonforest vegetation types consist of chaparral stands located in the Curtis-Devils Canyon PW. Although chaparral covers approximately 40% of this PW, a large majority of these stands are mature and dense, and are thus unlikely to accumulate extremely large snowpacks. The preponderance of dense, mature vegetation throughout the PWs in which rain-on-snow events are relatively common indicates that the contribution to flooding potential due to the extensive presence of immature vegetation is low.

Riparian Zone Overview

Riparian zones are areas adjacent to watercourses that support vegetation dependent on or highly tolerant of high soil water tables. Because they are located at the interface between aquatic and upland habitats, they play several key roles that support the proper functioning of montane forest ecosystems, including:

- trapping soil and other potential water pollutants being transported from upslope sources,
- controlling water temperature,
- providing cover and food for fish,
- providing large woody debris (LWD) to streams for maintenance of channel conditions (e.g., pools) supporting suitable fish habitat,

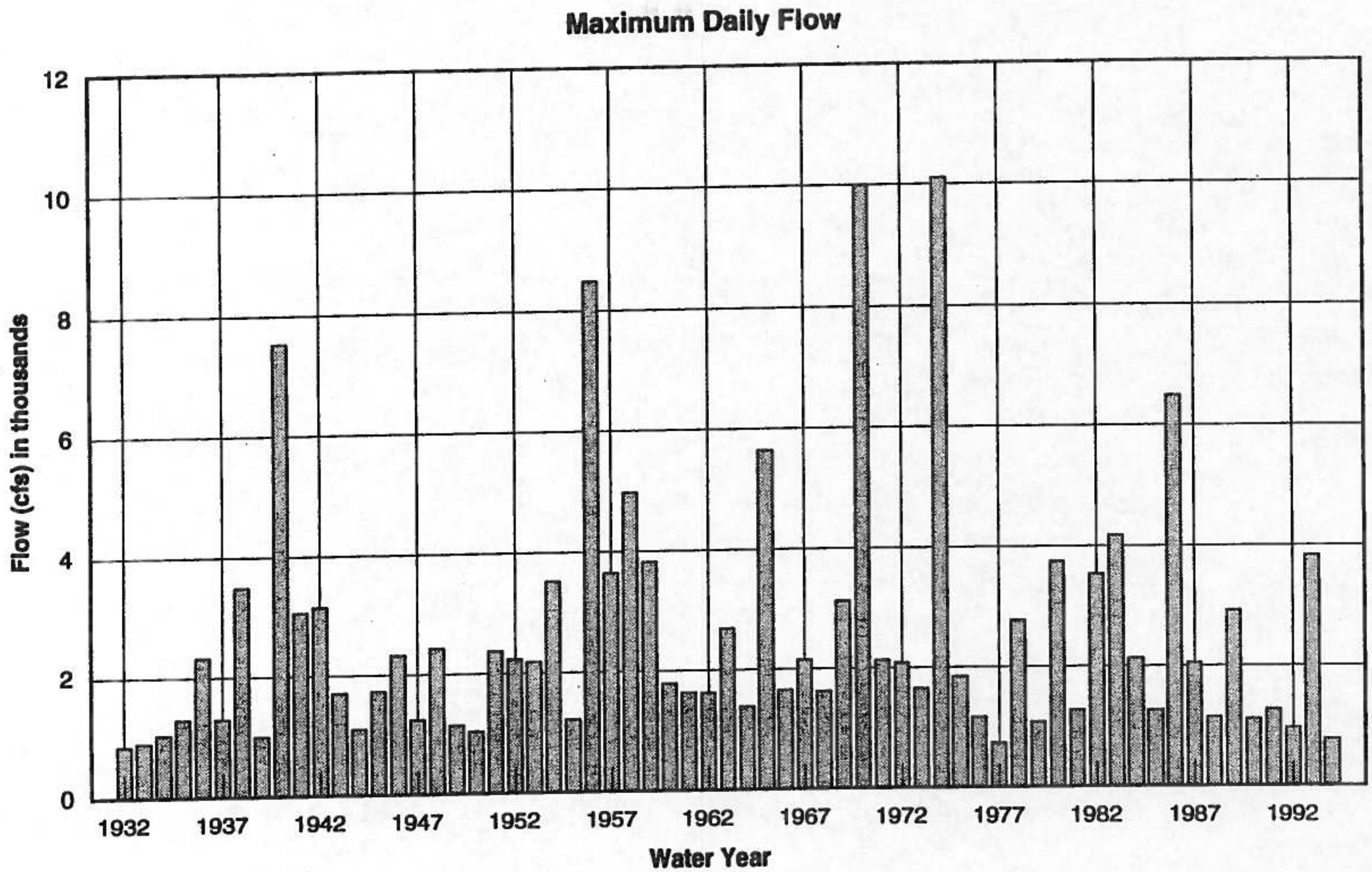


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Figure 3-4
Maximum Daily Flow in the McCloud River, 1932–1994

- providing specialized habitat for riparian-dependent wildlife and plant species, and

- providing cover habitat for watering and migration by terrestrial wildlife.

To protect riparian zones, the CFPRs establish and specify standards for WLPZs with which timber operations must conform. The main objectives of the WLPZ-related rules are to maintain adequate tree canopy and ground cover, avoid or minimize near-stream disturbance associated with the construction and use of facilities (i.e., stream crossings, roads, skid trails, and landings), and ensure that environmental damage or hazards that accidentally result from timber operations are quickly and effectively remedied. In addition, as discussed in Chapter 2, Hearst has proposed BMPs that are more protective of riparian resources than the CFPRs as well as in-lieu or alternative practices that have been demonstrated to meet the objectives of the Forest Practice Act for protection of the beneficial uses of water.

The density and composition of study area riparian vegetation were evaluated for this assessment through interpretation of aerial photographs (1:12,000 scale). This analysis was confined to the Class I streams within the five study area PWs, except that Tate Creek, a Class I stream outside the watershed study area, was also analyzed because it supports redband trout, a special-status species. (See "Redband Trout" discussion in Chapter 4.) The riparian canopy analysis involved dividing each Class I stream into segments within which forest vegetation was relatively uniform with regard to species type and canopy cover, structure, and planar arrangement. Nonforest riparian areas (i.e., meadows) were excluded from the analysis. Polygons were delineated on mylar overlays that encompassed both sides of the stream up to the first break in slope and extended the length of a stream segment. Four attributes were analyzed for each polygon:

- total canopy cover (0, 1%-25%, 26%-75%, or 76%-100%),
- dominant vegetation type (coniferous or deciduous),
- proportion of total canopy cover accounted for by the dominant vegetation type, and
- canopy stature (uniformly pioneer or short, multistoried, or uniformly tall).

Results for total canopy cover, stature, and the coniferous component are summarized in Table 3-4. One reason that total canopy cover is often lower for the larger streams than for the smaller streams is that the analyzed polygons included the stream channel in addition to the riparian zones. For large streams such as the McCloud River, much of the stream channel is uncovered by tree canopy even where mature conifers line both banks. For such streams, the influence of riparian conditions on aquatic habitat is generally reduced relative to the influence of instream conditions (e.g., streamflow and temperature).

Although some Class I streams (e.g., Mud Creek and Coyote Gulch) have relatively low densities of coniferous canopy cover, BMPs requiring retention of trees, snags, and large woody debris applicable to LSMZs (i.e., within 200 feet of all Class I and some Class II streams) and the CFPRs' WLPZ retention standards ensure that riparian coniferous canopy cover and opportunities for recruitment of instream large woody debris will increase in the future. Specifically, canopy cover of at least 50% with species composition similar to the preharvest condition will be retained in LSMZs and WLPZs except where sanitation-salvage prescriptions are implemented.

Stream Channel Overview

As part of the CWE analysis process applied for this watershed assessment, all perennial streams were divided into reaches and classified according to channel type based on the method developed by Rosgen (1996). The Rosgen classification system takes into account channel entrenchment (width of channel relative to width of valley enclosing the channel), relative channel depth (width-depth ratio), sinuosity, gradient, and channel substrate material (bedrock, boulder, cobble, gravel, or silt-clay). This analysis was conducted using 1:24,000-scale U.S. Geological Survey (USGS) maps, 1:24,000-scale infrared aerial photographs, and 1:12,000-scale black-and-white aerial photographs.

The CWE analysis process assigns sensitivity classes to channel types, which can be interpreted to provide information on sensitivity to and ability to recover from disturbance (e.g., flooding or sediment discharge) and streambank erosion potential. Reaches with low sensitivity are generally less susceptible to cumulative watershed impacts than higher-sensitivity reaches. Overall channel sensitivity was calculated for each PW by averaging the sensitivities of all reaches in the PW, weighted by length of reach.

Some factors considered in the Rosgen classification system (e.g., sinuosity and substrate material) are difficult or impossible to determine from maps and photographs in the absence of field verification. For any reach for which channel typing was uncertain because of such uncertainty, a range of likely types was specified. The reach was then assumed to have the type corresponding to the highest sensitivity class for the specified range of possible channel types. For example, for some reaches, uncertainty regarding substrate material made it possible that the reach was either a Rosgen type A2 or A3. Whereas the A2 type is considered to have low sensitivity, the A3 type is considered to be highly sensitive; in this case, the intervening sensitivity class of "moderate" was not an available option. Such reaches were assumed to be highly sensitive. This approach was adopted to bias assessments of stream sensitivity and watershed NSI upward. As discussed below, however, it did not entirely eliminate the possibility of understating sensitivity.

Detailed stream channel surveys and aquatic habitat inventories were conducted in 1995 for a 7-mile segment of Angel Creek extending from its mouth to Angel Meadow and for a 7-mile segment of Star City Creek extending from its mouth to Stouts Meadow (Thomas R. Payne & Associates 1996, 1997). Results of the channel surveys provided an opportunity to test the validity of the Rosgen channel typing and sensitivity classification conducted for this watershed assessment using maps and photographs and to assess the bias associated with the approach used for classifying sensitivity.

The channel survey classified the first (2.5-mile) reach of Angel Creek as a Rosgen channel type B3 (which has moderate sensitivity), the second (1.8-mile) reach as B2 (moderate sensitivity), the third (1.1-mile) reach as A2 (low sensitivity), and the fourth (1.1-mile) reach as A3 (high sensitivity) (Thomas R. Payne & Associates 1996). The first (1.7-mile) reach of Star City Creek was classified as B2 (moderate sensitivity) and the second (5.2-mile) reach was classified as A1 (low sensitivity) (Thomas R. Payne & Associates 1997).

Table 3-4. Riparian Zone Canopy Characteristics

Planning Watershed and Stream	Length (miles)	Percentage of Total Length by Total Canopy Cover Class				Percentage of Length by Stature Class			Average Percentage of Canopy Accounted for by Conifers
		0%	1%-25%	26%-75%	76%-100%	Short	Multistoried	Tall	
Wyntoon									
McCloud River	10.5	1	8	55	36	9	33	57	63
Mud Creek	1.1	0	0	18	82	81	19	0	16
Huckleberry Creek	3.8	2	17	54	27	0	98	0	45
McCloud Reservoir									
Quail Gulch	1.4	0	0	41	59	45	55	0	33
Angel Creek									
Angel Creek	7.6	2	24	34	40	1	97	0	42
Coyote Gulch	1.2	0	0	0	100	0	100	0	18
Star City Creek									
Star City Creek	8.5	1	3	60	36	2	97	0	40
Curtis-Devils Canyon									
Kosk Creek	5.7	2	11	59	28	24	74	0	39
Tate Creek									
Tate Creek	1.8	0	0	0	100	20	80	0	42

The first question addressed by comparing the results of the channel survey with the assessments made for this EIR was whether streams were consistently divided into channel reaches by both approaches. Results indicated that the approaches were highly consistent in that they both divided the 7-mile segment of Angel Creek into four reaches and the 7-mile segment of Star City Creek into two reaches, and the differences in the length of each individual reach was less than 0.2 mile in each case.

With regard to channel type and sensitivity class, the Rosgen channel typing conducted for this assessment using maps and photographs classified the first Angel Creek reach as being a B3, B4, C3, or C4 type, based on the infeasibility of accurately determining substrate material and entrenchment level from remotely sensed data. For this range of channel types, sensitivity could be either moderate or high and was thus assumed to be high for calculating NSI. The second reach was classified for this assessment as a B2 or B3 channel type, corresponding to moderate sensitivity. The third reach was classified as an A1 or A2 type, corresponding to low sensitivity. The first reach of Star City Creek was classified for this assessment as being a B2, B3, C2, or C3 type, corresponding to moderate sensitivity. The second reach was classified as an A1 or A2 type, corresponding to low sensitivity. For these five reaches, the sensitivity classifications conducted for this assessment were confirmed as being accurate by the channel survey results.

The fourth reach of Angel Creek, however, was classified as a B2 or B3 type, corresponding to moderate sensitivity, in comparison to a classification of A3 (high sensitivity) resulting from the channel survey. The reach was erroneously described as a "B" type as opposed to an "A" type apparently because its gradient was underestimated based on topographic map analysis, an error that was probably the result of the reach being relatively short (1.1 miles). The approach used for channel typing in this assessment thus understated by one class the sensitivity of one of the six reaches analyzed. This result indicates that, despite designing the approach with the intent of ensuring an upward bias in the channel sensitivity assessment, downward bias (i.e., underestimation of sensitivity) did occur in one specific instance and, in general, cannot be disregarded.

The CVRWQCB has identified existing beneficial uses of the McCloud River as municipal and domestic water supply, hydropower generation, contact recreation, noncontact recreation, coldwater fish habitat, and wildlife habitat. Canoeing and rafting are identified as potential beneficial uses. The beneficial uses specified for a stream generally apply to its tributaries ~~The CVRWQCB has not identified any beneficial uses for any other study area surface waters~~ (California Central Valley Regional Water Quality Control Board 1995).

Wyntoon Planning Watershed

Disturbance History Logging first occurred on Hearst Forests in the Wyntoon PW around 1900. Most of the watershed has been selectively harvested repeatedly since then.

Historical disturbances observed in the PW that could contribute to CWEs include the following:

- The road along the east side of McCloud River between Big Springs and the confluence with Angel Creek features some fill slopes that display debris slides and active raveling.

Geology

Physiography. The Wyntoon PW occupies 17,533 acres of relatively flat terrain southeast of the town of McCloud. Mud Creek (also known as Elk Creek) drains the northern part of the watershed from an elevation of 4,300 feet on the southeast flanks of Mount Shasta to an elevation of about 3,100 feet at its confluence with the McCloud River. The McCloud River enters the PW from the northeast and flows south to McCloud Reservoir. The lowest elevation is about 3,000 feet, where the McCloud River leaves the PW a few miles upstream of the reservoir. Huckleberry Creek, also a tributary of the McCloud River, drains the western part of the PW.

Bedrock. The surficial geology of the PW assessment area is shown in Figure 3-5. The large, flat, central part of the Wyntoon PW is covered with unconsolidated Quaternary alluvium, which forms deep soils. The predominant rock type around the perimeter of the alluvium is Quaternary basalt (map unit QVb). Near the southern boundary of the PW are exposures of the Bragdon Formation, the oldest of several late Paleozoic and early Mesozoic metamorphosed marine and volcanic rocks. The Bragdon Formation is a black mudstone and graywacke in thick, massive beds with frequent interbeds of various types of volcanic rocks.

Faulting is evident in the Quaternary basalt in a few locations. No surficial evidence of faults appears in the alluvium.

Geomorphology. The broad expanse of alluvium in this PW is the only significant deposit of recent stream sediments in the entire PW assessment area. The deposition in this area resulted from lava flows blocking the McCloud River and creating a depositional environment upstream of the blockage. The flat valley floor area that occupies most of the watershed slopes southward at a grade of about 1%.

Unstable Areas, Inner Gorges, and Eroded Areas. The only unstable areas identified in the Wyntoon PW are 178 acres of inner gorge primarily along the McCloud River (Figure 3-3). One area of 2.4 acres downstream of the confluence of Mud Creek and the McCloud River features accelerated erosion.

Soils

Soil series in the Wyntoon PW with high or very high EHR (based on the Forest Service procedure) include Etsel on slopes exceeding 15%, Kettlebelly and Neuns on slopes exceeding 30%, and Kindig and Neer on slopes exceeding 50% (Appendix H). Combined, they account for 507 acres, or 3%, of the PW. Surface slope classes are depicted in Figure 3-6.

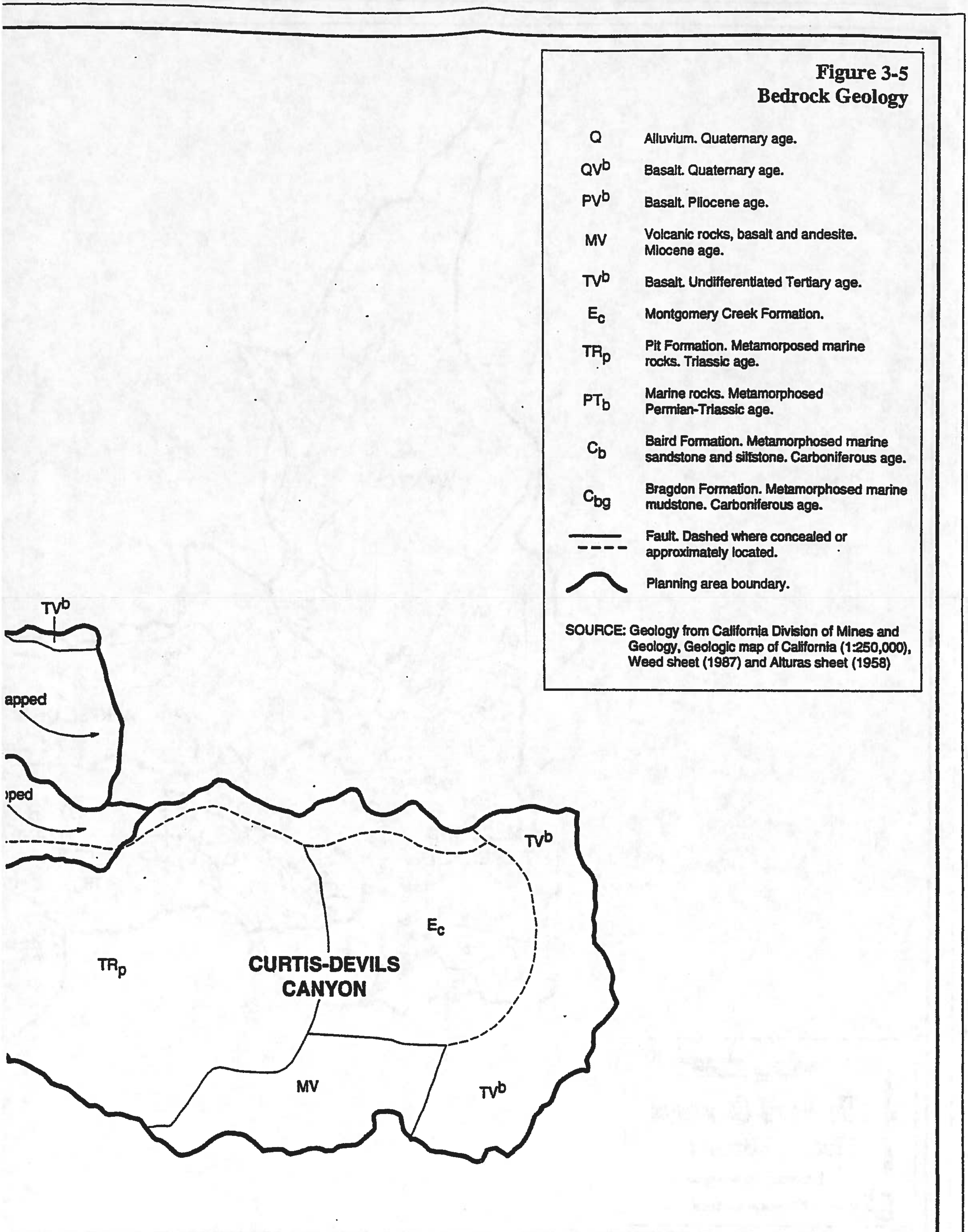
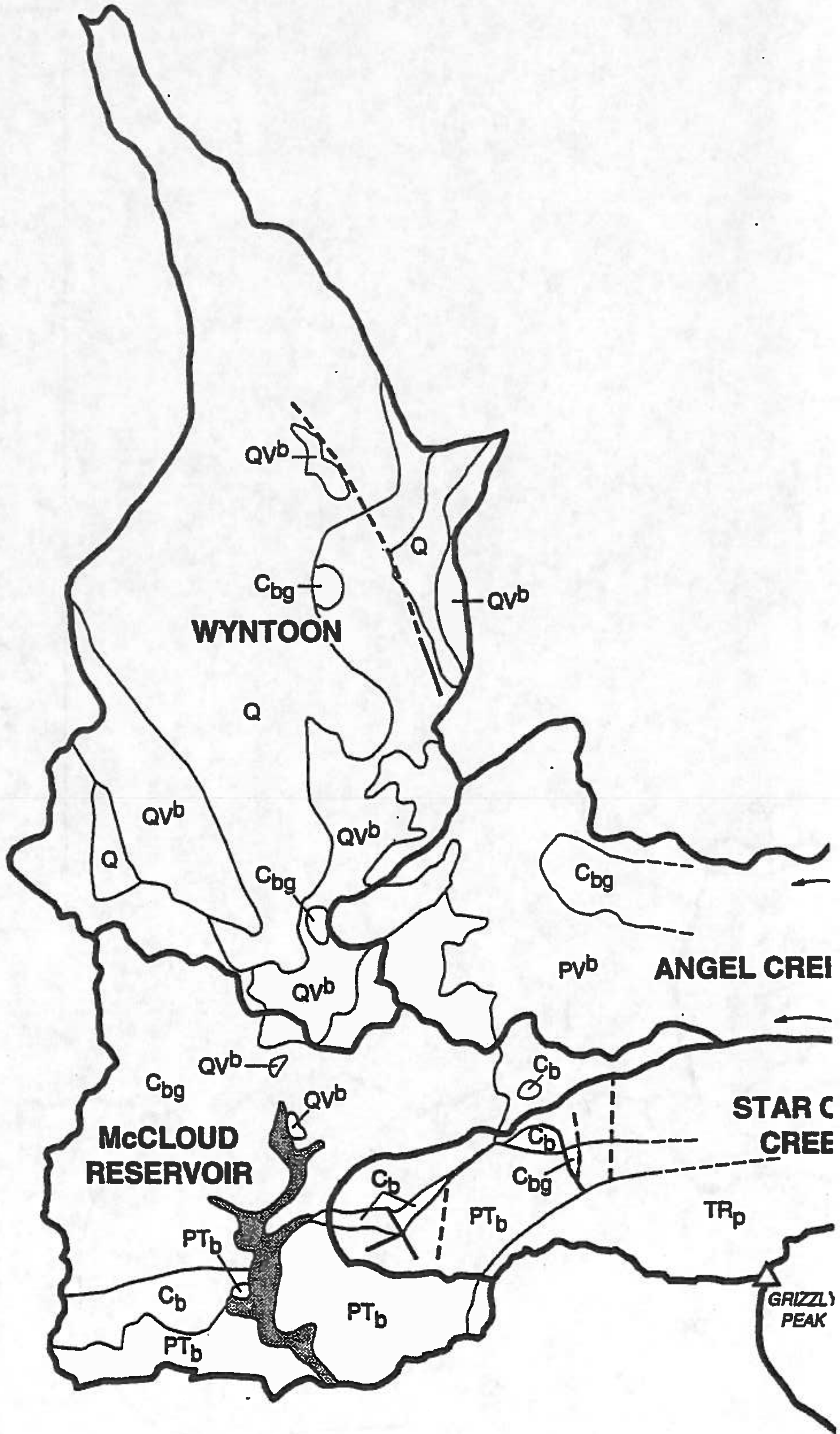


Figure 3-5
Bedrock Geology



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Hydrology

Mean annual precipitation for the Wyntoon PW ranges from approximately 50 to 60 inches, with average precipitation generally increasing from north to south (Rantz 1969). Almost 98% of the Wyntoon PW lies within the elevation range of 2,500-4,500 feet above sea level, which, in the southern Cascade Range, corresponds to the transient snow precipitation zone (Carlson and Christiansen 1993). In this zone, much of the precipitation is in the form of snow, but the snowpack typically disappears between major storms. Because the snowpack is usually small or absent when most rainstorms occur, intense rain-on-snow runoff events are relatively uncommon. From the perspective of precipitation regime, the basin's natural flooding potential is moderate to high.

Only 6 acres of rock outcrops and 1,953 acres (11% of the PW) of relatively impermeable soils are present in the Wyntoon PW. Its average relief ratio is 0.05. Based on the extent of relatively impermeable surfaces and slope, the watershed features low natural flooding potential.

As shown in the ERA summary in Appendix D, the ERA for the Wyntoon PW is 916 acres, or 5.2% of the watershed. This cumulative level of disturbance is low to moderate relative to that of the adjacent fifth-order watersheds in the Shasta National Forest (Shasta-Trinity National Forests 1994). Based on past human disturbance, the flooding potential of the PW is considered low to moderate.

Considering the precipitation regime, surface impermeability, and past disturbance of the watershed, its overall flooding potential is considered low to moderate.

Riparian Zones

Within the Wyntoon PW, riparian vegetation was analyzed for the McCloud River, Huckleberry Creek, and Mud Creek. Average total canopy covers along these streams were 62%, 52%, and 81%, respectively. The coniferous component of the canopy is largest for McCloud River (63%) and smaller for Huckleberry Creek (45%) and Mud Creek (16%). Along the McCloud River, canopies are primarily tall or multistoried; along Mud Creek, they are primarily low; and along Huckleberry Creek, they are all multistoried.

Stream Channels

The Wyntoon PW includes a total of 12.7 miles of Class I streams (McCloud River, Mud Creek, and Huckleberry Creek), 2.7 miles of Class II streams, 8.9 miles of Class III streams, and 5.1 miles of Class 4 streams. Mud Creek originates in a glacier on the southeast face of Mount Shasta and, as is typical of glacier-fed streams, carries a very large sediment load. The Class 4 stream consists of a ditch into which Mud Creek is diverted 0.2 mile south of State Highway 89; this ditch eventually discharges into Huckleberry Creek 0.2 mile upstream of its confluence with the McCloud River, immediately upstream of McCloud Reservoir.

Of the 33.4 miles of perennial stream channels shown on USGS maps, 11% were classified as having low sensitivity, 2% as having moderate sensitivity, 71% as having high sensitivity, and 16% as having extreme sensitivity. The predominance of high and extreme sensitivity classes in this PW results primarily from the low gradients characteristic of Huckleberry and Mud Creeks. Low-gradient reaches are geomorphically depositional; they are locations where sediments originating upstream are deposited, often resulting in the filling of pools, establishment of sand bars, and other channel changes.

McCloud Reservoir Planning Watershed

Disturbance History

The McCloud Reservoir PW was first logged in 1958-1961, before the reservoir zone was inundated. Much of the watershed was relogged subsequently.

Historical disturbances observed in the PW that could contribute to CWEs include the following:

- Battle Creek subbasin features a dense network of old roads and skid trails, including several roads and landings located in Class III watercourses with perched stores of unconsolidated sediments available for transport by high overland flows.

- Barker Valley Creek (which flows into the west side of McCloud Reservoir between Huckleberry Creek and Tarantula Gulch) subbasin includes an old harvest area where brush species are now the dominant vegetation and where Barker Valley Creek displays heavy channel aggradation and brush encroachment.

Geology

Physiography. The 9,996-acre McCloud Reservoir PW includes the reservoir and receives inflow from the Wyntoon, Angel Creek, and Star City Creek PWs. Elevations range from about 2,500 feet at McCloud Dam to 4,200 feet on a ridge top west of the reservoir. Because of a transition in surficial geology, the terrain is rather abruptly steeper than in the Wyntoon PW upstream of the reservoir.

Bedrock. Older marine rocks are exposed throughout almost the entire McCloud Reservoir PW. The Bragdon Formation occupies the northern two-thirds of the planning area, and the Baird and Bollibokka Formations occupy the southern one-third. There are also minor exposures of Pit Formation and Quaternary volcanics.

Geomorphology. The mountainous terrain in the McCloud Reservoir PW consists of deep creek valleys draining into the reservoir. Near the creek bottoms, the valley walls are typically steep (90%-160% slopes), with more moderate slopes (40%-50%) near the ridge tops.

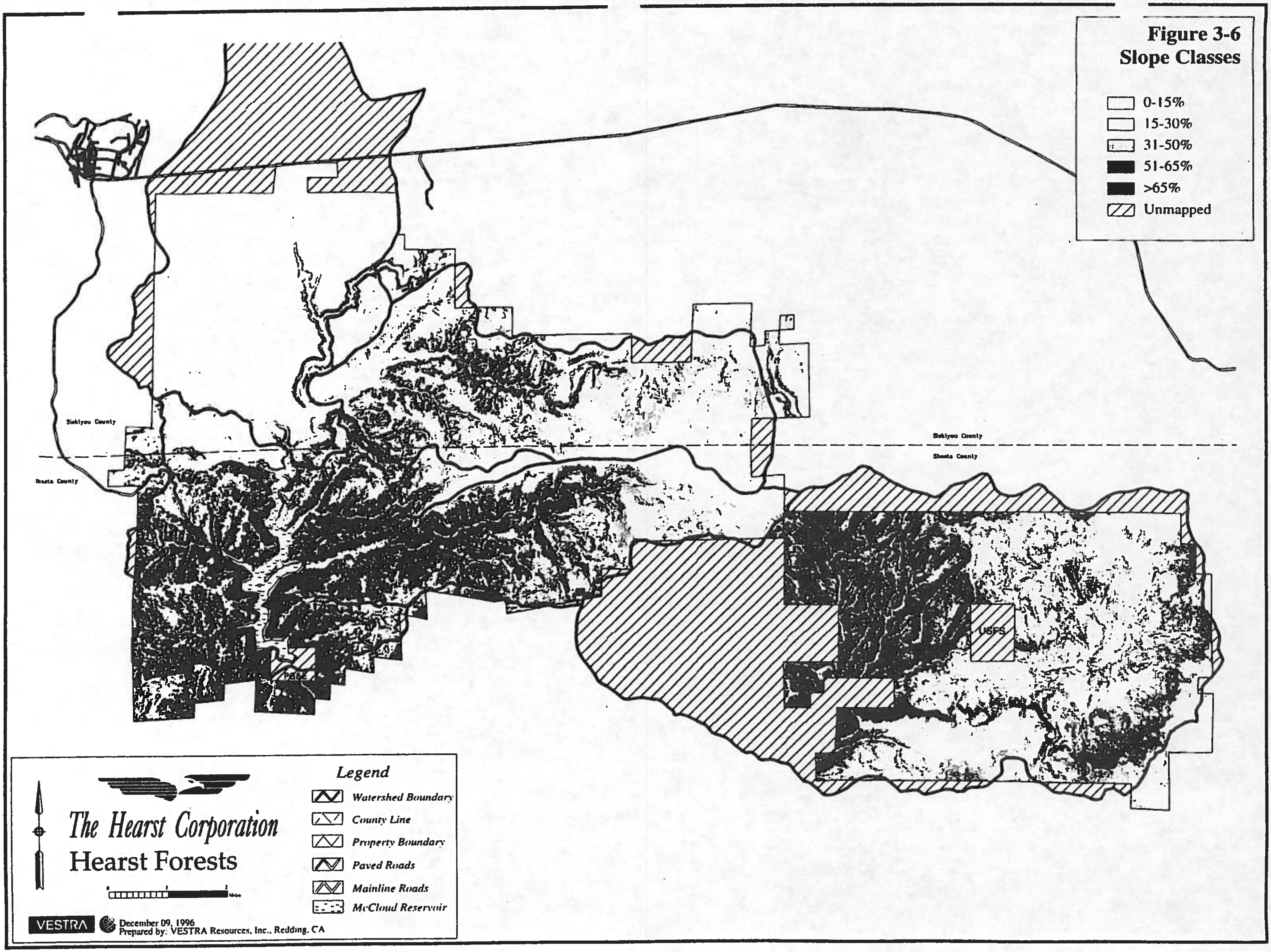


Figure 3-6
Slope Classes
0-15%
15-30%
31-50%
51-65%
>65%
Unmapped
Siskiyou County
Shasta County
USFS
Legend
Watershed Boundary
County Line
Property Boundary
Paved Roads
Mainline Roads
McCloud Reservoir
The Hearst Corporation
Hearst Forests
VESTRA
December 09, 1996
Prepared by: VESTRA Resources, Inc., Redding, CA

Unstable Areas, Inner Gorges, and Eroded Areas. A total of 2,252 acres of inner gorges were identified in the McCloud Reservoir PW, primarily along Tarantula Gulch, and Battle, Lick, Panther, and Lizard Creeks. An active debris flow encompassing 6 acres is located along the east shore of McCloud Reservoir. Active accelerated erosion sites totaling 27 acres have been mapped at scattered locations along Quail Gulch, Lick Creek, Tarantula Gulch, and an unnamed tributary to the northwestern portion of McCloud Reservoir (Figure 3-2).

Soils

Principal soil series with high or very high EHR (based on the Forest Service procedure) in the McCloud Reservoir PW include Etsel on slopes exceeding 30% and Neuns, Kindig, and Kettlebelly on slopes exceeding 50% (Appendix H). They account for a total of 4,206 acres, or 42% of the PW.

Hydrology

Average annual precipitation in this PW ranges from approximately 60 inches in the north to approximately 80 inches in the south (Rantz 1969). Approximately 94% of the watershed is in the 2,500- to 4,500-foot elevation range associated with a transient snow pack, and the remaining 6% is in the 4,500- to 6,200-foot range associated with a permanent seasonal snowpack. Lands with permanent seasonal snowpack have greater likelihood of experiencing intense rain-on-snow events than lands in the transient snow zone. The McCloud Reservoir PW has a precipitation regime associated with moderate to high natural flooding potential.

A total of 52 acres of rock outcrops and 1,532 acres (15% of the PW) of relatively impermeable soils are found in the watershed. Its average relief ratio is 0.124. Based on soil permeability and slope, the basin's natural flooding potential is high.

The ERA for the watershed is 431 acres (4.8% of the PW). This ERA is low relative to those of most of the adjacent fifth-order watersheds in the neighboring national forest (Shasta-Trinity National Forests 1994). Based on past disturbance levels, flooding potential in the McCloud Reservoir PW is considered low.

Taking into account the precipitation regime, natural impermeability, and disturbance history of the PW, its overall flooding potential is moderate to high.

Riparian Zones

Quail Gulch is the only Class I stream in this PW. It has an average total canopy cover of 72%, two-thirds of which is deciduous (Table 3-4). Structurally, the canopy is divided relatively evenly between low and multistoried.

Stream Channels

The McCloud Reservoir PW has a 1.6-mile reach of Class I stream (Quail Gulch), 21.8 miles of Class II streams, and 34.0 miles of Class III streams. Of the 41.1 miles of perennial stream channels shown on USGS maps, 34.0 miles were classified as having low sensitivity, 0.8 mile as having moderate sensitivity, 5.8 miles as having high sensitivity, and 0.5 mile as having extreme sensitivity.

McCloud Reservoir

McCloud Reservoir was formed by construction of McCloud Dam in 1965. It covers 520 acres and has a reported storage capacity of 35,300 acre-feet, for an average depth of 68 feet (California Department of Water Resources 1984). The dam is owned and operated by Pacific Gas and Electric Company, and the reservoir is used primarily for power production and recreation. Its fishery is described in Chapter 4, "Fisheries". Sediment originating in and upstream from the PWs forming the Wyntoon Tract of Hearst Forests is gradually reducing the reservoir's storage capacity. Mud Creek, a glacier-fed stream originating on Mount Shasta, naturally contributes an estimated 400-450 tons of sediment per day to McCloud Reservoir (McGurk pers. comm.). This rate of sediment influx greatly exceeds that from other tributaries.

Angel Creek Planning Watershed

Disturbance History

Logging in the Angel Creek PW began in the mid-1960s, generally proceeding from west to east and from north to south. By 1974, most of the PW had been harvested and the second harvest cycle had begun.

Historical disturbances observed in the PW that could contribute to CWEs include the following:

- Areas on the north side of Angel Creek (along Sunk Gulch and Dry Gulch) approximately 4 miles upstream from the mouth feature substantial gully erosion where an unmaintained road crosses these tributaries (Thomas R. Payne & Associates 1996).
- An area on the south side of Angel Creek approximately 5 miles upstream from the mouth is denuded of vegetation and features rills and gullies that probably contribute to Angel Creek's sediment regime (Thomas R. Payne & Associates 1996).
- A large volume of unconsolidated sediment was deposited in the floodplain of Fan Gulch following failure of a culverted crossing of a tributary to Fan Gulch.

Geology

Physiography. The Angel Creek watershed drains from east to west and empties into the McCloud River upstream of McCloud Reservoir. The ridge along the north side of the drainage has moderate slopes compared with the ridge along the south side, which rises steeply to a maximum elevation of 5,600 feet. The minimum elevation is about 3,000 feet, where Angel Creek meets the McCloud River. The total watershed area is 10,640 acres.

Bedrock. Old, metamorphosed marine rocks are present throughout the western half of the watershed; these rocks are unconformably overlain in many places by much younger Tertiary and Quaternary basalts. There are no substantial deposits of alluvium. The older rocks are mainly of the Bragdon Formation.

Geologic maps are not available for the eastern half of the watershed, but based on maps of surrounding areas, the general rock types and contact relationships are thought to be similar to those in the western half of the watershed and in the Star City Creek watershed.

Geomorphology. The western half of the watershed, downslope from Angel Meadow, consists of deeply incised creek and tributary valleys. The slopes of the valley walls are typically 60%-80%. Slopes in the eastern half of the watershed are generally more moderate, with slopes of 13%-33% along the north side of Angel Creek and near the divide between the Angel Creek and Star City Creek watersheds.

Unstable Areas, Inner Gorges, and Eroded Areas. A total of 373 acres of inner gorge was delineated in the Angel Creek PW, primarily along Angel Creek (Figure 3-2). One large (135-acre) stabilized ancient landslide has been mapped along the middle reach of Angel Creek, and another small one (2 acres) has been mapped along Red Ant Creek near Angel Creek's headwaters. Several small active rotational landslides totaling 17 acres and one active debris flow (9 acres) are located along the middle reach of Angel Creek. One debris slide (2 acres) is located at the confluence of Red Ant and Angel Creeks. Accelerated erosion sites totaling 5 acres are located along Fan Gulch, which joins Angel Creek from the south near its confluence with the McCloud River, and along upper Angel Creek.

Soils

Soils in the Angel Creek PW with high or very high EHR (based on the Forest Service procedure) include Kettlebelly and Neuns (>30% slope) and Etsel, Kindig, and Neer (>50%) (Appendix H). These series constitute 3,3406 acres, or 32%, of the PW.

Hydrology

Average annual precipitation in the Angel Creek PW ranges from approximately 60 inches in the northwest to 70 inches in the southeast. Approximately two-thirds of the drainage falls within the transient snow elevation zone, and one-third is within the permanent seasonal snowpack zone. These precipitation regimes correspond to moderate to high natural flooding potential.

A total of 83 acres of rock outcrops and 1,951 acres (19% of the PW) of relatively impermeable soils are found in the watershed, indicating a moderate to high natural flooding potential. The average relief ratio is 0.051, indicating a low natural flooding potential.

The ERA for the Angel Creek PW is 7.9%, which is moderate relative to the adjacent national forest watersheds. Flooding potential related to human disturbance is thus moderate.

Considering precipitation regime, natural impermeability, and past disturbance, the watershed's overall flooding potential is rated low to moderate.

Riparian Zones

Canopy cover along Angel Creek averages 55%, 42% of which is coniferous. Along Coyote Gulch, total canopy cover averages 88%, only 18% of which is coniferous. Both streams' canopy structure is almost entirely multistoried.

Stream Channels

The Angel Creek PW includes a total of 8.3 miles of Class I streams (Angel Creek and Coyote Gulch), 21.6 miles of Class II streams, and 45.6 miles of Class III streams. Of the 26.7 miles of mapped perennial stream channels, 66% were classified (based on remotely sensed data) as having low sensitivity, 16% as having moderate sensitivity, and 18% as having high sensitivity.

Star City Creek Planning Watershed

Disturbance History

Timber operations in the Star City Creek PW initially occurred in the Stouts Meadow area in 1968, in the extreme eastern portion of the watershed. Subsequently, however, logging proceeded up the drainage from west to east during 1969-1972. Cable yarding of the steeper areas occurred during 1975-1982. Additional logging has occurred in the watershed since then.

Historical disturbances observed in the PW that could contribute to CWEs include the following:

- Areas located on the south side of Star City Creek that were clearcut more than 20 years ago support sparse vegetation and probably contribute to high peak flows in Star City Creek.

- The road along the south side of Star City Creek, which traverses very steep terrain, has modified natural drainage patterns and contributed to active slides and debris torrents.
- A slump along an abandoned spur road in the Dropoff Creek subbasin approximately 3 miles upstream from the mouth of Star City Creek features gully erosion (Thomas R. Payne & Associates 1997).
- Gold Creek, which flows into Star City Creek from the south approximately 6 miles upstream from the mouth, displays substantial channel aggradation and vegetation encroachment near old clearcuts.

Geology

Physiography. Like the Angel Creek watershed, the Star City Creek watershed consists of a single, fairly narrow valley that drains from east to west. Star City Creek discharges directly into an arm of McCloud Reservoir. The terrain is mountainous, and slopes are steep along both sides of the creek. Elevations range from about 2,700 feet at Lake McCloud to 6,253 feet at the summit of Grizzly Peak. The total area of this watershed is 8,113 acres.

Bedrock. The geology in the western part of the watershed is similar to that in the Angel Creek watershed except for several distinct formations of older marine rocks and a lesser extent of overlying volcanics. The older rocks include the Bragdon, Baird, Bollibokka, and Pit Formations, which decrease in age from late Paleozoic to Triassic. The Baird Formation consists of metamorphosed green and purple volcanic siltstone and sandstone interbedded with minor amounts of chert and limestone. The Bollibokka Group includes slightly younger Permian and Triassic andesite, mudstone, and tuff formations. The Pit Formation is a weakly metamorphosed black, laminated mudstone with inclusions of tuff, siltstone, and some limestone.

Most of the eastern part of the watershed has not been mapped, but rock types probably consist of a mix of old marine metamorphic rocks and overlying volcanics similar to that found in the other PWs.

Geomorphology. Star City Creek flows through a steep-sided canyon along most of the length of the watershed. Slopes along the canyon walls are commonly 100%-130%. There is a narrow but relatively flat valley floor along the last 1.5 miles above McCloud Reservoir, and gentler terrain (40%-50% slopes) are present along the ridges that form the divides to the north and south and in a few headwaters areas near the eastern end of the watershed.

Unstable Areas, Inner Gorges, and Eroded Areas. Inner gorges constitute 1,313 acres in this PW, primarily along Star City and Dropoff Creeks. Other unstable areas mapped in the Star City PW include a stabilized ancient landslide (31 acres) near Bear Wallow along the middle reach of Star City Creek, two active debris flows (4 acres) along its lower and middle reaches, and three active debris slides (6 acres) along its lower and middle reaches (Figure 3-2). A small (2-acre) natural erosion site is located along Gold Creek (tributary to the middle reach of Star City Creek).

Soils

Soil series in this PW with high or very high EHR (based on the Forest Service procedure) include Obie and Mounthat (>30% slope) and Etsel, Kindig, Kettlebelly, Neer, and Neuns (>50%) (Appendix H). They extend over a total of 4,080 acres, or 50% of the watershed.

Hydrology

Annual precipitation levels in the Star City PW range from approximately 70 inches in the northwest to 80 inches in the southeast. Roughly 64% of the watershed is in the permanent seasonal snowpack elevation zone, and the remaining 36% is in the transient snow zone. Flooding potential related to precipitation regime is moderate to high.

An estimated 120 acres of rock outcrops and 2,206 acres (27% of the PW) of low-permeability soils are found in the watershed. Its relief ratio is 0.065. These factors indicate a moderate to high natural flooding potential.

The watershed has an ERA of 383 acres (4.7%), which is low relative to the ERA of most adjacent national forest watersheds. This level of cumulative watershed disturbance indicates a low flooding potential.

The PW's overall flooding potential is moderate.

Riparian Zones

Total canopy cover along Star City Creek averages 62%, of which 40% is coniferous. The canopy is almost entirely multistoried.

Stream Channels

The Star City Creek PW features an 8.5-mile reach of a Class I stream (Star City Creek), 18.5 miles of Class II streams, and 33.8 miles of Class III streams. Of the 29.1 miles of mapped perennial stream channels, 79% were classified as having low sensitivity, 6% as having moderate sensitivity, and 15% as having high sensitivity.

Curtis-Devils Canyon Planning Watershed

The Curtis and Devils Canyon drainages have been combined into a 28,674-acre PW for this assessment based on their hydrologic connectedness. Combined, these drainages constitute the upper portion of the Kosk Creek watershed. The Curtis drainage is the eastern and upstream portion of the PW; Devils Canyon drainage constitutes the western and downstream portion of the PW.

Disturbance History

Logging began in the Kosk Creek drainage in 1954 in the eastern portion of the PW. The southwestern portion of the watershed was harvested in the mid-1960s. Most of the existing road network had been constructed by 1968. The northwestern portion of the watershed has never been roaded or logged and is not being considered for future logging.

Historical disturbances observed in the PW that could contribute to CWEs include the following:

- Mass movements associated with roads are located north of Kosk Creek in Section 23, Township 38 North, Range 1 East.

Geology

Physiography. The Curtis drainage forms the upper portion of the Kosk Creek watershed. Elevations range from 3,700 feet where Kosk Creek crosses the western boundary of the PW to about 5,300 feet on the eastern rim. The terrain reflects the geology. The northwest quadrant of the PW is underlain by the unconsolidated Montgomery Creek Formation and has moderate slopes. The eastern and southern parts of the PW are occupied by steep slopes formed on Tertiary volcanics.

Devils Canyon drains the southeast side of Grizzly Peak and the lower part of the Kosk Creek watershed. Elevations range from about 2,000 feet at the confluence of Devils Canyon and Kosk Creek to 6,253 feet on Grizzly Peak. The terrain is steep and mountainous.

Bedrock. The only two formations exposed in the Curtis drainage are the Montgomery Creek Formation and Tertiary basalts. The Montgomery Creek Formation is a relatively young (Eocene), poorly consolidated assemblage of soft shales, sandstone, conglomerate, and lignite formed by fluvial and lacustrine deposition when Tertiary basalt flows impounded several local drainages. There are no substantial deposits of alluvium.

The west-central part of the Devils Canyon drainage is underlain by Triassic marine shales (probably the Pit Formation). The eastern portion of the drainage consists of the Montgomery Creek Formation. Marine rocks along the southeastern rim of the drainage are overlain by Miocene basalts and andesites that weather to thick tan or pale orange soils.

Geomorphology. Devils Canyon, Kosk Creek, and their tributaries within this planning watershed form deeply incised canyons in mountainous terrain. Almost all slopes along the canyon walls are in the 70%-125% range. Although slope stability has not been mapped in the western half of this area (Figure 3-2), the types, locations, and sizes of unstable areas can be inferred from adjoining mapped areas with similar terrain and geology. Most of the planning area is underlain by metamorphosed Paleozoic and Mesozoic marine sediments and volcanics. Slope instability occurs as small, isolated areas of active mass wasting, debris flows and slides, and natural erosion. Many of these areas are on steep hill slopes, although some are along creek channels.

The Montgomery Creek Formation, which is exposed in a mile-wide band along the eastern boundary of the Devils Canyon drainage, is relatively prone to landslides and creep because of the steepness of the terrain and the unconsolidated nature of the deposits. The hummocky terrain associated with this formation is evidence of historical soil and slope instability. The entire formation is mapped as historically unstable (Figure 3-2). The shale members of the formation are the weakest, and the sandstone and conglomerate deposits often form terraces or benches (Earth Science Consultants Associated 1978).

Unstable Areas, Inner Gorges, and Eroded Areas. A total of 1,933 acres of inner gorge were delineated in this PW, primarily along Alder Creek, Live Oak Canyon, Bull Canyon, and Kosk Creek. The eastern half of the PW is mapped as unstable because of the widespread occurrence of hummocky, disrupted ground resulting from ancient massive landsliding associated with the Montgomery Creek Formation. A large (71-acre) active debris slide is located near the headwaters of Bull Canyon and Coal Creek north of Kosk Creek. Debris flows of 9 and 21 acres are located along Alder Creek in the northwest portion of the PW and along an unnamed stream in the southeast portion of the PW, respectively. Active rotational landslides totaling 85 acres are located primarily along Kosk Creek in the western portion of the PW. Much of the extreme eastern portion of the PW features natural erosion attributable to its extreme steepness.

Soils

Soil series in this PW with high or very high EHR (based on the Forest Service procedure) include Neuns (>20% slope); Obie and Mounthat (>30%); and Etsel, Kindig, Neer, Neuns, and gullied lands (>50%) (Appendix H). Combined, they account for 12,653 acres (44% of the watershed).

Hydrology

Mean annual precipitation in the Curtis-Devils Canyon PW ranges from approximately 50 inches in the east to 80 inches in the west. Approximately 53% of the PW is in the transient snow zone; 44% is in the permanent seasonal snowpack zone; and 3% is in the rain-only zone (< 2,500 feet), which has relatively low flooding potential. These precipitation ranges correspond to an average natural flooding potential of moderate to high.

The watershed features 1,257 acres of outcrops and 6,307 acres (22% of the PW) of relatively impermeable soils. Its average relief ratio is 0.132. These factors indicate high to extreme natural flooding potential.

The watershed's ERA is 411 acres (1.4%). This cumulative level of disturbance is very low and indicates that flooding potential has not been substantially increased by past land management.

Given precipitation regime, watershed permeability, and past disturbance levels, the overall flooding potential for the watershed is considered moderate to high.

Riparian Zones

Total canopy cover for Kosk Creek averages 55% (Table 3-4). The coniferous component of the canopy averages 39%. Structurally, the canopy is primarily multistoried, with the remainder pioneer or low.

Stream Channels

The Curtis-Devils Canyon PW features a 7.7-mile reach of a Class I stream (Kosk Creek), 58.2 miles of Class II streams, and 56.4 miles of Class III streams. Of the 67.6 miles of mapped perennial stream channels, 56.4 miles were classified as having low sensitivity, 1.3 miles as having moderate sensitivity, and 9.9 miles as having high sensitivity.

Kosk Creek flows into the Pit River roughly 10 miles southwest of Hearst Forests. Because of the long intervening distance and the small portion of the Pit River's flow contributed by Kosk Creek, channel and habitat conditions in the Pit River are unlikely to be substantially affected by the proposed project. The Pit River is not included in the study area for this EIR.

IMPACTS AND MITIGATION MEASURES

The principal proposed watershed-disturbing activities are selective timber harvesting using tractor, cable, and helicopter yarding systems and construction and reconstruction of roads, skid trails, landings, and stream crossings to facilitate the timber harvesting. Up to 5% of the harvesting could involve regeneration harvests.

Impact Mechanisms

The proposed project could affect watershed processes through the following mechanisms:

- timber harvesting could decrease transpiration rates and increase runoff and flooding;
- log skidding and grading of roads, skid trails, and landings could compact or dislodge the soil surface;
- construction of roads and skid trails could undercut unstable areas and increase the risk of landslides;
- construction of roads and skid trails could divert and concentrate runoff and increase the risks of landslides, gullying, and flooding;

- elevated rates of surface erosion or mass wasting could increase discharge of sediments and organic debris into surface waters;
- harvesting timber in riparian zones could decrease stream shading and increase stream temperatures; and
- harvesting timber in riparian zones could reduce the supply of instream LWD and adversely affect the natural pool formation process.

Criteria for Determining Significant Impacts

The CWE analysis process used in this watershed assessment focuses on watershed processes at the PW scale, which is generally suitable for a programmatic environmental document such as this PTEIR. The method is robust, however, in that it accounts for the possibility that actual watershed or channel conditions may, for various reasons, be inconsistent with the results of the NSI-TOC and ERA calculations. As a hypothetical example, although a comparison of the TOC and ERA could indicate that a watershed is relatively insensitive to disturbance and in a relatively undisturbed condition, actual channel conditions could reflect extensive damage from old logging practices. The CWE analysis process goes beyond the comparison of the TOC and the ERA, however, in that it requires consideration of other available relevant information and assessment of the comprehensiveness and reliability of the available information. In the above example, either additional information would confirm that watershed damage had occurred, or, if such information were not available or were of low reliability, its absence or unreliability would be recognized and considered in forming conclusions. Evaluation of information independent of that used in the ERA and NSI-TOC calculations provides a context for interpreting the results of the ERA analysis to form conclusions regarding the significance of cumulative watershed impacts.

Watershed impacts were considered significant if a proposed activity would result in a substantial increase in erosion, runoff, sediment discharge, flooding, or water temperature or in a substantial deficiency of instream LWD. Conclusions as to the effects of proposed activities were considered based on professional judgments of both the effectiveness and limitations of the CFPRs and BMPs in avoiding or minimizing watershed impacts. Consideration was given to the localized existence of special conditions (e.g., soils with high EHR, unstable areas, and riparian zones) where results of the CWE analysis process may not accurately reflect existing conditions or the effects of disturbance.

Watershed impacts were considered potentially significant if any of the following conditions applied:

- projected ERA exceeded 80% of the TOC for a PW,
- projected ERA exceeded 50% of the TOC for a PW and additional available information not considered in the NSI-ERA evaluation (e.g., disturbance related to logging or fires

that occurred before 1985) indicated that the PW is particularly susceptible to CWEs from proposed activities, or

- available information was inadequate to support reasonable assessment of watershed hazards or susceptibility to CWEs from proposed activities.

No-Project Alternative

Cumulative Disturbance in Relation to Watershed Sensitivity

Under the No-Project Alternative, no timber operations would be conducted on Hearst Forests. Watershed recovery would proceed so that conditions would gradually resemble those in undisturbed watersheds. Over the next 20 years, ERAs would gradually decline from their current levels. In 2015, ERAs are projected to range from 7.3% of the TOC in the Curtis-Devils Canyon PW to 35.1% of the TOC in the Angel Creek PW (Table 3-2).

Other Impacts

Because human disturbance would be minimal, no significant impacts on watershed processes (e.g., soil compaction, erosion, mass wasting, sedimentation, runoff, stream warming, or woody debris recruitment) resulting from human activity would occur. Wildfire hazards and risks would increase substantially relative to existing conditions as fuel loads accumulated and management staffing levels declined.

Proposed Project

Cumulative Disturbance in Relation to Watershed Sensitivity

Extensive information on watershed sensitivity and historical disturbance was compiled and analyzed for each PW as part of the CWE analysis. This information was supplemented by reconnaissance surveys and systematic analysis of maps and aerial photographs. Although limited site-specific information was available for use in this assessment, additional information on locations and conditions of potentially major sediment sources will be compiled over the next 2 years. This information will be used to evaluate the feasibility of reducing sedimentation hazards by stabilizing potential sediment sources, and to prioritize and schedule stabilization projects. Existing information is adequate to support a reasonable assessment of watershed hazards and susceptibility to CWEs for the five PWs that make up the study area.

One of Hearst's key strategies for minimizing cumulative watershed disturbance is to use cable or helicopter yarding systems rather than tractor skidding in sensitive areas. Aerial yarding systems protect soil resources not only because ground disturbance associated with log yarding is avoided, but also because areas yarded with aerial systems require fewer roads than tractor-logging areas. Consistent with the CFPRs and the Hearst BMPs, and as discussed below under "Surface Erosion" and "Mass Wasting", heavy equipment exclusion zones will include:

- all slopes greater than 65%;
- all slopes greater than 50% with high or extreme EHR, except for existing, stable skid trails;
- all slopes greater than 50% that lead without flattening to a watercourse; and
- all active unstable areas.

To accomplish harvesting on small, isolated portions of tractor units from which heavy equipment is excluded, however, tractors may be positioned on relatively gentle slopes to end-line logs from an adjacent exclusion zone.

Wyntoon Planning Watershed. ERA is projected to increase from its current level of 916 acres (28% of the TOC) to 1,936 acres (58% of the TOC) over the next 20 years (Table 3-2). ERA projections are particularly conservative (overestimated) for this watershed because of the limited amount of recovery assumed to occur on tractor-yarded land, and the fact that the Wyntoon PW is yarded entirely by tractor. No effects of historical human disturbances that would increase the PW's susceptibility to CWEs are known.

McCloud Reservoir Planning Watershed. ERA is projected to increase from its 1996 level of 431 acres (32% of the TOC) to 882 acres (64% of the TOC) in 2016. Although adverse watershed effects of early logging in this PW have been observed as noted in the environmental setting, these effects do not substantially increase the risk of significant CWEs.

Angel Creek Planning Watershed. ERA is projected to increase from its current level of 793 acres (44% of the TOC) to 1,369 ~~1,328~~ acres (76% ~~73%~~ of the TOC) after 20 years. Although a few potential sources of sediment discharge associated with roads close to Angel Creek have been identified, the Angel Creek PW is not unusually susceptible to CWEs.

Star City Creek Planning Watershed. ERA is projected to increase from its 1996 level of 388 acres (37% of the TOC) to 630 acres (60% of the TOC). Although some potential sources of substantial sediment discharge have been identified (e.g., sparsely revegetated clearcut areas, active landslides, and road-related gully erosion), such conditions commonly occur on steep timberlands and do not necessarily indicate high susceptibility to CWEs.

Curtis-Devils Canyon Planning Watershed. The ERA for this PW, which is currently 393 acres (9% of the TOC), is projected to increase to 1,564 acres (46% of the TOC) after 20 years. Although this watershed is characterized by relatively high natural instability, only a few mass movements appear to be associated with human disturbance. The PW's susceptibility to CWEs based on its natural instability is largely offset by the relatively low levels of planned future disturbance.

Other Planning Watersheds. Because no assessment of watershed conditions has been conducted for lands in Hearst Forests outside the five-PW study area, the potential for significant CWEs resulting from future management cannot be determined.

Impact: Cumulative Watershed Effects in Watersheds outside the Study Area. CWEs could result from implementation of timber operations on lands that have been excessively disturbed by past management or wildfires. This impact is considered potentially significant.

Mitigation Measure: Conduct a Watershed Assessment and Watershed Restoration as Needed. When preparing PTHPs for timber operations on lands outside the five PWs analyzed in this EIR, Hearst should conduct an assessment of watershed resources consistent with the standards specified in Technical Rule Addendum Number 2 to the CFPRs. If, based on a combination of high rates of sedimentation and high channel sensitivity, the watershed assessment determines that significant channel effects could result from the proposed timber operations in conjunction with past watershed disturbance, the proposed operations should be modified as needed to minimize land disturbance and related concentration of runoff. If significant adverse channel effects are unavoidable, watershed restoration (e.g., sediment hazard remediation) projects should be implemented in conjunction with the timber operations to offset their adverse effects. Implementing this mitigation measure would reduce this impact to a less-than-significant level.

Soil Compaction and Loss of Productive Timberland

Up to 10 additional miles of forest roads could be constructed over the next 20 years, resulting in the grading and permanent compaction of approximately 13 acres of soil surface. In addition, some lands would be used for landings, skid trails, and cable roads. Assuming that an average of 25 miles of skid trails and cable roads are used to access a square mile of timberland (which corresponds to an average spacing of skid trails and cable roads of 225 feet), it is estimated that 3.7% of the land base would be used for skid roads and cable roads. Other areas could also be affected by heavy-equipment use because grapple skidders, which are not confined to skid trails, are used extensively on Hearst Forests for yarding logs. Forests managed to promote uneven-aged stands through selective harvesting are disturbed by harvesting equipment more often than areas under even-aged management.

Soils on Hearst Forests are predominantly of volcanic origin, coarse textured, and not highly susceptible to compaction. Skid trails located relatively close to landings receive relatively concentrated use and probably incur the most compaction and related loss of productivity. Less-used skid trails and other harvested areas recover some of their natural permeability between harvesting cycles. Skid trails constructed on steep (> 40% slope) portions of Hearst Forests are typically permanent features of the transportation network and constitute long-term reductions in the timber-producing land base. On flatter areas, however, skid trails used in one entry are usually quickly reforested and are unlikely to be used for skidding in subsequent entries. Similarly, cable ways used to transport logs on lands too steep or sensitive for tractor use are temporary features. Because they remain productive timberlands as opposed to being converted to transportation facilities, and because of the resilience of the predominantly sandy soils, tractor skidding on slopes with less than 40% slope and cable yarding does not substantially reduce productivity.

Because the permanent compaction associated with proposed road and landing construction and skid trail construction and use is limited ... ities would have less-than-significant effects on soil ...

Surface E...

p. 224-4841

Tim ... oil disturbance associated
with tree fal ... rates and patterns related
to reduced ... isturbance that increases
runoff rates ... e EHR map (Figure 3-3)
is intended ... l detailed analysis and
mapping of E ... alized variations in soil
type and cove...

Key ol ... erodible areas and to
ensure that roa ... o avoid concentration
of runoff leadi ... erally prohibit use of
tractors in areas ... s with moderate EHR
and slopes of ... that do not require
reconstruction u ... before logging. The
maximum allow ... l diagonally across a
road or skid trail...

Because o ... ction, special rules
apply to timber o ... April 1, except for
purposes of install ... r 15). The CFPRs
specify that, if tim ... d, a winter-period
operating plan mu ... er things, EHR,
erosion control pro ... e limitations. The
winter-period opera ... ached BMPs (see
Appendix C).

In addition to the CFPRs, special BMPs are being implemented by Hearst to minimize erosion. In areas with high or extreme EHR (based on the BOF procedure):

- no timber operations will occur during the winter period;
- clearcutting will be prohibited to ensure retention of sufficient tree canopy to avoid increases in peak runoff resulting from reduced transpiration;

- broadcast burning of harvest areas will be prohibited to maintain adequate soil cover; and

- if tractors are used, mulch or logging slash will be placed on skid trail segments immediately adjacent to landings to provide adequate soil cover.

Ongoing monitoring of timber harvest areas, roads, and skid trails will be conducted to assess the effectiveness of the above BMPs to control erosion (see Appendix B). If the monitoring indicates that timber operations are resulting in substantially accelerated erosion, additional restrictions will be implemented as needed to protect soil resources.

Implementing and monitoring the effectiveness of the proposed BMPs, in conjunction with complying with the CFPRs, is expected to limit erosion attributable to timber operations to a less-than-significant level.

Mass Wasting

Mass wasting can be induced in unstable areas primarily by increasing soil moisture and by disturbing the toes of landslides. Slides usually occur when soil moisture from large storms reduces the friction that normally enables rock layers to cohere. Timber harvesting can increase soil moisture by reducing transpiration; facility construction can increase soil moisture by concentrating runoff. Constructing road cuts in the toes of slides reduces the mass buttressing the unstable area, increasing the risk of mass movement.

The CFPRs require that heavy equipment (e.g., tractors) not be operated on unstable areas unless such use is unavoidable and justifiable and its effects are specifically mitigated. In selection of road alignments, unstable areas must normally be avoided. Logging systems must be planned to minimize excavation or placement of fills on unstable areas.

Mitigation measures to avoid excessive disturbance of unstable areas will be developed by a RG or CEG; these measures will be incorporated into all subsequent PTHPs involving unstable areas. Until such measures have been developed, all timber operations involving unstable areas will conform with all applicable standards of the CFPRs. Additional mitigation measures will be adopted on a site-specific basis as needed to avoid significant adverse impacts on soil and aquatic resources, based on the judgment of the Hearst RPF and approved by the CDF Director.

The effectiveness of these BMPs will be assessed through an ongoing monitoring program (Appendix B). If such monitoring indicates that timber operations have resulted in mass wasting, additional restrictions will be applied as needed to prevent its recurrence.

Complying with the CFPRs and implementing and monitoring the BMPs will limit the risk of mass wasting to a less-than-significant level.

Sedimentation

Soil and rock dislodged through surface erosion or mass wasting inevitably moves downslope. Whether such material eventually moves into a stream channel depends primarily on the distance of the source of the material from the channel, the slope of the hillside, and the intervening topography. The impact of sediment discharges on stream channels depends on their sensitivity. For example, high-gradient stream reaches usually have a large capacity for sediment transport, so their sediment influxes are quickly flushed downstream, leaving relatively few persistent effects. Similarly, channels with large substrate particle sizes (e.g., boulders or cobbles) are relatively resistant to scouring during high flows. In contrast, channels with low gradient, alluvial banks, or small-sized substrate materials are naturally sensitive to large sediment influxes and extreme flow levels. The potential for sediment discharges to alter stream channels and affect aquatic habitat is indicated by Rosgen sensitivity class. With the principal exceptions of Huckleberry and Mud Creeks, channels in the study area are predominantly classified as having low or moderate sensitivity.

Erosion in riparian zones is especially likely to lead to stream sedimentation. WLPZ protection measures in the CFPRs were adopted in large part to control sediment discharge to streams. Relevant CFPRs include provisions that require retention of overstory and understory canopy and ground cover, exclusion of road and skid trail construction from WLPZs unless approved by CDF, exclusion of heavy equipment from WLPZs unless approved by CDF, minimization of the number of stream crossings installed, stabilization of areas of exposed mineral soil and deposits of fill or sidecast material in or adjacent to a WLPZ, stabilization of soil and logging debris on landings in or adjacent to a WLPZ, and prompt removal of soil or debris accidentally deposited in channels.

Among the BMPs implemented by Hearst that provide protection of WLPZs beyond that required by the CFPRs include:

- establishment of 50-foot-wide heavy equipment exclusion zones adjacent to Class III watercourses on slopes exceeding 50%;
- flagging of the centerline of all other Class III watercourses in timber harvest areas to make them clearly visible to timber operators (loggers);
- establishment of heavy equipment exclusion zones 25-50 feet wide adjacent to Class II springs;
- establishment of 200-foot-wide LSMZs adjacent to each side of all Class I and selected Class II streams within which timber harvesting will be restricted so that the average overstory tree size and overstory canopy density (as indicated by WHR class) will not be reduced by tree removal; and
- mulching of all landings and skid trails in WLPZs and Class III watercourses before the start of the winter period or within 10 days of completion of their use, whichever occurs later.

A key focus of sediment control is culverted stream crossings where failure of the culvert could result in the diversion of the stream down a road, leading to extensive gullying. Crossings with high diversion potential and other watershed hazards will be identified over the next 2 years through an ownership-wide inventory (see attachment to Appendix C). Hazards identified through the inventory will be evaluated to determine whether they can be stabilized, the sediment yield that could be avoided by implementing stabilization projects will be assessed, and the relative cost-effectiveness of each feasible stabilization project will be estimated. Hazards will be prioritized for stabilization treatment based on the feasibility and cost of remediation, the estimated volume of sediment discharge that would be avoided by the treatment, and the relative extent of watershed damage or stream impairment within the PW. A schedule for implementing cost-effective stabilization projects will be developed as part of the hazard inventory. Project implementation will be monitored to ensure compliance with the schedule.

Watershed hazards will be inventoried and evaluated every 10 years, or following each 50-year storm event, should such an event occur between regularly-scheduled inventories.

Most of the alternative and in-lieu practices Hearst proposes to implement involve construction and use of roads, landings, and skid trails in WLPZs or in or adjacent to Class III streams (see Appendix G). These practices would be implemented primarily because of the operational impracticality and adverse environmental impacts of locating such facilities farther from watercourses. For example, Hearst proposes to use some existing facilities within a WLPZ rather than construct new facilities outside the WLPZ because the overall disturbance associated with the new construction would greatly exceed that of using the existing facility. Similarly, Hearst proposes to construct some facilities within WLPZs because no feasible alternative locations are available.

Mitigation measures have been developed to avoid or reduce the adverse impacts of each proposed alternative or in-lieu practice. All of these mitigation measures have been included in the BMPs, which in turn have been incorporated into the project description. Mitigation measures intended to minimize the watershed impacts of construction of facilities within WLPZs include prohibitions on construction during the winter period, restriction of heavy equipment to the running surface of affected roads, avoidance of unstable areas, flagging of heavy equipment exclusion zones, removal of excavated material that could slough into streams to areas outside the WLPZ, and stabilization of exposed slopes that could transport sediment to streams (see Appendix G).

Channel surveys of Angel Creek conducted in 1995 concluded that the stream has a stable channel morphology. No major erosion sites or other human-caused disturbances were identified within the 7-mile segment analyzed. Very little sediment is stored in Angel Creek pools. Although no evidence was found indicating sedimentation problems in Angel Creek, several upslope sediment sources were identified. Gully erosion is occurring at Sunk Gulch and Dry Gulch where an unmaintained road crosses these north-side tributaries. An unvegetated area near the stream on the south side approximately 5 miles above the mouth features gullies and rills. Although these erosion sites probably contribute sediment to Angel Creek, their downstream channel effects are minimal because of the channel's high gradient. The absence of substantial downstream sedimentation effects in Angel Creek was confirmed by the relatively high frequency of pools exceeding 2 feet in depth and low levels of cobble embeddedness observed in lower Angel Creek. This reach has a gradient of 2%-4%. (Thomas R. Payne & Associates 1996.)

The effectiveness of the BMPs and the proposed alternative practices in controlling sedimentation and related impacts on channel structure and aquatic habitat will be monitored during implementation of the proposed project. The monitoring program will periodically assess changes in channel structure and habitat; if such changes are detected, their sources will be analyzed. Land management practices implemented in both riparian zones and uplands will be surveyed to determine whether they caused the impacts on channel and habitat conditions. If the practices are determined to be responsible for the channel or habitat impacts (e.g., by causing accelerated erosion), additional feasible measures will be implemented to prevent the recurrence of such problems.

The proposed project is not expected to result in significant adverse stream sedimentation impacts in the watershed assessment area for the following reasons:

- a large majority of study area stream reaches have channels with low or moderate sensitivity;
- most of the study area's high-sensitivity channels are located in areas of relatively flat topography and low EHR;
- the cumulative disturbance associated with past and future management of each PW is low relative to its natural sensitivity index;
- channel surveys of representative streams (Angel and Star City Creeks) indicate that, although accelerated erosion resulting from past timber operations occurring at a few localized sites is probably contributing sediment to the stream, such sedimentation has had negligible channel effects;
- restrictions on disturbance of sensitive areas (riparian zones and unstable and highly erodible areas) embodied in the CFPRs and BMPs are being implemented to minimize sedimentation; and
- a monitoring program is in place to identify and remedy future sedimentation problems that may arise.

Impact: Potential Channel Effects of Sedimentation Resulting from Cumulative Disturbance in Watersheds outside the Study Area. Although there is no evidence that watershed conditions on Hearst lands outside of the five-PW study area are either more sensitive or more highly disturbed than those within the study area, insufficient information has been obtained for these watersheds outside the study area to rule out the potential for significant sedimentation impacts. This impact is considered potentially significant.

Mitigation Measure: Conduct a Watershed Assessment and Watershed Restoration as Needed. This mitigation measure was described above under "Cumulative Disturbance in Relation to Watershed Sensitivity". Implementing this mitigation measure would reduce this impact to a less-than-significant level.

Peak Flows and Flooding

Flooding potential reflects a combination of natural watershed conditions (i.e., precipitation regime and permeability of land surfaces) and the types and extent of historical and future disturbances. Given natural conditions and past disturbances, the Wyntoon, Angel Creek, and Star City PWs are considered to have relative low flooding potential, and the McCloud Reservoir and Curtis-Devils Canyon PWs to have relatively high flooding potential. Stream reaches that are sensitive to sediment influxes (e.g., Huckleberry and Mud Creeks in the Wyntoon PW) are usually also sensitive to flooding impacts.

The results of the ERA analysis (Appendix D) indicate that proposed timber operations could result in minor increases in flooding potential in all PWs over the next 20 years. In other words, increases in peak flows resulting from future management activities are expected to be nearly offset by the gradual natural recovery of areas subject to past disturbance. This conclusion is based on the relatively limited disturbance that would result from the small amount road construction proposed and the proposed use of selective harvesting prescriptions. It is also based on highly conservative assumptions regarding recovery rates for disturbed lands.

Proposed timber operations are not expected to substantially increase peak flows or flooding potential in any of the PWs.

Stream Temperature

Study area waters are unusually cold for surface waters in California. The low temperatures characteristic of the McCloud River are the result primarily of their groundwater source (particularly Big Springs, which accounts for most of the downstream flow in the river), which flows year round at 43°-45°F. (Galovich and Ingram 1992.) Temperatures in the tributaries to the McCloud River that are fed primarily by surface runoff are also relatively low; those measured in Angel Creek in the summer of 1995 ranged from 49° to 56°F. (Thomas R. Payne & Associates 1996.) The low water temperatures in the tributaries are partly the result of the presence of relatively dense canopies characteristic of riparian zones throughout the ownership.

Because timber harvesting in riparian zones would be limited to light selection or sanitation-salvage prescriptions designed to maintain stream shading, the proposed project would result in negligible adverse effects on stream temperature.

Large Woody Debris Recruitment

Instream LWD performs a variety of aquatic functions, including pool formation, channel stabilization, and provision of fish cover. Although past timber harvesting substantially reduced the density of large trees in riparian areas throughout most of the ownership, stream surveys of Angel and Star City Creeks and reconnaissance surveys conducted for this EIR did not indicate any areas where LWD is deficient or where the functions performed by instream LWD are substantially impaired. The stream survey of Star City Creek found that instream LWD appeared to be in short supply and tended to be concentrated at a few locations, (Thomas R. Payne & Associates 1997). Because of the stream's relatively high gradient, LWD (which is relatively abundant in adjacent riparian areas) tends to be flushed rapidly down Star City Creek and into McCloud Reservoir. The scarcity of LWD in Star City Creek was attributed to its geomorphology, as opposed to a lack of LWD recruitment (Thomas R. Payne & Associates 1997). Because of the retention standards that limit removal of timber from WLPZs and LSMZs, the BMPs that require retention of downed logs and snags, and the low dependence of Star City Creek on LWD to provide quality fish habitat, future supplies of instream LWD are expected to continue to be adequate on streams in Hearst Forests. Specifically, at least 50% canopy cover will be retained in WLPZs (except for sanitation-salvage harvests), and no reductions in WHR size or density class will result from harvesting in LSMZs.

Intensive Management Alternative

Under the Intensive Management Alternative, the average annual timber harvesting level over the next 20 years would increase by 5% relative to levels under the proposed project. Approximately 19% of the harvest areas would receive regeneration harvests such as clearcutting. Other aspects of the timber operations (e.g., the rate of road construction) and the forest practice standards (i.e., the CFPRs, BMPs except for those applying to LSMZs, and alternative and in-lieu practices) that would be met would be the same as under the proposed project.

Cumulative Disturbance in Relation to Watershed Sensitivity

Impact: Cumulative Watershed Effects in Watersheds outside the Study Area. CWEs could result from implementation of timber operations on lands that have been excessively disturbed by past management or wildfires. This impact is considered potentially significant.

Mitigation Measure: Conduct a Watershed Assessment and Watershed Restoration as Needed. This mitigation measure is described above for the proposed project. Implementing this mitigation measure would reduce this impact to a less-than-significant level.

Impact: Excessive Cumulative Watershed Disturbance. As shown in Table 3-2, ERAs (expressed as a proportion of the TOC) in the five study area PWs are projected to range from 46% (in the Curtis-Devils Canyon PW) to 94% (in the Wyntoon PW) in 2016. The Wyntoon and Angel Creek PWs are the only watersheds where ERA would exceed 80% of the TOC. Under the Intensive Management Alternative, future timber harvesting is expected to result in a level of cumulative disturbance in these PWs that could lead to significant CWEs. This impact is considered significant.

Mitigation Measure: Reduce Rate of Harvesting or Extent of Clearcutting. The rate of harvesting or the extent of clearcutting should be reduced below the planned levels to ensure that ERA does not exceed 80% of the TOC for the Wyntoon and Angel Creek PWs. Implementing this mitigation measure would reduce this impact to a less-than-significant level.

Impact: Loss of Timberland Productivity. Extensive even-aged regeneration harvesting combined with tractor skidding under this alternative could substantially accelerate erosion. This impact is considered potentially significant.

Mitigation Measure: Reduce Rate of Harvesting or Extent of Clearcutting. Implementing the mitigation measure proposed for the preceding impact would reduce this impact to a less-than-significant level.

Impact: Potential Channel Effects of Sedimentation Resulting from Cumulative Disturbance in Watersheds outside the Study Area. Insufficient information has been obtained for these watersheds outside the study area to rule out the potential for significant sedimentation impacts. This impact is considered potentially significant.

Mitigation Measure: Conduct a Watershed Assessment and Watershed Restoration as Needed. This mitigation measure was described above under "Cumulative Disturbance in Relation to Watershed Sensitivity" for the proposed project. Implementing this mitigation measure would reduce this impact to a less-than-significant level.

Other Watershed Impact Areas

Because the same watershed protection standards (e.g., the CFPRs and all BMPs except those applying to LSMZs) applicable under the proposed project would also apply under this alternative, and because the areas disturbed by harvesting would increase only moderately relative to the areas disturbed under the proposed project, other watershed impacts (i.e., soil compaction, loss of productive timberland, surface erosion, mass wasting, sedimentation, peak flows and flooding, stream temperature, and LWD recruitment) are expected to be similar to those projected for the proposed project. No additional significant impacts would result.

Chapter 4. Fisheries

ENVIRONMENTAL SETTING

Study Area

The fisheries study area consists of the five PWs that were analyzed in Chapter 3. These PWs account for all Class I (i.e., fish-supporting) waters within Hearst Forests. Principal study area waters include McCloud Reservoir; the McCloud River between Lower Falls and McCloud Reservoir; several tributaries of the upper McCloud River (i.e., Huckleberry Creek, Star City Creek, Angel Creek, Mud Creek, and Quail Gulch) and upper Kosk Creek, a tributary of the Pit River (Figure 4-1). This analysis also addresses the reach of Tate Creek (in the Tate Creek PW) on the ownership because it supports a population of redband trout, a special-status species.

Regional Fish Resources

Historically, the fisheries of the McCloud River below its major waterfalls (Lower, Middle, and Upper Falls) included chinook salmon, steelhead trout, rainbow trout, and bull trout. Lower Falls was the upstream migration limit of anadromous fish (salmon and steelhead). The only native salmonid above the falls was the upper McCloud River redband trout. Nongame fish in the McCloud River included Sacramento squawfish, hardhead, Sacramento sucker, and prickly sculpin (Moyle et al. 1982). Except for prickly sculpin, these species primarily occurred downstream of the present location of McCloud Dam. The completion of Shasta Dam in 1945 and subsequent filling of Shasta Lake inundated 16 miles of the McCloud River and eliminated all runs of anadromous fish. McCloud Dam, built upstream of Shasta Dam in 1965, further restricted fish movements and divided the McCloud River into its upper and lower river fisheries.

The upper McCloud River fishery above Middle Falls consists of rainbow, brown, and brook trout and isolated populations of redband trout. The brown and brook trout are wild descendants of introduced stock. Stocking of hatchery rainbow trout above Middle Falls, which was discontinued in June 1994, may have resulted in hybridization between some subpopulations of upper McCloud River redband trout and stocked hatchery trout (Upper McCloud River Redband Trout Working Group 1995). DFG currently stocks hatchery rainbow trout at Fowlers Campground between Middle and Lower Falls, but hatchery fish are relatively uncommon below Lower Falls (Rode pers. comm.).

The upper McCloud River from Lower Falls to Huckleberry Creek supports an exceptional wild rainbow trout fishery. Rainbow trout are abundant and sometimes reach 20 inches in length.

Some resident brown trout are also found in this reach but are not as well suited to the river's extremely low water temperatures as are rainbow trout. Additional brown trout appear in this reach during the fall spawning migration from McCloud Reservoir (Galovich and Ingram 1985). Highly restricted public access has contributed to the high trout population levels in this reach.

The lower McCloud River supports one of the premier wild trout fisheries in California. The fishery is dominated by wild rainbow and brown trout. Average catch rates are high, the average size of caught trout has remained large, and a significant portion of the catch consists of trophy-sized trout. In 1976, the California Fish and Game Commission designated a 10.5-mile reach below McCloud Dam for special management and protection under the California Wild Trout Program, which was established in 1971 to "identify, enhance, and perpetuate natural and attractive trout fisheries" where wild strains of trout are given management emphasis (Rode 1989).

In recent years, approximately 18,000 catchable-size Shasta-strain rainbow trout, 50,000 Shasta-strain fingerlings, and 80,000 Eagle Lake rainbow trout fingerlings have been planted annually in McCloud Reservoir (Rode pers. comm.). Wild rainbow and brown trout produced in the McCloud River and its major tributaries also contribute to an unknown degree to the reservoir fishery.

Like the McCloud River, the Pit River no longer supports anadromous runs of chinook salmon and steelhead trout because Shasta Dam blocks their spawning migrations. Game species currently found in the Pit River drainage include native and introduced rainbow trout, introduced brown and brook trout, and a number of introduced warmwater species (e.g., largemouth bass). Nongame species include the Pit-Klamath brook lamprey, Sacramento sucker, tule perch, a number of native minnows (e.g., Sacramento squawfish), and the three sculpin species (Moyle et al. 1982). Kosk Creek, a tributary of the Pit River, is known to support rainbow trout (Rode pers. comm.). Rainbow trout is probably the dominant species in Kosk Creek, but the abundance and distribution of rainbow trout have not been documented for this stream.

Common Fish Species of the Study Area

Rainbow Trout

Distribution and Abundance. Rainbow trout are native to Pacific coast streams from northern Mexico to Alaska and as far inland as the Rocky Mountains. In California, they are native to coastal streams from the Los Angeles and Ventura Rivers north to the Klamath River, and most of the Sacramento-San Joaquin River system.

Rainbow trout are the most numerous and widely distributed fish in the McCloud and Pit River systems. They are native to the McCloud and Pit River drainages but their range has been considerably expanded, particularly above natural barriers, by the planting of hatchery-reared fish (Moyle et al. 1982). Although information on their distribution in the project area is limited, rainbow trout probably occupy all of the major tributaries of these rivers designated as Class I waters. Most of these populations are sustained by natural reproduction. Recent surveys in Angel

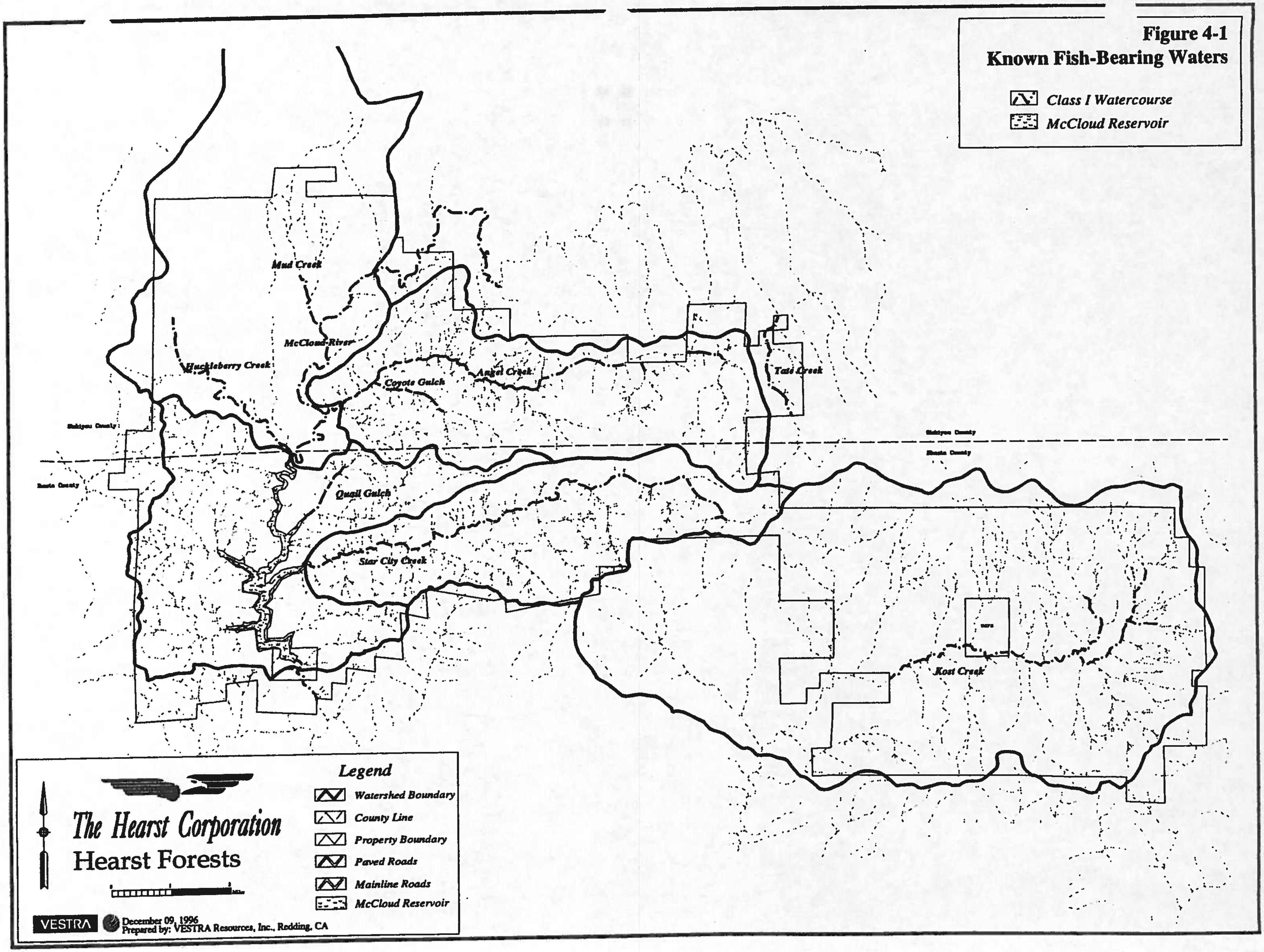


Figure 4-1
Known Fish-Bearing Waters
Class I Watercourse
McCloud Reservoir
Mud Creek
McCloud River
Huckleberry Creek
Coyote Gulch
Angel Creek
Tate Creek
Siskiyou County
Shasta County
Quail Gulch
Star City Creek
Kost Creek
Legend
Watershed Boundary
County Line
Property Boundary
Paved Roads
Mainline Roads
McCloud Reservoir
The Hearst Corporation
Hearst Forests
VESTRA
December 09, 1996
Prepared by: VESTRA Resources, Inc., Redding, CA

and Star City Creeks found that rainbow trout were the dominant trout species throughout the surveyed reaches (Thomas R. Payne & Associates 1996; Salamunovich pers. comm.).

Life History. The life history patterns of rainbow trout range from the highly migratory, sea-going pattern characteristic of steelhead trout to the resident pattern of small streams where fish may spend their entire life in a small area. Fish distribution and size data from recent surveys of Angel Creek suggest that rainbow and brown trout exhibit two life history patterns: a truly resident pattern and a migratory pattern in which trout occupy the McCloud Reservoir or McCloud River during most of their lives but use the lower portion of Angel Creek for spawning and rearing (Thomas R. Payne & Associates 1996).

Most rainbow trout mature in their second or third year. Successful reproduction of rainbow trout generally requires a gravel riffle where the female can dig a redd and eggs can successfully incubate. Most wild rainbow trout spawn each spring (February to June), but low temperatures can delay spawning until July or August. Rearing can take place in the natal streams, or juveniles may move downstream to larger streams or lakes to grow and mature.

Habitat Requirements. The following description of rainbow trout habitat requirements was summarized primarily from Raleigh et al. (1984).

Rainbow trout are typically found in cool, clear, well-oxygenated permanent streams and rivers with a combination of riffle and pool habitats. Rainbow trout are almost exclusively stream spawners and generally require streams with gravel substrate in riffle areas for reproduction to occur. Production of aquatic invertebrates, an important food source for trout, is greatest in riffle areas. Pools, which are occupied by adults and juveniles throughout the year, provide important summer rearing habitat and a refuge from high flows, predators, and adverse winter conditions. A pool-to-riffle ratio of approximately 1:1 is often associated with maximum trout production in streams.

Because rainbow trout are permanent residents of Class I streams as embryos, juveniles, or adults, adequate streamflows are needed year round for their survival. Trout populations are often limited by low summer flows that reduce the amount of available living space and increase their vulnerability to the effects of competition, predation, and disease. An annual base flow that exceeds 50% of the average annual daily flow (ADF) is considered excellent for salmonid production, a base flow of 25%-50% of ADF is considered fair to good, and a base flow of less than 25% of ADF is considered poor. Annual base flow for the McCloud River exceeds 50% of its average ADF. Although comprehensive flow data are not available for other study area waters, it is assumed that they have relatively low annual base flows because of their dependence on winter precipitation and snowmelt runoff. Seasonal flow fluctuations are generally needed for successful migration and spawning.

Cover provided by overhanging vegetation, undercut banks, debris piles, logs, large rocks, deep pools, and surface turbulence supplies important hiding, resting, and feeding areas for trout. Pools and associated cover can be particularly important for maintaining stable trout populations during low summer flow periods or harsh winter conditions. Consequently, the availability of suitable pool habitat and cover often limits trout populations. Cover for adult trout consists of areas of obscured bottom at least 6 inches deep. Juveniles and adults apparently require at least 15% and 25% cover, respectively.

Riparian vegetation is an important component of trout habitat because it provides shade for stream temperature control; contributes organic material to streams, providing food for aquatic invertebrates; protects streambanks from erosion; buffers streams from upslope sources of sediment; and is an important source of instream LWD. Roughly 50%-75% midday stream shading is generally considered an optimal range for trout streams, although shading becomes less important as stream gradient and size increase. Well-vegetated riparian strips at least 100 feet wide and stable, rocky streambanks generally provide adequate erosion control and sediment filtering and maintain stable banks characteristic of good trout habitat.

Optimal water temperatures for incubation of rainbow trout embryos range from 45°F to 54°F. Optimal temperatures for juvenile and adult life stages generally range from 59°F to 68°F. Although rainbow trout may survive over a broad range of temperatures, growth rates and ability to avoid predators and resist disease often decrease when temperatures exceed the optimal range. In small streams, dissolved oxygen concentrations may be reduced by the presence of large amounts of organic debris when temperatures are high and flows are low.

Successful spawning, incubation, and fry emergence require suitable substrate conditions. Suitable substrate size depends on the size of spawners but generally ranges from 0.6 to 2.4 inches in diameter for rainbow trout less than 20 inches long. As the proportion of fine sediments (particles less than 0.1 inch in diameter) increases in spawning gravels, the suitability of gravel for spawning decreases. Optimal conditions for spawning gravel include the proportion of fines being less than 5%; a composition of more than 30% fines results in low survival of embryos and emerging alevins. A relatively high proportion (greater than 10%) of fines in riffles can reduce the production of aquatic invertebrates.

Brown Trout

Distribution and Abundance. Brown trout, a species native to Europe and western Asia, was introduced to North America in 1883 and has become established in much of the United States and Canada. Brown trout occur in cold waters throughout much of California.

Within the project area, brown trout appear to be less numerous and more limited in their distribution than rainbow trout. In surveys of Angel and Star City Creeks, brown trout were found to be less abundant than rainbow trout and were limited to the lowermost reaches (Thomas R. Payne & Associates 1996 and 1997). During snorkeling surveys of the McCloud River, Galovich and Ingram (1985) observed few brown trout downstream of Big Springs before the fall spawning migration. Consistently low water temperatures may preclude the presence of resident brown trout in the upper McCloud River below Big Springs (Galovich and Ingram 1985).

Life History. Brown trout are typically sedentary in streams but often undertake fall migrations to upstream spawning areas. They usually mature in their second or third year; spawning commonly occurs in November or December in California (Moyle 1976). Like rainbow trout, brown trout exhibit both resident and migratory life history patterns in the McCloud River system.

Habitat Requirements. Although there are important distinctions between rainbow and brown trout, their habitat requirements are generally similar. Optimum brown trout habitat consists of medium to large, slightly alkaline, clear streams with both swift riffles and large, deep pools. Adult brown trout are largely bottom-oriented pool dwellers but younger, smaller brown trout are likely to be found in both riffles and pools. Temperature plays an important role in determining their distribution. Brown trout generally exhibit good growth and survival at temperatures of 54°-66°F but prefer temperatures in the upper half of this range (Moyle 1976).

Brook Trout

Distribution and Abundance. Brook trout are native to northeastern United States and eastern Canada. By 1890, large numbers were being raised and distributed throughout California. They are now established in mountain streams and lakes from the San Bernardino Mountains to the Oregon border. Despite widespread historical planting throughout California, brook trout have persisted primarily in small, spring-fed headwater streams and in isolated mountain lakes.

In the project area, brook trout appear to be primarily restricted to the upper portions of tributaries, such as the upper and middle reaches of Angel Creek, where they coexist with rainbow trout (Thomas R. Payne & Associates 1996).

Life History. Although brook trout are fall spawners, the specific time of spawning depends on water temperatures. In California, they usually spawn from mid-September to early January and at water temperatures of 39°-52°F (Moyle 1976). Their optimal range for growth and survival is generally between 52°F and 61°F (Raleigh 1982).

Habitat Requirements. The general habitat requirements of brook trout are similar to those of rainbow and brown trout.

Special-Status Species

Bull Trout

In California, bull trout were native exclusively to the McCloud River below Lower Falls. This native population is believed to have been extirpated. Intensive efforts to capture bull trout from the McCloud River, including portions of Angel, Star City, Huckleberry, and Mud Creeks, have been unsuccessful since two fish were confirmed to be present there in 1975 (Rode 1990). No bull trout were noted in Angel or Star City Creeks during snorkeling and electrofishing surveys in 1995 and 1996 (Thomas R. Payne & Associates 1996 and 1997). An attempt was made to reintroduce bull trout from the Klamath Basin in Oregon to the McCloud River, but the success of this reintroduction is unknown (Rode pers. comm.).

Extirpation of bull trout in the McCloud River has been attributed to habitat inundation, upstream extension or introduction of competitors such as brown trout, flow stabilization, elimination of juvenile anadromous salmonids as prey, and blockage of historical spawning habitat (Moyle 1976). Most of these factors are related to construction and operation of Shasta and McCloud Dams. Bull trout were listed as an endangered species under the California Endangered Species Act in 1980 (Rode 1990). USFWS recently reviewed available information on the current status of bull trout, and concluded that the listing of bull trout is warranted but precluded because of other higher priority actions (60 FR 30825).

Redband Trout

In California, redband trout were originally found in several small tributaries of the McCloud River, the Pit River, Goose Lake, and the upper Klamath River. Redband trout populations have been largely depleted throughout their range, primarily by hybridization and competition with non-native trout and by habitat damage associated with land management activities. McCloud River redband trout have been reported in the McCloud River above Middle Falls, its direct tributaries, and a few isolated drainages in the northern part of the McCloud basin (e.g., Sheepheaven, Tate, Edson, Bull, and Racoon Creeks). Only the Sheepheaven Creek population appears to be genetically pure.

Redband trout is currently recognized by USFWS as a candidate species for listing under the federal Endangered Species Act (61 FR 7596). The Forest Service has designated redband trout as "sensitive" in California. Redband trout conform to the California Endangered Species Act definition of a threatened species and could qualify for state listing (Moyle et al. 1995). Efforts are currently being coordinated to determine the genetic purity of redband trout populations in the upper McCloud River and to develop a management plan to avoid or minimize adverse effects on the species related to timber operations, grazing, recreation, and water diversions (Upper McCloud River Redband Trout Working Group 1995).

The study area includes a portion of Tate Creek known to support an isolated redband trout population. No redband trout were noted in Angel or Star City Creeks during snorkeling and electrofishing surveys in 1995 and 1996 (Thomas R. Payne & Associates 1996 and 1997).

Fish Habitat in the Study Area

Information on stream channel and fish habitat conditions in Class I waters within Hearst Forests was obtained from habitat and fish population surveys, field observations, and discussions with agency biologists and Hearst foresters. As described in Chapter 3, stream channel stability and sensitivity to disturbance were evaluated using channel typing results based on analysis of USGS topographic maps and aerial photographs of Class I streams. Additional information on channel stability and habitat conditions was available for Angel and Star City Creeks, where stream surveys were conducted in 1995 and 1996, respectively. Evaluations of total canopy cover and composition of riparian vegetation along each Class I stream were used to assess the extent of shading and the density of woody riparian vegetation adjacent to the stream channel.

Wyntoon Planning Watershed

The Wyntoon PW includes the upper portion of McCloud Reservoir and three Class I reaches (McCloud River, Mud Creek, and Huckleberry Creek).

McCloud River. The McCloud River from Lower Falls and Huckleberry Creek provides favorable trout habitat along much of its length. This reach is generally characterized by swift, cold water; excellent water quality; an abundance of instream boulders; and a well-developed riparian zone (Galovich and Ingram 1985). Much of the flow during summer and fall is provided by springs that maintain relatively stable flow and temperature conditions, particularly in the reach below Big Springs.

Mud Creek. The lower 1.1 miles of Mud Creek is designated as Class I. Much of the channel upstream of this reach appears to be of moderate to high sensitivity because the channel meanders through a low gradient outwash plain of unconsolidated sediments deposited by past mud flows originating from Mount Shasta. The average tree canopy cover along the Class I reach is 81%.

Huckleberry Creek. The entire length of Huckleberry Creek is designated as Class I. During a field visit to Huckleberry Creek in October 1995, the stream channel downstream of the spring source (Huckleberry Meadow) appeared to be in good condition with stable banks; a bottom consisting largely of fine sediments and rooted aquatic vegetation; and clear, cold water (52°F at 2:00 p.m.). Downstream of the meadow, the stream enters a higher gradient, forested section where the habitat changes to riffle-run sequences and occasional pools. The reach between the meadow and the main road was characterized by gravel substrates, stable banks, a moderate canopy density, and diverse stream habitat associated with large woody debris. The reach downstream of the road consists of a high-gradient channel with cascade and plunge pool habitat types. Overall, the average canopy cover along Huckleberry Creek is 53%.

McCloud Reservoir Planning Watershed

The McCloud Reservoir PW includes the lower portion of McCloud Reservoir and several small tributaries. Quail Gulch is the only Class I watercourse in this PW.

McCloud Reservoir. Aquatic habitat in McCloud Reservoir can generally be characterized as lacustrine. Reservoirs are typically much less productive per surface acre than natural lakes because their generally deep, steep-sloped basins and unstable water levels greatly limit habitat diversity and the quality of littoral habitat (i.e., nearshore areas), which is important for food production and as nursery habitat. Consequently, regular planting of hatchery trout is necessary to maintain fish population levels suitable for recreational harvest.

Quail Gulch. The lowermost 1.6 miles of Quail Gulch are classified as Class I. The lower portion of Lick Creek (which flows into Quail Gulch near McCloud Reservoir) is heavily aggraded by sediment. Canopy cover within the stream's riparian zone averages 72%.

Angel Creek Planning Watershed

Angel Creek. Thomas R. Payne & Associates conducted a stream survey on Angel Creek in summer 1995 to describe and evaluate existing fish habitat and aquatic resources within Hearst Forests. A total of 6.67 miles of Angel Creek were surveyed from the confluence of the creek with the McCloud River to Angel Meadows. The primary tasks included channel typing, a fish habitat inventory, snorkel and electrofishing surveys, and substrate typing.

Channel types varied from a low-gradient, slightly entrenched, alluvial channel in the Angel Meadows area to a steep, boulder-dominated channel confined within a narrow canyon. Run habitat was the dominant habitat type (accounting for 67% of the surveyed reach), followed by riffles (18%), pools (12%), and cascades (3%). Significant side-channel habitats were found in the lower reach.

Trout habitat in Angel Creek was characterized as excellent. Cool water temperatures; clean substrates; stable, well vegetated banks; dense overhead canopy; and abundant instream cover were observed in most of the survey area. These habitat features were found to provide a range of microhabitats for all life stages of fish and aquatic invertebrates. Although pool habitat was limited in extent, existing pools had depths adequate to maintain healthy fish populations (Thomas R. Payne & Associates 1996).

The results of the channel typing, habitat survey, and substrate analysis indicated a stable channel morphology. No signs of major streamside erosion or extreme watershed disturbance were observed in the survey area. Substrate evaluations at two geomorphic reference sites indicated no significant sediment loads or discharges of fine sediment. Although two potential sediment sources were identified along Angel Creek, no adverse effects of the sedimentation on downstream habitat were evident apparently because of the stream's high channel gradient.

The following sensitivity ratings correspond to the channel types identified during the 1995 stream surveys: 17% of the main channel of Angel Creek has low sensitivity, 66% has moderate sensitivity, and 17% has high sensitivity.

Riparian canopy cover averages 55% along Angel Creek.

Coyote Gulch. The 1.2-mile Class I reach of Coyote Gulch features dense (averaging 88%) riparian canopy cover.

Star City Creek Planning Watershed

Star City Creek. Stream surveys similar to those conducted on Angel Creek were conducted on Star City Creek in 1996. Two study reaches were identified. The lower reach (1.67 miles) was classified as a B2 channel type, which has a moderate sensitivity rating. The upper reach (5.16 miles) was classified as an A1 channel type, which has a low sensitivity rating. Both reaches were characterized by relatively high gradients, a stable streambed and banks composed largely of boulders and/or bedrock, and low quantities of fine sediment. As on Angel Creek, run-type habitat was the most common habitat type (accounting for 68% of the total surveyed length). Roughly equal proportions of riffles and pools were present (16%). (Thomas R. Payne & Associates 1997.)

Canopy cover averages 62% along Star City Creek.

Curtis-Devils Canyon Planning Watershed

Kosk Creek. A limited portion of the upper Kosk Creek channel was examined during the October 1995 site visit. The channel consisted of a mixture of cobble and boulders, with cobbles embedded approximately 30%-50% in sand and gravel. The habitat consisted largely of riffles, and no pools were present. The streambed and banks appeared to be stable.

Riparian-zone canopy cover in the 7.7-mile Class I reach of Kosk Creek analyzed averages 55%.

Tate Creek

Tate Creek is outside the five PWs constituting the watershed assessment study area but is contained partially within Hearst Forests. It is of special interest because it supports redband trout. Canopy cover averaged 88% within the 1.8 miles of the stream analyzed for this EIR. Stream surveys of Tate Creek conducted during the 1970s reported habitat to be generally in fair condition (U.S. Forest Service 1979, 1996).

IMPACTS AND MITIGATION MEASURES

Impact Assessment Methodology

Timber operations can affect stream habitat and fish populations through several mechanisms, including increased sedimentation of aquatic habitat resulting from increased erosion; changes in water temperature and primary production resulting from reductions in stream shading; reduced recruitment of LWD; alteration of flow patterns resulting from changes in runoff characteristics; and blockage of fish migration at stream crossings. The degree to which each of these mechanisms would affect fish populations was assessed based on the general life-history habitat requirements of key species (i.e., rainbow, brown, and brook trout), the condition of existing fish habitat, the sensitivity of specific streams to watershed disturbance, and the projected effects on specific habitat parameters resulting from the proposed project and the alternatives.

The CWE analysis (see Chapter 3, "Watershed Assessment") provided additional information for evaluating the potential for soil erosion and sedimentation of aquatic habitat in Class I streams.

Additional habitat survey data and field observations were used to augment the information in and support the conclusions of the CWE analysis.

Because data on past and present fish populations and aquatic habitat are limited, and because quantitative relationships between timber operations and their effects on fish habitat in the study area have not been specified, the assessment of fishery impacts was generally qualitative. It analyzed habitat changes and their effect on fish based on existing habitat conditions and the degree of change expected to result from implementation of the proposed project and the alternatives.

Criteria for Determining Significant Impacts

Populations of fish and other aquatic organisms respond to changes in their environment through changes in survival, growth, and reproduction. These changes can result in short- or long-term changes in fish abundance and distribution.

Impacts on fishery resources were considered significant if proposed actions (either alone or in conjunction with past, present, and future actions) would directly or indirectly cause or contribute to substantial short- or long-term reductions in fish abundance or distribution. In addition, effects were considered significant if the proposed actions would result in permanent or temporary habitat loss or habitat avoidance leading to reduced survival or reproductive success of individuals of any state-listed or federally listed fish species, state or federal candidate for listing, state designated species of special concern, or federally designated sensitive species.

No-Project Alternative

Termination of logging and associated reductions in watershed disturbance would result in gradual increases in riparian canopy cover and localized reductions in sediment discharge, which could increase stability in some stream reaches and would probably lead to long-term improvement of their aquatic habitat conditions. Because most Class I stream channels are currently stable and relatively insensitive to changes in watershed disturbance, riparian canopy cover is typically relatively dense and water temperatures are generally low, and instream LWD is currently adequate and plays a limited role in pool formation and channel stabilization, however, habitat improvements resulting under this alternative would be confined to localized stream segments.

Proposed Project

Sedimentation of Aquatic Habitat

Timber harvesting and related activities (e.g., road, landing, and skid trail construction) that cause ground disturbance can increase surface erosion rates and mass wasting risks, resulting in the potential for increased sedimentation of streams and other receiving waters. Specific mechanisms that can lead to increases in erosion are discussed in greater detail in Chapter 3.

Sediments entering watercourses, whether they settle or remain suspended, can damage aquatic habitats and reduce fish survival, growth, and reproduction in downstream reaches. Fine sediments deposited in gravels can lower spawning success by reducing embryo survival and trapping emerging fry or reduce the availability of food in streams by reducing primary production and invertebrate abundance. Fine sediments that remain in suspension can increase turbidity, which can reduce feeding opportunities for sight-feeding fish (e.g., trout), and lower fish production by causing fish to avoid biologically important habitat or by delaying migration to upstream spawning habitats.

Coarse sediments can alter the channel bed, channel geometry, and bank erosion rate. Stream reaches that become aggraded (i.e., accumulate bed materials) with coarse sediments typically become wider and shallower, with more riffle habitat area and less pool habitat area, volume, and depth. Loss or reduction of pool habitat can limit trout populations by reducing the availability of resting, feeding, and refuge areas.

Impact: Potential for Increased Sedimentation of Class I Streams. Under the proposed project, watershed disturbance caused by timber harvest operations would increase relative to conditions under the No-Project Alternative. Compliance with the CFPRs and implementation of the BMPs (including the alternative and in-lieu practices) discussed in Chapter 2, however, is expected to provide substantial protection to aquatic habitats from sedimentation impacts. The CWE analysis indicates that current ERAs for all five PWs are substantially lower than their respective TOCs, and ERA is expected to decline slightly in the future under the proposed project. Habitat surveys of Angel Creek, which had the highest relative current ratio of ERA to TOC (56%) of the study area PWs, indicated that the stream channel was stable, fish populations were healthy, and no significant sediment loads or quantities of fine sediment were present in the channel. These results indicate that past harvesting, which was generally more intensive and environmentally damaging than proposed logging practices, has had relatively limited adverse effects on fish and fish habitat.

Recent sediment and substrate analyses of Angel and Star City Creeks strongly suggest that the channels are stable and that sedimentation rates have not limited fish populations. However, limited information is available to directly assess past trends or project future trends in sedimentation and trout populations. Additionally, no information is available to assess current and future habitat conditions and trout populations in other Class I streams such as Kosk Creek (i.e., Curtis-Devils Canyon PW) or Tate Creek, which supports redband trout, a special-status species. Therefore, because sedimentation of stream habitat is potentially a limiting factor for trout production, and because of uncertainty regarding future sedimentation impacts on fish habitat, sedimentation of Class I waters in the Hearst property is considered a potentially significant impact.

Mitigation Measure: Implement Adaptive Aquatic Management for Angel and Kosk ~~Star City~~ Creeks. Based on consultations with DFG and CVRWQCB, Hearst will modify its aquatic habitat monitoring program to focus on Angel and Kosk Creeks, rather than Angel and Star City Creeks. To improve knowledge of the natural variation in aquatic habitat conditions, Hearst will complete a total of two baseline sediment surveys in the selected streams over the next 3 years.

This means that one additional baseline sediment survey will be conducted in Angel Creek, replicating the 1995 survey, and two baseline sediment surveys will be conducted in Kosk Creek over the next 3 years. The sediment surveys will focus on two selected geomorphic reference reaches in each stream. In addition, baseline habitat typing surveys and fish abundance surveys will be conducted in Kosk Creek following the standard protocols applied previously in Angel and Star City Creeks. Kosk Creek habitat typing and fish abundance surveys will be restricted to the accessible portion of the stream within Hearst Forests, namely, the approximately 3-mile reach between the crossing in Section 26 (T. 38 N., R. 1 E.) and the crossing in Section 7 (T. 38 N., R. 2 E.). Finally, continuous stream temperature recording will be conducted during the summer months at one accessible location in the lower portion of each study area for at least 2 years.

Following completion of the baseline aquatic surveys, Hearst and CDF will develop, with input from DFG, a schedule for conducting subsequent aquatic surveys involving at least one additional sediment survey and one year of stream temperature recording in Angel and Kosk Creeks. Based on the results of the baseline surveys, Hearst and CDF will also develop thresholds of departure from baseline conditions to use in determining whether substantial habitat degradation has occurred. If the thresholds are exceeded, the reasons for the degradation will be explained, and, if warranted, additional habitat typing and fish abundance surveys will be conducted. If the reasons for the habitat degradation are not readily apparent, additional surveys will be conducted in tributary streams, or on hillslopes to determine the extent and sources of the damage. If deemed necessary by Hearst and CDF, additional measures (e.g., reduced harvesting in streamside areas, increased road abandonment, or increased stabilization of active erosion sites) will be implemented to restore habitat quality.

Angel and Star City Creeks account for 39% of the total length of Class I streams on the ownership. Periodic monitoring of geomorphic conditions and fish populations should be implemented in the lower reaches in Angel and Star City Creeks, where baseline data were collected in 1995 and 1996. These sites are the most suitable for monitoring because of their representativeness of streams tributary to the McCloud River and Reservoir, their accessibility, and their importance as spawning and rearing habitat for trout that contribute to the McCloud River and Reservoir fisheries. The principal monitoring variables should be geomorphic variables collected during baseline sampling (V* and D50 surface-to-subsurface ratios) and fish abundance estimates and size data.

Because of the very low levels of human disturbance that have occurred historically in the Curtis-Devils Canyon PW (as indicated by an ERA of 1.5% in 1995) and the low disturbance levels proposed there for the next 20 years (as indicated by a projected ERA of 1.1% in 2015), and because of the high natural geomorphic instability of the PW, timber operations are unlikely to contribute substantially to the total volume of sediment discharged into the PW's surface waters or substantially affect its habitat quality or fish populations. Based on these conditions and expectations, no aquatic monitoring is proposed for streams in the Kosk Creek Tract.

The selected monitoring reaches should be resampled in 10 years to evaluate changes in sediment and fish populations. If no substantial degradation related to sedimentation is found, monitoring should be repeated 10 years later.

~~If degradation related to sedimentation is found, surveys (e.g., aerial photograph interpretation, stream surveys) should be conducted to identify major sediment sources. If major sources are found and determined to be treatable, they should be treated in a reasonable time period. If the surveys do not identify major sediment sources, the increased sedimentation is likely to be the result of extensive changes in hillslope erosion processes, and surveys should be conducted to identify and assess these changes. Based on the findings, timber operations that potentially contribute to increased hillslope erosion should be identified and modified as needed to control sedimentation. Monitoring should be repeated 5 years after implementation of any mitigation actions to evaluate instream responses (e.g., changes in sediment conditions and fish populations). Implementing this mitigation measure would reduce this impact to a less-than-significant level.~~

Stream Shading Reductions in stream shading from removal of streamside vegetation can affect instream water temperatures and photosynthetic rates. These effects can be either beneficial or adverse for fish populations.

Removal of streamside vegetation can lead to increased solar insolation (heating of water by sunlight) and instream water temperatures. Substantial increases in average temperatures or daily fluctuations in temperatures can be detrimental to trout, particularly if water temperatures exceed suitable levels for prolonged periods. Warm temperatures may reduce juvenile growth and survival, inhibit upstream migration of adults, increase susceptibility of fish to disease, reduce metabolic efficiency, or alter species interactions.

Increased solar insolation typically results in higher photosynthetic rates in aquatic habitats. Such increases can benefit fish populations with limited food supplies by causing an increase in the abundance of aquatic invertebrates, an important food source for stream-dwelling salmonids. The

benefits of increased food supply may be offset, however, by the adverse effects of warmer water discussed above.

Compliance with the CFPRs and implementation of BMPs, including alternative and in-lieu practices, is expected to minimize water temperature impacts related to removal of stream canopy provided by riparian trees and shrubs. WLPZs must generally be managed to prevent degradation of water quality and impairment of the beneficial uses of water. Within the WLPZ of Class I watercourses, at least 50% of the overstory and 50% of the understory canopy covering the ground and adjacent waters should be left, with the residual overstory canopy composed of at least 25% of the existing overstory conifers. Where less than 50% canopy (including both tree and woody shrub canopy components) exists in the WLPZs of Class I and II waters before timber operations, only sanitation-salvage harvesting is allowed.

The estimated average percent canopy cover provided by conifers and deciduous trees along all Class I waters in Hearst Forests ranged from 52% for Huckleberry Creek to 88% for Coyote Creek (a tributary of Angel Creek) and Tate Creek. Although no information is available on the riparian canopy contribution of shrubs, they would undoubtedly increase the percentages specified above for trees. Water temperatures measured in Angel Creek in summer 1995 (46°-56°F) were generally below or within the optimal range for juveniles and adults of all three trout species, despite Angel Creek having had one of the lowest average canopy coverages (55%) of all Class I reaches on the ownership. Although removals of riparian trees could reduce canopy coverage to levels below that generally considered optimal for trout streams (50%), reductions in canopy cover consistent with the CFPRs and BMPs would not increase water temperatures above the optimal range for trout.

Recruitment of Large Woody Debris

Timber management activities can reduce the source of woody material for streams, resulting in deficient amounts of large, stable woody debris in channels. LWD can influence montane stream morphology and fish habitat by affecting storage and routing of sediments and by creating and maintaining fish habitat (particularly pools). The abundance of juvenile salmonids is often directly correlated with LWD abundance. Reduced recruitment of instream LWD could decrease habitat complexity, the number and volume of pool habitats, the amount and quality of instream fish cover, and the capacity of streams to store high-quality sediments.

Recent surveys of Angel and Star City Creeks indicate that these streams feature adequate pool habitat for all resident trout species.

No direct measurements of LWD in or near Angel or Star City Creeks were made during the 1995 or 1996 stream surveys. These surveys indicated that the primary sources of instream cover for trout were boulders, overhanging vegetation, and bubble curtains. However, estimates of the density and composition of riparian vegetation along these reaches indicate that substantial tree densities border most Class I streams (excluding a few meadow reaches), implying that LWD sources are present and available for recruitment to the stream.

The CFPRs restrict timber removal adjacent to watercourses within WLPZs, the widths of which depend on the slope adjacent to a watercourse and its class. Some of the BMPs discussed in Chapter 2 and Appendix C (e.g., onsite retention of unmerchantable cull logs in all harvest areas) are specifically intended to maintain adequate supplies of LWD. Nonvariable 200-foot-wide LSMZs will also be established along both sides of all Class I watercourses (Figure 2-2) to be managed for development of late seral attributes, including production of mature conifers, which have the highest value as sources of LWD. Standards for WLPZs (including the proposed modifications in WLPZ width constituting alternative practices discussed in Chapter 2) and related BMPs ensure retention of sufficient mature conifers and deciduous trees to provide a sustained supply of large woody material to the stream channel. As a result of implementing these standards and practices, adequate supplies of LWD would be maintained along Class I streams.

Streamflows

Timber operations can affect streamflows by altering the water balance or affecting the rate at which water moves from upland areas to stream channels. Heavy equipment used for road building and log yarding can reduce water infiltration capacities of the soil and increase surface runoff, causing higher peak flows and increased sediment transport in stream channels, particularly if water discharges to the channel are synchronous. Changes in peak streamflows can also result from construction of roads, skid trails, and landings, which reroute and concentrate surface runoff. Substantial increases in peak flows can reduce the availability and suitability of fish habitat by increasing bank erosion and changing channel geometry, habitat complexity, instream cover values, and substrate quality.

Reductions in vegetative cover associated with timber harvesting can also influence the magnitude of streamflows. Harvesting reduces the vegetative transpiration rate, thus increasing the moisture content of the soil and runoff rates during storms. Although the effect of land use on peak streamflows is probably relatively small for extreme storm events, the rate of stormwater discharge to channels could increase in response to timber operations. In clearcut areas, such increases in streamflow usually persist for less than 10 years, or only until new root systems become established through regeneration. For selectively harvested areas, streamflow effects are typically much more short-lived.

Reduced transpiration related to logging can also benefit fish by increasing low summer and fall flows.

As discussed in Chapter 3, flows in the McCloud River are dominated by groundwater discharge and thus are unusually stable compared with those of other California rivers. Other study area streams are relatively susceptible to streamflow effects resulting from timber operations.

Compliance with the CFPRs and the BMPs would prevent or reduce the potential for soil compaction and runoff diversion and concentration. Streamflow impacts of the proposed project would be less than significant.

Migration Barriers

Culverted stream crossings may impede fish migration if the culverts are elevated too far above the streams, convey excessive or insufficient flows, are too long, or result in a combination of these factors. Such obstacles can limit access to important upstream spawning and rearing habitats. Hearst, however, will consult with DFG and obtain a Streambed Alteration Agreement (California Fish and Game Code Sections 1600-1603) prior to installing a bridge or culvert at any Class I stream. The permit will identify the design, construction, scheduling, and maintenance specifications for the structure, as well as any mitigation measures for impacts on aquatic habitat. In addition, implementing BMPs focusing on minimizing sedimentation and avoiding landslides will reduce the potential for formation of natural migration barriers. As a result, the proposed project would not result in potentially significant impacts on fish migration.

Intensive Management Alternative

Under this alternative, annual timber harvesting levels and the area receiving regeneration harvests (e.g., clearcutting) would increase, and the average period between selective harvest entries would decrease, relative to the proposed project. In addition, no LSMZs would be established under the Intensive Management Alternative. Because increased ground disturbance relative to the proposed project would largely be limited to areas outside the WLPZs, and because all resource protection standards encompassed in the CFPRs and BMPs would be unchanged, potential impacts on aquatic habitat and fish populations under this alternative are expected to be similar to those identified for the proposed project.

Impact: Potential for Increased Sedimentation of Class I Streams. This impact is potentially significant.

Mitigation Measure: Implement Adaptive Aquatic Management for Angel and Star City Creeks. This mitigation measure is described above under "Proposed Project". Implementing this mitigation measure would reduce this impact to a less-than-significant level.

Chapter 5. Vegetation

ENVIRONMENTAL SETTING

Sources of information used in preparing this chapter include timber type maps and aerial photographs provided by Hearst, Holland (1986), Barbour and Major (1977), and the DFG Natural Diversity Data Base (NDDB) (Natural Diversity Data Base 1996). In addition, Jones & Stokes Associates conducted a reconnaissance-level survey of the ownership from October 23 to 25, 1995, and November 12 to 14, 1995, to evaluate and describe the major vegetative communities. No floristic surveys or surveys for special-status plants were conducted for this EIR.

Hearst Forests is located in the southern Cascade Range of northern California. This range is usually described in terms of its volcanic origins, with high mountain peaks, cinder cones, and lava flows and long, narrow valleys and canyons formed by geologic folding and faulting (Norris and Webb 1990). Elevations on the ownership range from 2,800 to nearly 6,000 feet above sea level. Topographic relief on the ownership is highly variable. For example, the northern half of the Wyntoon Tract is part of McCloud Flats and features very little topographic relief; in contrast, much of the Star City Creek PW has considerable topographical relief, with slopes up to 80%. The regional climate is characterized by cool, wet winters and warm, dry summers.

Forest Types

The Hearst ownership is within a vegetation zone dominated by various conifer forest types. The distribution of forest types within this zone is primarily related to variations in elevation, precipitation, aspect, and fire history (Barbour and Major 1977). Locations of forest types and other habitats are shown in Figure 5-1.

Mixed Conifer

Mixed conifer forest is characterized as a relatively dense forest dominated by a variety of conifer species, including white fir, incense cedar, Douglas-fir, Jeffrey pine, sugar pine, and ponderosa pine, and nonconifer species, including greenleaf manzanita, black oak, chinquapin, and snow bush. This community occurs primarily on moist soils and usually on mid-elevation north-facing slopes (Holland 1986).

Ponderosa Pine

Ponderosa pine forest is characterized as an open, parklike forest of coniferous evergreens dominated by ponderosa pine and an understory of scattered shrubs, such as antelope bush, basin sagebrush, and ceanothus (Holland 1986). Ponderosa pine dominates xeric sites with well-drained soils at low elevations, often on south-facing slopes.

Jeffrey Pine

Jeffrey pine forest is a tall, open forest similar to ponderosa pine forest, but is dominated by Jeffrey pine. It typically occurs at mid- to high elevations on dry, well-drained slopes and ridges. Characteristic species include basin sagebrush, chinquapin, antelope bush, and ceanothus.

Lodgepole Pine

Lodgepole pine forest is characterized by open stands of lodgepole pine with sparse litter accumulation and little shrub or herbaceous understory (Barbour and Major 1977). This community most often occurs on rocky, well-drained soils at high elevations, above the red fir zone, and often near the treeline (Holland 1986). It is frequently found in stands around meadows or other moist areas. Representative species include mountain heather, quaking aspen, and cinquefoil.

Knobcone Pine

Knobcone pine forest is a fire-maintained forest occurring on shallow, dry, rocky sites dominated by knobcone pine. It occurs at low to mid-elevations. The understory typically is sparse and consists of chaparral shrubs.

White Fir

The white fir type is characterized by relatively dense stands of nearly pure white fir. The understory is sparse and consists of chinquapin, red current, and ceanothus. White fir forest is characteristic of previously harvested sites but is most common on mid-elevation, moist, north-facing slopes.

Red Fir

The red fir type is similar to white fir except that it forms a denser forest canopy and typically consists of pure stands of red fir. It is also found at higher elevations above the mixed conifer zone on cooler, moister, often north-facing slopes (Holland 1986). It has a sparse understory often consisting of chinquapin, red current, and snowberry. At lower elevations it will mix with white fir, and at higher elevations it will mix with lodgepole pine.

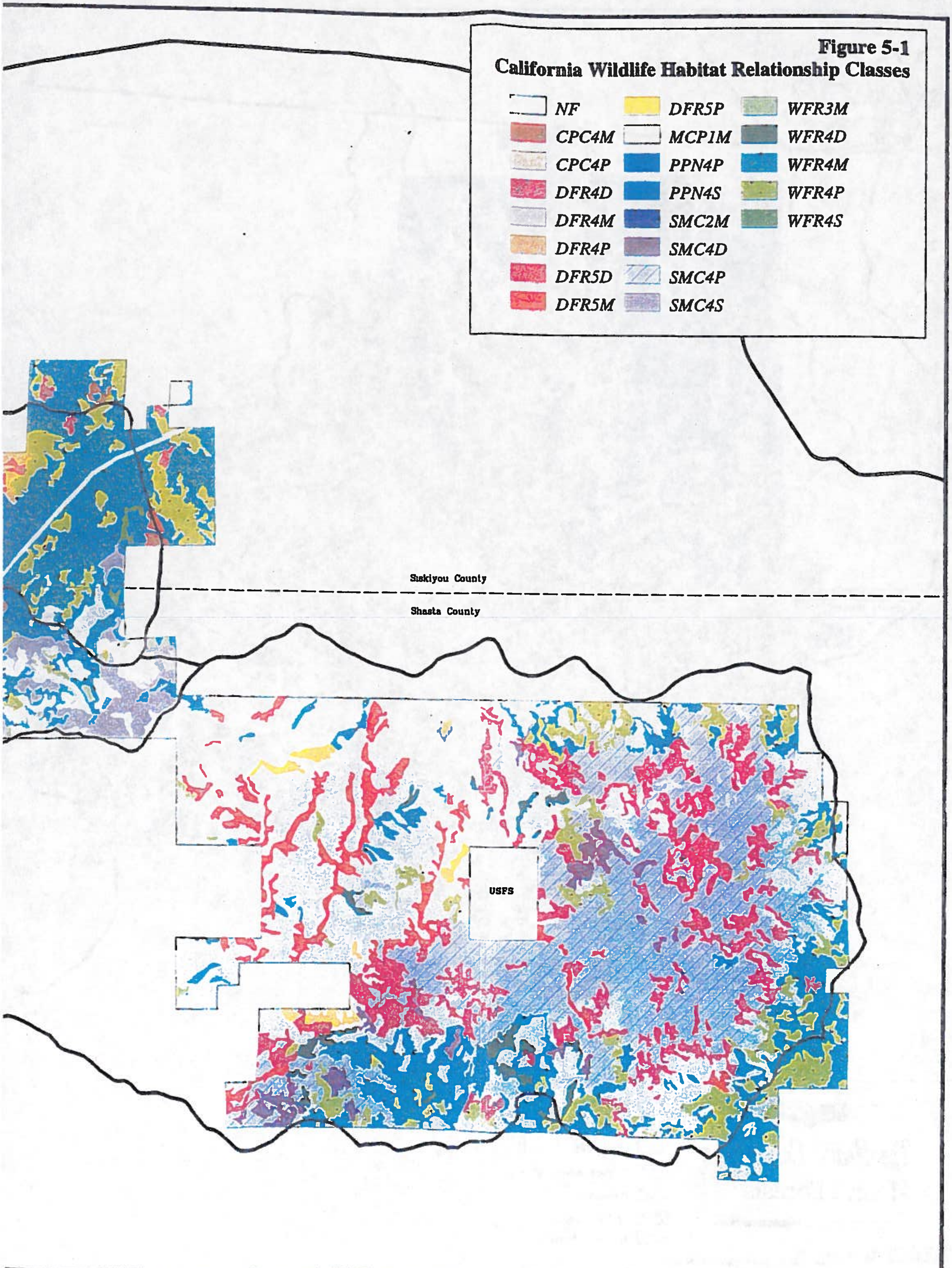
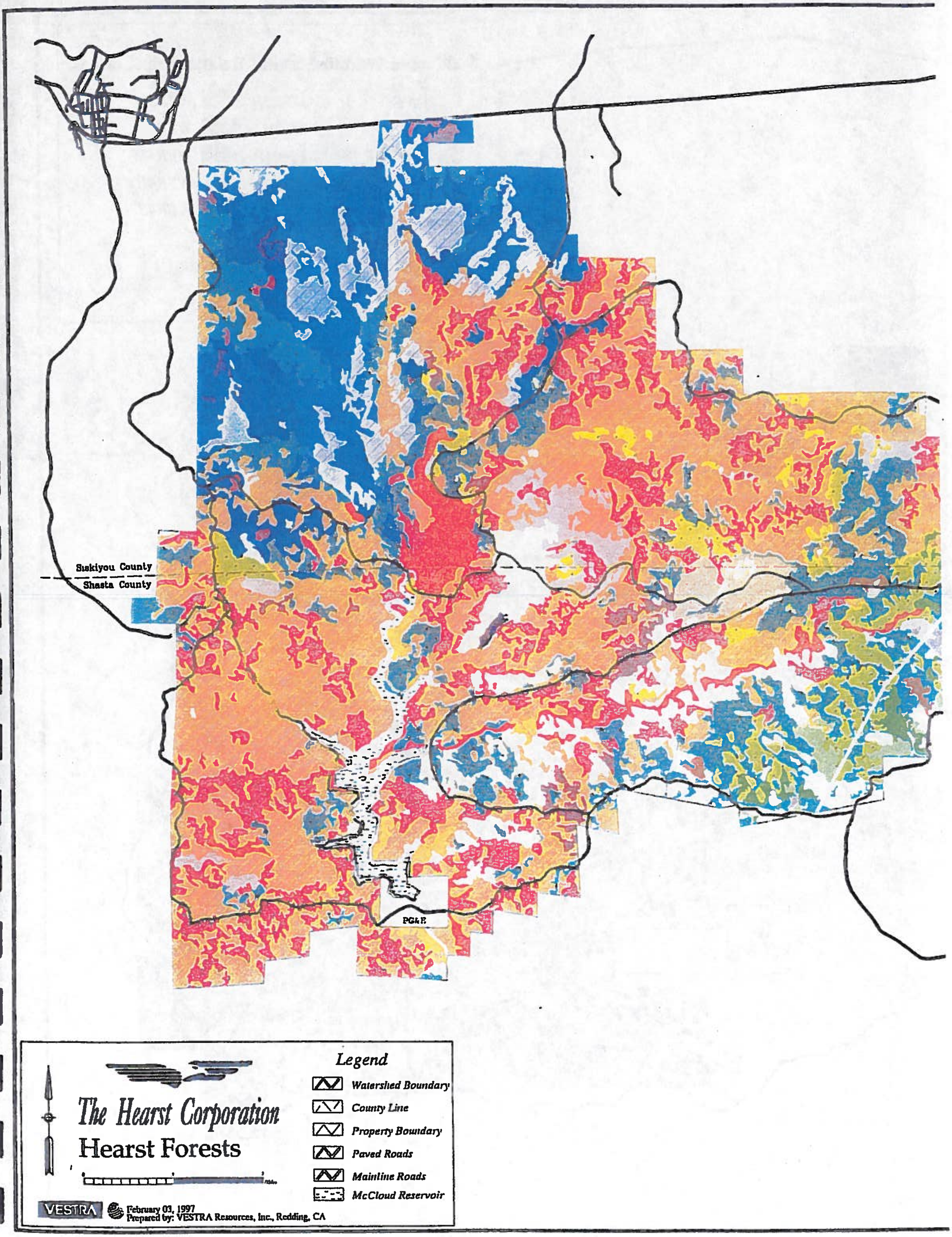


Figure 5-1
California Wildlife Habitat Relationship Classes
NF
CPC4M
CPC4P
DFR4D
DFR4M
DFR4P
DFR5D
DFR5M
DFR5P
MCP1M
PPN4P
PPN4S
SMC2M
SMC4D
SMC4P
SMC4S
WFR3M
WFR4D
WFR4M
WFR4P
WFR4S
Siskiyou County
Shasta County
USFS



Siskiyou County
Shasta County
PG&E
Legend
Watershed Boundary
County Line
Property Boundary
Paved Roads
Mainline Roads
McCloud Reservoir
The Hearst Corporation
Hearst Forests
VESTRA
February 03, 1997
Prepared by: VESTRA Resources, Inc., Redding, CA

Other Communities

Mixed Chaparral

Mixed chaparral consists of broad-leaved sclerophyll shrubs forming dense vegetation and dominated by scrub oak, manzanita, and ceanothus. This community occurs on dry, rocky, often steep slopes, and typically on south-facing slopes (Holland 1986). Mixed chaparral occurs primarily on south-facing slopes in the Kosk Creek Tract.

Montane Hardwood-Chaparral

Montane chaparral is typically found at higher elevations than mixed chaparral and is more closely associated with conifer forests. It occurs primarily on dry slopes but may also occur in other conditions throughout the forest (Mayer and Laudenslayer 1988). Low, dense-growing varieties of *Artcostaphylos* and *Ceanothus* dominate this community, and occur with scrub oak, mountain mahogany, and California buckthorn. Montane chaparral occurs primarily in the Kosk Creek Tract.

Montane Riparian Community

The montane riparian community occurs along streams as a narrow corridor consisting primarily of alder, big-leaf maple, black cottonwood, Oregon ash, and willow. The streamside hardwood vegetation also often has a conifer overstory component. Riparian habitats are characterized by a diversity of plant and wildlife species. The montane riparian community is found along several watercourses in both the Wyntoon and Kosk Creek Tracts, including Huckleberry Creek, Battle Creek, and Kosk Creek.

Wet Meadow

The wet meadow community generally consists of a single layer of herbaceous plants, predominantly perennial sedges, rushes, and grasses (Barbour and Major 1977). Shrubs and trees are usually absent but are important components of the meadow edge or may occur as riparian vegetation along narrow streams within the meadow community (Mayer and Laudenslayer 1988). Wet meadows occur as ecotones between emergent wetland and mesic meadow and are thus composed of a variety of both grass and wetland species. Common genera include *Agrostis*, *Carex*, *Danthonia*, *Juncus*, and *Scirpus* (Mayer and Laudenslayer 1988).

Three wet meadows are present on the Wyntoon Tract: Huckleberry Meadow in the Wyntoon PW, Amos Meadow in the McCloud Reservoir PW, and Stouts Meadow in the Star City Creek PW.

Special-Status Species

Special-status plant species include plants that are protected under the state or federal Endangered Species Acts, species protected under regulations, species given other conservation designation by federal resource agencies, and species considered sufficiently rare by the scientific community to qualify for such listing. Special-status species include plants:

- listed or proposed for listing as threatened or endangered under the federal Endangered Species Act (50 CFR 17.12 and various notices in the Federal Register [proposed species]);
- that are candidates for possible future listing as threatened or endangered under the federal Endangered Species Act (61 Federal Register 40, February 28, 1996);
- listed or proposed for listing by the State of California as threatened or endangered under the California Endangered Species Act (14 CCR 670.5);
- listed under the California Native Plant Protection Act (Cal. Fish and Game Code, Section 1900 et seq.); and
- considered by the California Native Plant Society (CNPS) to be "rare, threatened, or endangered in California" (Lists 1B and 2 in Skinner and Pavlik 1994).

Special-status plant species with potential to occur on Hearst Forests are described below and are listed in Appendix E along with summaries of their legal status, distribution, and habitat associations.

Scott Mountain Phacelia

Scott Mountain phacelia is an herbaceous annual in the Waterleaf Family (*Hydrophyllaceae*). It grows in gravelly soils derived from ultramafic substrates (serpentinite, peridotite). It occurs in openings or among shrubs in montane coniferous forest of pines and firs, at elevations ranging from 4,950 to 6,600 feet. The species has a very limited distribution, restricted to the mountains of northern Trinity County and bordering areas in Shasta and Siskiyou Counties. One population has been reported from the McCloud River near Fowler's Camp. Scott Mountain phacelia is not listed under the state or federal Endangered Species Acts. The species is on CNPS List 1B. Threats to the species include cattle grazing, road construction, and timber harvesting and related activities.

Bellinger's Meadowfoam

Bellinger's meadowfoam is an herbaceous annual in the Meadowfoam Family (*Limnanthaceae*). It grows in vernally wet sites in oak woodlands and ponderosa pine forest, including wet edges of meadows and on damp, stony flats, at elevations between 1,000 and 3,100 feet. In California, Bellinger's meadowfoam is known only from five occurrences in Shasta County, although it also occurs in southern Oregon. Bellinger's meadowfoam is on CNPS List 1B. The taxonomic validity of this species has been questioned.

Shasta Snow-Wreath

Shasta snow-wreath is a deciduous shrub in the Rose Family (*Rosaceae*). It grows on shaded, north-facing slopes in lower montane coniferous forest of Douglas-fir, oaks, and other deciduous trees. It is a dominant species in the dense, diverse shrub understory. Shasta snow-wreath is known only from limestone areas in Shasta County. The species was not discovered until 1992, and fewer than 10 populations are known. Because of its recent discovery, it has not yet been considered for listing under the federal or state Endangered Species Acts. The species is on CNPS List 1B. A limestone formation on which it occurs is mined to make high-quality cement, and mining may pose future threats to the species.

Long-Haired Star-Tulip

Long-haired star-tulip is an herbaceous perennial in the Lily Family (*Liliaceae*). Like many species in this family, it grows from a bulb. It inhabits meadows and other mesic sites in yellow pine forest (ponderosa or Jeffrey Pine), lodgepole pine forest, or sagebrush scrub. It typically occurs on meadow margins or in other open areas, such as drainages. The species' California distribution includes northwest Shasta County, southeast Siskiyou County, and western Modoc County, at elevations ranging from 3,250 to 6,175 feet. Its range also extends into Oregon and Washington. The species is on CNPS List 1B. The species is listed as endangered in Oregon and as threatened in Washington. Potential threats to the species include grazing, timber harvesting, and energy projects.

Columbia Yellow Cress

Columbia yellow cress is an herbaceous perennial in the Mustard Family (*Brassicaceae*). It grows on lake margins, on river banks, and in other wet areas in yellow pine forest and juniper woodlands, at elevations between 4,000 and 5,000 feet. In California, it occurs in eastern Siskiyou County and northwest Modoc County, and its range extends north into Oregon and Washington. Columbia yellow cress is on CNPS List 1B. The species is also state listed as endangered in Washington and is a candidate for listing in Oregon.

IMPACTS AND MITIGATION MEASURES

Impact Assessment Methodology

Impacts on vegetative communities were assessed by projecting changes in their extent over the next 20 years and comparing their current and projected distributions. Impacts on special-status species were assessed by identification of species that could occur on the ownership, determination of whether such species could be affected by proposed timber operations, and assessment of the intensity of the effect of timber operations on individuals or populations of the species.

Criteria for Determining Significant Impacts

All of the vegetative communities that occur on Hearst Forests also occur extensively throughout the southern Cascade region. Although all of these communities have been substantially altered by human activity, none has been reduced in quality or extent to the point at which additional modifications resulting from normal management activities within a single ownership could affect its regional viability or the viability of special habitats it supports. Impacts on vegetative communities were considered potentially significant if the proposed activities would substantially reduce the extent of a community within the ownership.

The significance of impacts on special-status species depended on the species' legal status. Impacts on species listed as threatened or endangered were generally considered potentially significant if they would result in mortality of an individual plant. Consistent with Sections 15380 and 15065 of the State CEQA Guidelines, impacts on nonlisted species that meet the criteria for listing under the state or federal Endangered Species Acts were considered significant if they would reduce the number or restrict the range of a rare or endangered plant. Impacts on other special-status species were generally considered at the population level; they were considered potentially significant if a proposed activity could result in the extirpation of one or more populations.

No-Project Alternative

Because no timber operations would occur under this alternative, no significant impacts on vegetation resources would result.

Proposed Project

Because proposed harvesting would result in virtually no conversion of an area's forest type, the proposed project would not substantially reduce the extent of any of the forest types or vegetative communities that occur on Hearst Forests.

None of the five special-status plant species with potential to occur on Hearst Forests are listed as threatened or endangered under the federal or state Endangered Species Acts. Of these species, Scott Mountain phacelia and long-haired star tulip have potential to be significantly affected by timber operations (Stopher pers. comm.). The remaining species are associated with habitats not expected to be substantially disturbed by timber operations. ~~Of these species, only Columbia yellow cress typically occurs under closed forest canopy. The remaining species are associated with serpentine or limestone outcrops or meadows. Although disturbance incidental to timber operations could injure individuals of these species, it would not result in the extirpation of a population.~~

~~Impacts on Columbia yellow cress would be minimal because this species is semi-aquatic. Its occurrence in the forest would be limited to areas immediately adjacent to water. Riparian zone protection provided by the CFPRs and the Hearst BMPs ensure that this species would be adequately protected from project-related disturbance, should it occur on the ownership.~~

Impact: Potential Mortality of Scott Mountain Phacelia or Long-Haired Star Tulip

Timber operations could reduce populations of Scott Mountain phacelia or long-haired star tulip, should these species occur on Hearst Forests. This impact is potentially significant.

Mitigation Measure: Conduct Reconnaissance Surveys for Suitable Habitat and, If Present, Either Avoid or Conduct Surveys for the Species; If the Species Are Found to Be Present, Prepare and Implement a Protection Plan

To avoid the potential for such impacts, a three-phased survey and protection strategy will be implemented. First, reconnaissance surveys will be conducted as part of PTHP preparation to determine whether suitable habitat for either of these species occurs within the project area. Scott Mountain phacelia grows at high elevations in open, brushy areas within mixed-conifer stands on soils derived from serpentine. Long-haired star tulip grows in grassy meadows in ponderosa pine forest. Second, if suitable habitat is identified through such surveys, it will either be flagged and avoided, or surveys will be conducted by a qualified person trained to identify the subject species to determine whether they are present. Third, if the species is determined to be present, a protection plan will be prepared by Hearst and CDF, with input from DFG, and the population will be protected consistent with this plan. Implementing this mitigation measure would reduce this impact to a less-than-significant level.

Impact: Potential Damage to Species Acquiring Special Status Although the proposed project would not significantly affect any plant species currently classified as a special-status species, timber operations could affect other species that acquire special status in the future. This impact is considered potentially significant.

Mitigation Measure: Periodically Review Special-Status Species Lists and Protect Additional Species as Needed Hearst should review the lists of special-status plant species described above at least once every 5 years to identify species newly classified as special-status species that could occur on Hearst Forests and be significantly affected by timber operations. If such species are identified, surveys should be conducted of planned harvest areas by an RPF or an RPF's designee appropriately trained to identify the species of interest. Such surveys should be conducted during the species' flowering periods. If the species is identified in an area proposed for harvest or other disturbance, the operations should be changed to avoid excessively disturbing them. Implementing this mitigation measure would reduce this impact to a less-than-significant level.

Intensive Management Alternative

Although larger areas would be affected annually by timber harvesting and the intensity of disturbance would generally be greater under this alternative than under the proposed project, no substantial reductions in the extent of any forest type or vegetative community would result.

No plant species currently classified as a "special-status species" would be significantly affected as a result of implementation of this alternative. Impacts on special-status plants would be minor for the same reasons as explained above under "Proposed Project".

Impact: Potential Damage to Species Acquiring Special Status

Timber operations could affect plant species that acquire special status in the future. This impact is considered potentially significant.

Mitigation Measure: Periodically Review Special-Status Species Lists and Protect Additional Species as Needed This mitigation measure was described above under "Proposed Project". Implementing this mitigation measure would reduce this impact to a less-than-significant level.

Chapter 6. Wildlife Resources

ENVIRONMENTAL SETTING

Background

The study area for this assessment of wildlife resources included all land within Hearst Forests. Reconnaissance surveys were conducted on Hearst Forests from October 23 to 25, 1995, and November 12 to 14, 1995, to evaluate wildlife habitat conditions. Although systematic surveys have been conducted on the ownership for northern spotted owls and northern goshawks, only limited information has been gathered on general wildlife use and abundance and on special-status species occurrences. Sources of information used to evaluate wildlife habitat relationships and potential occurrence of special-status species include published and unpublished literature, DFG's NDDB (1996), WHR maps and data, aerial photographs, and results of reconnaissance field surveys conducted by Jones & Stokes Associates.

Wildlife Management Goals and Practices

Hearst is committed to sustaining natural resource values, including wildlife and wildlife habitat, on the ownership through its management practices. For example, it has implemented a land management ethic for the ownership featuring the following objectives:

- to keep the land as productive as possible, and to maintain and enhance the health of the timber that grows on it; to this end uneven-age-stand structures are encouraged, but even-age strategies are also employed as site-specific conditions warrant;

- to institutionalize silvicultural strategies to benefit the diverse wildlife resource as well as timber over the landscape; and

- to promote operational practices that maximize the aesthetic qualities of the landscape.

To achieve these objectives, timber harvest planning on the ownership incorporates practices to sustain and enhance wildlife habitat. They include selective harvesting to retain overstory canopy, stand structure, and large trees; retention of snags and large down logs; limited group selection to provide small forest openings and edges; establishment of LSMZs; special protection of biologically unique and sensitive habitats; and road and landing design features to reduce erosion and stream sedimentation.

Hearst has adopted a northern spotted owl management plan (Hearst Corporation 1993a) that provides guidelines for owl habitat retention across the ownership, including preserving existing late successional stands, maintaining a high proportion of mid-successional forest across the ownership, maintaining a diversity of forest age classes, and retaining important habitat components at the stand level (e.g., cull trees, snags, and logs). This northern spotted owl management plan has been approved by USFWS as an effective approach to avoiding take of individual northern spotted owls. The plan is reproduced as Appendix I to this EIR.

Hearst has also developed a northern goshawk adaptive management plan that provides guidelines for identifying goshawk activity and managing forest conditions to protect goshawk nesting sites (Hearst Corporation 1993b).

Hearst is in the process of executing a memorandum of understanding (MOU) with DFG to establish procedures to avoid incidental take of, and minimize adverse impacts on, wildlife species listed as threatened or endangered under the California Endangered Species Act that have the potential to occur on the ownership. Bald eagle, willow flycatcher, great gray owl, greater sandhill crane, California wolverine, and Shasta salamander are covered by this MOU. The draft MOU is reproduced as Appendix F to this EIR.

Wildlife Habitat Relationship Classes

Conifer Forest Habitats

The dominant plant communities and associated habitat types of an area are key determinants of its wildlife composition. The various conifer forest communities described in Chapter 5 provide habitat for a variety of wildlife species on the ownership. The assemblage of wildlife species present is determined by forest type, age class, and structure. Timber management on the ownership has resulted in the presence of a diversity of forest age classes, including 3,082 acres in the WHR classes associated with late successional habitat (5M, 5D, or 6) (Figure 5-1). Besides having average tree size and canopy closure characteristic of late successional habitat, these areas also support the functional characteristics of late successional forest, including snags and downed logs. Inventory data for Hearst Forests indicate that the stands in these WHR classes support an average of 13.6 downed logs per acre at least 11 inches in diameter at the large end and 13 feet in length, and 3.3 snags per acre at least 9.5 inches dbh. Thus, a diverse assemblage of wildlife occupies the ownership, including species associated with late successional forest as well as those associated with all other age classes.

To assess the overall effects of timber management on wildlife over the next 20 years, future timber types derived from growth modeling were converted to WHR size and closure classes and stages using VESTRA Resources' (VESTRA's) WHR crosswalk software (Airola 1988, Mayer and Laudenslayer 1988, Holmen pers. comm.). The WHR program was developed by DFG as a system that describes the management status, distribution, and habitat requirements of wildlife species in California. The program is used as a tool to predict the occurrence of wildlife species based on habitat relationships as defined by WHR and to evaluate the potential for occurrence in the future based on habitat changes over time. WHR habitat classifications are based on the structural characteristics of stands using two principle variables, tree size and canopy closure. Table 6-1 shows the existing and projected distributions of acreage by WHR type. They are intended for comparison of alternatives; the actual distribution of acres may differ somewhat from that shown in the table. Projected acreages by WHR type shown in Table 6-1 were obtained using the forest growth and yield modeling process described in Chapter 8, "Timber Resources", as follows:

- Size class was assigned based on the quadratic mean diameter (QMD) of the largest trees in the stand, as determined by including trees from the plot's tree list in declining order of dbh until 75% of the plot's total basal area was accounted for.
- Density class was assigned based on the percent canopy closure provided by all trees greater than 6 inches dbh.
- Species class was assigned based on the predominant tree species among the trees present with dbh exceeding the minimum diameter for the stand's size class.

Chaparral Habitats

Chaparral is one of the major habitat types in the Kosk Creek Tract. Chaparral communities provide important habitat for deer; rodents; and birds, including woodland bird species that use chaparral as foraging habitat.

Riparian Habitats

Riparian forests and woodlands are among the most biologically and structurally diverse habitats in montane ecosystems. Riparian communities function as water sources and migration corridors and provide thermal cover and diverse nesting and feeding opportunities for many wildlife species (Mayer and Laudenslayer 1988). Montane riparian habitat is found along Huckleberry Creek, Battle Creek, Kosk Creek, and several other watercourses on the ownership. All riparian habitats are within LSMZs or WLPZs.

Meadow Habitats

Four large meadows are present on the ownership: Huckleberry Meadow, Amos Meadow. McBride Field, and Stouts Meadow. Meadows provide important nesting and foraging habitat for various birds, wetland habitats for amphibians, grassland habitats for rodents, and foraging habitat for deer. Several species (e.g., sandhill crane, great gray owl, and willow flycatcher) are closely associated with meadow habitats.

Stream Habitats

Other specialized species groups, primarily aquatic amphibians and aquatic invertebrates, are associated with stream habitats on the ownership. Several frog and salamander species and numerous invertebrate species probably occur in stream habitats on the ownership.

Special-Status Species

Special-status animals are species in the following categories:

- animals listed or proposed for listing as threatened or endangered under the federal Endangered Species Act (50 CFR 17.11 [listed animals] and various notices in the Federal Register [proposed animals]);
- animals that are candidates for possible future listing as threatened or endangered under the federal Endangered Species Act (61 FR 40, February 28, 1996);
- animals listed or proposed for listing by the State of California as threatened or endangered under the California Endangered Species Act (14 CCR 670.5);
- animal species of special concern to DFG (Remsen 1978 [birds], Williams 1986 [mammals], Jennings and Hayes 1994 [reptiles and amphibians]); and
- animals fully protected in California (Cal. Fish and Game Code, Sections 3511 [birds], 4700 [mammals], and 5050 [reptiles and amphibians]).

Table E-2 in Appendix E lists the special-status species with potential to occur on the ownership along with their legal status and habitat associations.

The following is a discussion of the distribution, habitat requirements, and potential for occurrence of each of these species.

Northern Spotted Owl

Status and Distribution. The northern spotted owl is federally listed as threatened and is designated by DFG as a species of special concern. This species ranges from southwestern British Columbia through western Washington and Oregon to the northern Coast Ranges and Cascade Range of northern California (Johnsgard 1988). In California, the range extends east to western Modoc County, south to Marin County, and north to the Oregon border (California Department of Forestry and Fire Protection 1992).

Reasons for Decline. Loss of late seral forest habitat from timber harvest is considered the primary reason for the decline of the northern spotted owl (Thomas et al. 1990). Habitat

Table 6-1. Projected Acreage by Wildlife Habitat Relationship Size and Density Class and Decade

WHR Size and Density	1996	2006	2016	2026	2036	2046	2056	2066	2076	2086	2096	2106
No-Project Alternative												
1M	2,686	0	0	0	0	0	0	0	0	0	0	0
2M	102	2,686	0	0	0	0	0	0	0	0	0	0
3P	0	102	2,402	585	0	0	0	0	0	0	0	0
3S	0	268	0	0	0	0	0	0	0	0	0	0
3M	268	0	386	50	0	0	0	0	0	0	0	0
3D	0	0	0	234	0	0	0	0	0	0	0	0
4P	24,899	5,981	2,857	3,053	2,768	2,832	3,419	3,077	3,045	3,035	2,160	465
4S	3,436	2,785	285	0	0	0	0	0	0	9	9	0
4M	11,159	28,007	30,807	11,728	9,532	6,646	5,085	2,504	2,504	2,589	2,589	187
4D	7,341	8,349	10,400	25,797	28,385	25,839	18,504	14,288	14,305	2,489	1,567	1,275
5P	410	0	0	0	285	299	310	652	2,043	2,043	2,918	4,547
5S	0	0	0	0	0	0	0	0	0	0	0	75
5M*	1,843	3,964	3,088	8,443	8,920	12,599	13,541	16,078	14,336	14,607	14,553	16,896
5D*	1,239	1,239	3,157	2,612	2,273	2,461	9,117	13,615	15,273	24,873	23,454	19,348
6D*	0	0	0	879	1,218	2,705	3,406	3,168	1,878	3,737	6,131	10,588
Proposed Project												
1M	2,686	0	0	0	0	0	0	0	0	0	0	0
2M	102	2,686	0	0	0	0	0	0	0	0	0	0
3P	0	102	2,402	585	0	0	0	0	0	0	0	0
3S	0	268	0	0	0	0	0	0	0	0	0	0
3M	268	0	386	50	60	0	0	0	0	0	0	0
3D	0	0	0	234	0	0	0	0	0	0	0	0
4P	24,899	11,499	10,332	13,297	14,603	18,659	16,521	20,148	20,663	21,373	20,594	18,862
4S	3,436	3,066	320	614	764	1,015	2,950	3,547	2,918	2,395	858	216
4M	11,158	27,195	28,337	17,673	22,028	19,049	18,129	13,660	13,216	12,997	13,142	13,190
4D	7,340	4,018	3,675	8,312	3,684	1,876	1,597	1,508	1,523	241	96	176
5P	410	1,109	3,194	4,520	5,771	7,198	8,420	8,221	9,189	8,551	9,685	9,093
5S	0	0	0	2,566	941	55	20	554	35	486	1,668	3,148
5M*	1,844	3,395	4,146	4,621	4,941	4,905	5,188	5,170	4,981	5,468	5,128	6,765
5D*	1,239	45	590	910	587	621	471	528	696	1,711	1,987	1,681
6D*	0	0	0	0	3	5	85	46	159	159	224	250
Intensive Management Alternative												
1M	2,686	5,323	1,907	769	1,352	0	0	0	4,116	1,762	1,113	1,009
2S	0	0	0	1,070	1,259	520	1,352	0	0	0	1,070	1,457
2M	102	2,686	5,323	1,907	769	1,352	0	0	0	4,116	1,762	1,113
3P	0	102	2,402	585	34	0	0	0	0	0	0	0
3S	0	268	0	0	0	0	0	0	0	0	0	0
3M	268	0	386	4,302	1,551	360	0	791	0	0	3,046	1,241
3D	0	0	0	234	4,387	1,797	769	561	0	0	0	3,180
4P	24,899	14,175	11,463	11,175	19,009	19,742	20,524	26,332	20,802	24,546	26,805	22,113
4S	3,436	2,788	285	0	8	215	59	9	0	0	0	16
4M	11,159	17,355	21,843	21,765	14,517	14,903	12,528	10,203	16,820	11,349	6,072	10,372
4D	7,341	7,750	6,967	8,344	6,726	9,224	12,011	8,710	4,868	4,773	3,303	2,144
5P	410	34	265	1,269	845	2,387	2,199	4,644	4,261	4,662	5,077	4,857
5S	0	0	0	0	0	0	0	10	0	0	68	407
5M*	1,843	2,856	813	1,807	2,564	2,843	3,221	2,123	2,514	2,173	5,065	5,049
5D*	1,239	45	1,727	153	364	39	719	0	1	0	1	424

* Late successional habitat.

fragmentation may also have contributed to declines because of spatial considerations and the lack of dispersal into isolated habitat fragments. Other related factors include the reduced distribution and abundance of owl prey species in managed and fragmented forests; the range expansion of the barred owl, a species that competes for resources with the spotted owl; and additional habitat loss from wildfires (Thomas et al. 1990).

Habitat Requirements. Throughout its range, the northern spotted owl occurs primarily in late seral-stage conifer forest (Forsman et al. 1984). These forests provide the structural characteristics and habitat elements necessary to meet nesting, food, and cover habitat requirements of northern spotted owls. Optimal northern spotted owl habitat is characterized as multi-aged forest with well-developed, multitiered stratification, large trees, and considerable decadence (e.g., trees with broken tops and cavities for nesting, snags, decaying logs, and debris on the forest floor) (Dawson et al. 1987, LaHaye 1988, Thomas et al. 1990).

Northern spotted owls are also found in younger forest stands and in habitat mosaics featuring mixtures of old-growth, mid-age, and young-growth forest and forest openings (Forsman 1988, Kerns 1989a and 1989b, Pious 1989). Regional differences apparently exist, however, regarding the extent of old-growth forest structure required for successful nesting. Although northern spotted owls can successfully nest and rear young in intensively managed stands, studies conducted in the Oregon Coast Ranges and in the Douglas-fir region of northwestern California suggest that owls prefer landscapes dominated by old-growth timber for nest sites and home ranges. (Carey et al. 1990, Solis and Gutierrez 1990, Ripple et al. 1991.) Moreover, Carey et al. (1990) found that home range size expands with decreasing proportion of late seral-stage forest. In some areas, the density of breeding populations decreases with increased forest fragmentation (Carey et al. 1992). These data indicate that the spotted owls prefer old-growth stands for foraging and roosting and typically use early to middle stages less than or in proportion to their availability within their home range (Carey et al. 1990, Solis and Gutierrez 1990).

In contrast, studies conducted within the redwood forest region of northwestern California (Kerns 1989a, Diller 1989) indicate that spotted owls frequently use stands dominated by younger age classes. In coastal redwood forests, foraging habitat is less dependent on old-growth structure than nesting or roosting habitat, and habitat surrounding spotted owl nests typically contains more younger age-class forest (31-60 years) than older age classes (61 to >200 years) (Diller 1989, Kerns 1989a, and Simpson Timber Company 1992). These and other studies (Pious 1989, Kerns 1989b) suggest that managed forests can support high owl breeding densities.

Study Area Occurrence. No northern spotted owl nests are known to be present on the ownership (Hearst Corporation 1993a). As of 1993, only four spotted owl vocal responses had been detected, and two of these originated from known nesting territories located off the ownership. The other two responses were single males in the Kosk Creek and Angel Creek drainages. All followup attempts to relocate these owls to determine nesting status were unsuccessful (Hearst Corporation 1993a).

The results of surveys to date indicate that spotted owls do not nest within the ownership but could occasionally use portions of the ownership for roosting, foraging, or dispersal.

Bald Eagle

Status and Distribution. The bald eagle is federally listed as threatened and state listed as endangered. Historically, bald eagles nested throughout California; however, the current bald eagle nesting population is restricted primarily to mountainous habitats in the northern third of the state, primarily in the northern Sierra Nevada, Cascade Range, and northern Coast Ranges (California Department of Fish and Game 1994). In addition, bald eagles have recently nested in mainland southern California, in the central Coast Ranges, and on Santa Catalina Island. They winter at lakes, at reservoirs, and along rivers throughout most of central and northern California and in a few southern California localities (California Department of Fish and Game 1994).

California's nesting population of bald eagles is increasing in both numbers and range, and the winter population appears stable. By 1990, the nesting population had increased to 108 breeding pairs, up from a low of 26 in 1972 and 50 in 1981 (Jurek 1990). In 1981, bald eagles nested in eight different counties; by the early 1990s, the breeding range had expanded to portions of 19 counties. Although the winter population of bald eagles in California varies from year to year, it may exceed 1,000 birds in some winters (California Department of Fish and Game 1994).

Reasons for Decline. Early declines in bald eagle populations have been attributed to persecution by humans and destruction of riparian, wetland, and coniferous forest habitats. The most important factor contributing to the decline of bald eagle populations, however, was environmental contamination resulting from the introduction of DDE, a metabolite of DDT (dichloro-diphenyl-trichloroethane), into the food chain (Detrich 1985).

By 1972, only 26 active bald eagle territories were known in California (Thelander 1973). Conservation laws and policies, including the banning of DDT in 1972 and implementation of the Pacific Bald Eagle Recovery Plan (U.S. Fish and Wildlife Service 1986) and local bald eagle management plans, have subsequently contributed to the species' continuing recovery. Since the early 1980s, the bald eagle population has been expanding into its former breeding range.

Habitat Requirements. Historically, bald eagles bred in a variety of habitats in California, including offshore islands, coastal bluffs and pinnacles, and along coastal rivers, interior valley streams and wetlands, and mountain lakes and rivers (Detrich 1985). Nest trees included a wide variety of hardwoods as well as conifers. However, most eagle nesting territories are now found in mountainous habitats in ponderosa pine and mixed conifer forests (Lehman 1979, Detrich 1985, Jurek 1990). Ponderosa pine is the tree most often used for nesting, although nest sites have been observed in a variety of tree species (Jurek 1988).

Bald eagle nest sites are always associated with a lake, river, or other large water body that supports abundant fish, waterfowl, or other water bird prey. Nest trees are usually within 1 mile of water and are typically in mature or old-growth conifer stands (Hodges and Robards 1982). Nests are constructed in trees that provide an unobstructed view of the water, typically with dominant or codominant crown position (Lehman 1979). Snags and dead-topped live trees are important, providing perch and roost sites.

Bald eagles winter along rivers, lakes, or reservoirs that support abundant fish or water bird prey and have large trees or snags for perch and roost sites. They often roost communally during winter, typically in mature trees or snags isolated from human disturbances.

WHR analysis indicates that bald eagle nesting habitat requirements on the ownership are met primarily in medium- to large-tree conifer stands with sparse to dense canopy (i.e., WHR types 4, 5, and 6).

Study Area Occurrence. One bald eagle nest is known to be located on the ownership. The nest is located along the eastern edge of McCloud Reservoir near Star City Creek. The site has been active since at least 1983 (Jurek 1990) and typically is reproductively successful. Other bald eagle nests are known to be located in the vicinity along the Pit River and at Iron Canyon Reservoir, approximately 10 miles south of the ownership (Jurek 1990). Bald eagles are also regularly sighted near McCloud Reservoir and along the main channel of the McCloud River. They also have been detected near Huckleberry and Stouts Meadows.

American Peregrine Falcon

Status and Distribution. The American peregrine falcon is federally and state listed as an endangered species. Historically, resident peregrine falcons occurred throughout most of California (California Department of Fish and Game 1994, U.S. Fish and Wildlife Service 1982). The population increased during winter, when migrating birds arrived from the north. Peregrine falcons nested throughout the state, with breeding pairs concentrated along the coast and around the Channel Islands. Interior nesting locations included Tule Lake in Siskiyou County, Mono Lake in Mono County, and the inner Coast Ranges in Kern County. (Grinnel and Miller 1944.)

The population of American peregrine falcons in California began to decline seriously in the 1950s. From a population of breeding pairs conservatively estimated at 100 in California before 1947, fewer than 10 nesting sites were believed to be active in 1969 (Herman 1971). In 1970, the presence of only two nesting pairs was confirmed, with probably fewer than five nesting pairs existing statewide (Herman 1971). Since 1970, additional nesting pairs were located, probably because of increased efforts to locate nesting birds and limited recovery of the population (U.S. Fish and Wildlife Service 1982). In 1980, the existence of 39 nesting pairs was confirmed in the state. In 1992, approximately 140 breeding pairs of peregrine falcons were noted in California, primarily in mountains of the central and northern Coast Ranges and Cascade Range (California Department of Fish and Game 1994).

Reasons for Decline. The widespread use of organochloride pesticides, especially DDT, was a primary cause of the decline in American peregrine falcon populations (Hickey and Anderson 1968, U.S. Fish and Wildlife Service 1982), leading to thin eggshells, aberrant reproductive behavior, and reproductive failure. High levels of these pesticides and their metabolites have been found in the tissues of peregrine falcons. Other causes of decline include illegal shooting, illegal falconry activities, and habitat destruction (California Department of Fish and Game 1994).

Habitat Requirements. Peregrine falcons nest on protected ledges of high cliffs, primarily in woodland, forest, and coastal habitats (U.S. Fish and Wildlife Service 1982). They have been known to nest at elevations as high as 10,000 feet, but most occupied nest sites are below 4,000 feet (Shimamoto and Airola 1981). Peregrine falcons prefer to nest near marshes, lakes, and rivers that support an abundance of birds, but they may travel several miles from their nesting grounds to forage on pigeons, shorebirds, waterfowl, and songbirds (Grinnell and Miller 1944, Johnsgard 1990). Coastal and inland marsh habitats are especially important in fall and winter, when they attract large concentrations of water birds (California Department of Fish and Game 1994). WHR analysis does not indicate any stand type preferences for the peregrine falcon.

Study Area Occurrence. No peregrine falcon nests are known from the ownership and no suitable cliff nesting habitat exists on the ownership. However, peregrine falcons could use portions of the ownership, such as the meadows and other wetland habitats, for foraging.

Osprey

Status and Distribution. The osprey is designated by DFG as a species of special concern (Remsen 1978). The species is widely distributed throughout Eurasia, the Americas, Africa, and Australia (Johnsgard 1990). Ospreys breed throughout northern California from the Cascade Range south to Marin County and throughout the Sierra Nevada (Zeiner et al. 1990a). Large river systems in northwestern California support numerous breeding pairs.

Reasons for Decline. Osprey populations probably declined in California largely as a result of pesticide contamination, removals of nest trees, degradation of river and lake environmental quality, boating and other human disturbances on lakes, and shooting (Henny et al. 1978). Osprey populations have noticeably increased in California over the last decade as a result, at least in part, of a decrease in pesticide residues in the environment (Henny and Anthony 1989, California Department of Fish and Game 1992).

Habitat Requirements. The essential habitat requirements of the osprey include a water body with abundant and accessible fish and a nearby accessible nest site (Johnsgard 1990). Foraging exclusively on fish, ospreys are found only in association with lakes, reservoirs, coastal bays, or large rivers. Nests are usually within 1,000 feet of water but are occasionally as far away as 1 mile (Airola and Shubert 1981). Nest sites consist of large stick nests typically constructed on the tops of tall, broken-top trees or snags. Nest sites are usually in open forest habitat or along the edge of a water body for easy accessibility (Zeiner et al. 1990a).

Forested habitat, per se, is not required for nesting ospreys. Those trees with suitable structure to serve as nest substrates, however, are typically found in older forests or are residual trees in younger forests. Thus, WHR analysis indicates that osprey nesting habitat on the ownership is found primarily in small to large tree stands with sparse to dense canopy (i.e., WHR size classes 3 through 6).

Study Area Occurrence. One known osprey nest is located near the shore of McCloud Reservoir and at least six active nests are located along the McCloud River between Big Springs and the reservoir. Ospreys are a regular breeding and wintering resident of the McCloud River drainage and the McCloud Reservoir.

Northern Goshawk

Status and Distribution. The northern goshawk is designated as a species of special concern by DFG (Remsen 1978). The goshawk is holarctic in distribution, occupying a wide range of montane and boreal forests in North America. In California, goshawks are found in mid- to upper-elevation conifer forests in the Sierra Nevada, Klamath, Cascade, Warner, and north Coast Ranges.

Reasons for Decline. In California, and throughout the western United States, presumed population declines are attributed primarily to habitat loss associated with timber harvest (Crocker-Bedford 1990, Herron et al. 1985, Bloom et al. 1985), although other factors, such as fire suppression, drought, and toxic chemicals, have been suggested (Reynolds et al. 1992). Although some level of forest fragmentation may improve habitat conditions, extensive logging could reduce stand sizes below suitable levels.

Habitat Requirements. The goshawk is a forest habitat generalist, occurring in a variety of coniferous, deciduous, and mixed forest types in the western United States. Thus, specific attributes of nesting habitat are highly variable. In general, goshawks nest in large trees in forest stands containing a high density of large trees and high canopy closure. Nest sites tend to be near water, on north- or west-facing, gentle to moderate slopes, and near small forest openings or habitat edges (Shuster 1980, Reynolds et al. 1982, Moore and Henny 1983, Hall 1984, Speiser and Bosakowski 1987, Hargis et al. 1994, Squires and Ruggiero 1996).

Northern goshawks are generally associated with mature, unmanaged forests, although they will occupy residual mature stands in a managed forest if the required habitat components are present. Hall (1984) examined nesting habitat conditions at 10 nest sites in Douglas-fir forests of northwest California. The typical suitable nesting habitat condition consisted of a mature Douglas-fir stand within a young-growth Douglas-fir tract with a scattered hardwood component. Recent analysis indicates that, in mixed-conifer and Douglas-fir forests, optimal goshawk nesting habitat corresponds to WHR types 4M, 4D, 5M, 5D, and 6 (Goshawk Working Group 1995).

Size of forest stands used for nesting was positively correlated with occupancy rate in northern California, but not with overall reproductive success (Woodbridge and Detrich 1994). "Nest stand clusters" smaller than 50 acres were generally occupied less than 50% of the time, compared with the average occupancy rate of 74%. However, minimum stand sizes required for successful reproduction have not been determined. In northwestern California, forest stands used for nesting ranged from 4 to 74 acres (mean = 25 acres) (Hall 1984).

Foraging habitat requirements of goshawks are poorly known. Bright-Smith and Mannan (1994) studied goshawk movements in relation to canopy cover, forest edge, and an index of habitat diversity. Of the 11 birds studied, six used habitats in proportion to their availability, three used high-canopy cover habitats more than expected, and three used open-canopy habitats less than expected. Telemetry studies of Hargis et al. (1994) and Austin (1993) suggest that goshawks may forage preferentially in areas with large trees, high basal area, and high canopy cover. However, Shuster (1980) observed goshawks foraging in forest openings and clearcuts and Younk and Bechard (1992) found goshawks foraging in open sagebrush away from trees in Nevada. The Goshawk Working Group (1995) found that optimal foraging habitat corresponds to WHR types 4M, 4D, 5S, 5P, 5M, 5D, and 6.

Study Area Occurrence. The northern goshawk has been detected on the ownership (Hearst Corporation 1994). At least two inactive goshawk nests have been located. No active nests have been found and reproduction has not been noted since systematic THP surveys for goshawks were initiated in 1993. Hearst has developed a cooperative adaptive management study for the northern goshawk and has entered into an MOU with DFG to identify and protect the northern goshawk on the ownership.

Cooper's Hawk

Status and Distribution. The Cooper's hawk is designated by DFG as a species of special concern (Remsen 1978). The species is found throughout most of the United States, southern Canada, and northern Mexico. In California, Cooper's hawks nest in most wooded areas of the state, including low to mid-elevation areas of the Sierra Nevada, the Cascade Range, and the north Coast Ranges; coastal California; and much of southern California. The highest populations are found in areas of broken woodland, foothill riparian forests, and areas with abundant habitat edges.

Reasons for Decline. Historically, Cooper's hawks nested in lowland riparian woodlands in the Central Valley and coastal valleys. Population declines have been attributed primarily to the loss of lowland riparian forests in these areas (Remsen 1978). Pesticide contamination may also have contributed to declines. Populations have recovered in the Sierra Nevada foothills since the 1960s (Robbins et al. 1986). The effects of logging on Cooper's hawk populations are not well documented.

Habitat Requirements. Cooper's hawks breed in a wide variety of habitat types, including deciduous, coniferous, and mixed forests; oak woodlands; deciduous riparian habitats; woodlots; and suburban and urban areas. In forested habitats, forest edge habitats are generally included within the home range (Rosenfield and Bielefeldt 1993). Cooper's hawks generally nest in areas with moderate densities of large-diameter and pole-sized trees in even-age or uneven-age conifer stands, at low to moderate elevations. In Oregon, Cooper's hawks have nested in stands of intermediate ages (30 to 70 years old) and densities (907 trees per hectare) (Reynolds et al. 1982, Moore and Henny 1983). A wide variety of tree species are used for nesting. On average, nests are 8-15 meters high, in trees 21-52 centimeters dbh, in stands with 64%-95% canopy closure (Rosenfield and Bielefeldt 1993).

According to WHR analysis, Cooper's hawk nesting habitat requirements on the ownership would be met under a wide range of stand conditions, from moderate to dense pole-sized stands to multilayered stands (WHR size classes 2 through 6).

Study Area Occurrence. At least three records of nesting Cooper's hawks on the Hearst ownership exist (Swift pers. comm.). Uneven-aged timber management has been effective in retaining suitable habitat conditions for nesting and foraging Cooper's hawks on the ownership; nesting Cooper's hawks are probably distributed throughout most of the ownership.

Sharp-Shinned Hawk

Status and Distribution. The sharp-shinned hawk is designated by DFG as a species of special concern (Remsen 1978). This species nests in mid-to upper-elevation conifer forests in the Sierra Nevada, Cascade, and north Coast Ranges. Additional breeding sites include the Warner Mountains and central Coast and Transverse Ranges of southern California (Zeiner et al. 1990a). The sharp-shinned hawk winters throughout the state.

Reasons for Decline. Sharp-shinned hawks may never have been abundant in California during the breeding season. Although a decline has been noted since the early part of this century (Grinnel and Miller 1944), data were lacking to clearly identify its causes. Population declines have been attributed, at least in part, to timber harvesting (Remsen 1978), but the intensity of this effect on statewide populations is undetermined. Pesticide effects, as described for the Cooper's hawk, also may have affected this species in the 1960s (Bednarz et al. 1990).

Habitat Requirements. Sharp-shinned hawks usually nest in deciduous riparian habitat or in dense, relatively young, even-age stands of conifers that are cool, are well shaded, and have little ground cover (Reynolds et al. 1982, Moore and Henny 1983). Nests are usually situated on moderately steep north-facing slopes and are often associated with a watercourse (Reynolds et al. 1982). This species forages on the edges of forested areas and in other open habitats.

According to WHR analysis, sharp-shinned hawk nesting habitat requirements would be met on the ownership in ponderosa pine, white fir, Klamath mixed conifer, and montane riparian habitat types, in stand ages ranging from pole-sized trees to medium/large-sized trees, and moderate to dense canopy closure (WHR types 3M, 3D, 4M, 4D, 5M, and 5D).

Study Area Occurrence. There is one nesting record of sharp-shinned hawk on the ownership. Much of the ownership is suitable habitat for sharp-shinned hawks and it is likely that the species is a regular summer resident.

Great Gray Owl

Status and Distribution. The great gray owl is state listed as endangered by DFG. Very little historical information is available regarding the distribution of this species in California. The species is thought to have once occurred throughout the Sierra Nevada, Cascade, and north Coast Ranges. Nearly all recent sightings have been in the Sierra Nevada, with a few observations reported from Del Norte, Siskiyou, and Shasta Counties (Winter 1980). DFG considers the current range to include the Sierra Nevada between Quincy in Plumas County south to Yosemite National Park, and the Warner Mountains in Modoc County (Zeiner et al. 1990a). Only 10 pairs of breeding great gray owls have been documented recently, all in Yosemite and adjacent national forests (California Department of Fish and Game 1994). The current statewide population estimate is approximately 60 individuals (California Department of Fish and Game 1994).

Reasons for Decline. Great gray owl population declines have been attributed to timber harvesting in the red fir and mixed conifer forest types that provide important nesting and roosting habitat, and to overgrazing of montane meadows, which has reduced rodent prey populations (California Department of Fish and Game 1994).

Habitat Requirements. Great gray owls are generally associated with mixed conifer forest characterized by ponderosa pine, sugar pine, white fir, Douglas-fir, incense cedar, and black oak, or at higher elevations with red fir forest consisting of red fir, lodgepole pine, Jeffrey pine, and white pine (Winter 1980). They are always associated with mountain meadows. They nest and roost in late successional forest with high canopy closure and high snag density. Nest sites are usually in large-diameter broken-top snags and cavities. Nesting and roosting habitat is immediately adjacent to meadow habitat, which is used by great gray owls for foraging on rodents.

Study Area Occurrence. Great gray owls are not known to occur on the ownership or on nearby lands. Because the species is rare and its distribution extremely limited, its potential for future occurrence on the ownership is low. However, timber stands immediately adjacent to the two large meadow complexes on the ownership, Huckleberry Meadow and Stouts Meadow, are considered good habitat for the great gray owl. In particular, pine stands of relatively high canopy closure immediately adjacent to Huckleberry Meadow, which show a preponderance of broken-topped snags, are high-quality habitats.

California Yellow Warbler

Status and Distribution. The California yellow warbler is designated by DFG as a species of special concern (Remsen 1978). Before the 1940s, it was common and locally abundant throughout most of California (Grinnell and Miller 1944). The current breeding range includes the Great Basin, Sierra Nevada, Cascade Range, Klamath Mountains, Coast Ranges, Transverse Ranges, and northern Sacramento Valley. Only 5% of available habitat is occupied by yellow warblers in the upper Sacramento and San Joaquin Valleys. The California yellow warbler is locally common in the central and northern Coast Ranges. (Remsen 1978.)

Reasons for Decline. The two primary reasons for declines in California yellow warbler populations are the loss of riparian forests, particularly in the Sacramento and San Joaquin Valleys, and nest parasitism by the introduced brown-headed cowbird (Remsen 1978). Riparian habitats have been eliminated or reduced by human activities, including flood control projects, hydroelectric projects, stream channelization and stabilization projects, reservoir construction, and housing developments. Along the north coast and in the Cascade Range, populations are thought to be relatively stable, not having suffered the same declines as those in the interior lowlands. Marcot (1979) considered the species a common breeder in the north coast-Cascade region. Harris (1991) considered the species locally common along the coast during summer, and the species was found to be locally common along the Pit River in Shasta County (Jones & Stokes Associates file data).

Habitat Requirements. Yellow warblers nest in riparian scrub and riparian forest habitats from lowland riparian areas up to the mixed north-slope forest zone. Breeders are closely associated with alder-cottonwood-willow stands in riparian cover (Harris 1991), but they will apparently also nest in shrub-sapling-size Douglas-fir forest (Meslow and Wight 1975). Nests are typically placed in shrubs and low trees in deciduous riparian habitat (Beedy and Granholm 1985, Zeiner et al. 1990a). Taller trees are also used as perches (Marcot 1979). The species forages mainly in deciduous riparian habitat but also in adjacent woodlands and conifer stands (Marcot 1979).

According to WHR analysis, yellow warbler nesting habitat requirements would be met on the ownership primarily in montane riparian habitats as well as in open to moderately open younger-aged stands (i.e., sapling, pole, and small-tree size classes) of white fir, Klamath mixed conifer, and montane riparian habitats. Foraging requirements would be met in most conifer habitats of all age classes.

Study Area Occurrence. There are no records of nesting yellow warblers on the ownership. Montane riparian forest along several watercourses (e.g., Huckleberry and Battle Creeks), however, provides suitable habitat for this species. The suitable habitat conditions and the relative abundance of yellow warblers throughout the northern portion of its range suggest that the yellow warbler is likely to nest on the ownership.

Greater Sandhill Crane

Status and Distribution. The greater sandhill crane is state listed as threatened. The largest of four recognized subspecies of sandhill crane (Walkinshaw 1949), the greater sandhill crane was once a common breeder on the northwest plateau (Grinnell and Miller 1944). The subspecies is greatly reduced in numbers, with a current nesting distribution that includes portions of Siskiyou, Modoc, and Lassen Counties and Sierra Valley in Plumas and Sierra Counties (Zeiner et al. 1990a).

Reasons for Decline. The decline in the breeding population in California is attributable primarily to the loss and degradation of important wetland breeding sites in northeastern California (California Department of Fish and Game 1994). Conversion of native meadows and marshes to agricultural land, mowing of meadow grasses during the breeding season, and damage to meadow habitats and active nests from cattle grazing have contributed to the population decline.

Habitat Requirements. The greater sandhill crane nests in extensive, open wetland habitats, including meadows and fresh emergent wetland. It feeds in wetlands, shortgrass plains, and grain fields (Zeiner et al. 1990a).

Study Area Occurrence. No nesting occurrences have been documented on the ownership. The nearest known greater sandhill crane breeding site is in Fall River Valley (Littlefield 1989), approximately 20 miles southeast of Hearst Forests. Huckleberry Meadow and Amos Meadow provide suitable meadow breeding habitat for the greater sandhill crane. The suitability of these sites for the greater sandhill crane may vary annually in response to snowmelt, precipitation, and livestock grazing pressure. In recent years, livestock grazing has not occurred on Hearst lands and precipitation has been greater than normal. Under these conditions, good nesting habitat for cranes has existed.

Little Willow Flycatcher

Status and Distribution. The little willow flycatcher is state listed as endangered. This subspecies of the willow flycatcher occurs in small, isolated populations in the central Sierra Nevada, Cascade, and Klamath Ranges in California (California Department of Fish and Game 1994) and throughout most of western Oregon.

Reasons for Decline. In California, the willow flycatcher has been extirpated as a breeding bird from most of its former range (Serena 1982). The principal cause of the population decline of the little willow flycatcher is the loss of riparian habitat and the degradation of montane meadow willow riparian habitat. Willows have declined in meadows as a result of fires, livestock grazing, and development of hydroelectric reservoirs. Nest destruction by livestock and nest parasitism by brown-headed cowbirds have also contributed to the decline of this subspecies (California Department of Fish and Game 1994). Logging activities that disturb nesting habitat could also adversely affect this species.

Habitat Requirements. Willow flycatchers nest in dense willow thickets in riparian habitats and montane meadow habitat (Zeiner et al. 1990a). Nesting areas are typically in broad, open river valleys or large mountain meadows with dense clumps of shrubby willows (Serena 1982). Dense willow thickets are required for nesting and roosting. Low, exposed branches are used for singing posts and hunting perches (Zeiner et al. 1990a). Nests are usually constructed near slow-moving streams, ponds, or other open water.

Study Area Occurrence. The willow flycatcher has not been detected on the ownership and few detections have been made anywhere in Shasta or Siskiyou Counties. The nearest records are from Bigelow Meadow, just off the ownership, where expansive areas of willow habitat exist, and from the Lassen National Forest (Harris et al. 1988). One active nest also was recently discovered near the Klamath River in western Siskiyou County (Hillsaple pers. comm.). Suitable willow riparian habitat exists along portions of Huckleberry Creek and upper Star City Creek (Stouts Meadow).

Vaux's Swift

Status and Distribution. The Vaux's swift is designated by DFG as a species of special concern. In California, the species occurs during the breeding season primarily in the narrow redwood-forested coastal zone from the Oregon border south to Santa Cruz County. The species also occurs across the northern portion of the state and in the Sierra Nevada, although apparently at much lower densities (Bull and Collins 1993, Sterling and Patton 1996) .

Reasons for Decline. Information concerning population declines of the Vaux's swift is lacking. The removal during timber harvest of large snags and hollow trees, which are generally associated with late seral-stage forests, has probably contributed to population declines (Bull and Collins 1993).

Habitat Requirements. Vaux's swifts appear to prefer redwood and Douglas-fir forest types, constructing their nests in large hollow trees and snags and burned-out hollows (Bull and Cooper 1991). Manuwal and Huff (1987) and Carey (1989) found a strong correlation between the presence of Vaux's swifts and old-growth forests. However, they do not appear to require old-growth forests per se, but rather need suitable nest and roost trees, which are more likely to be found in old-growth forests because of the large size and decay conditions of such trees (Bull 1991, Bull and Hohmann 1993). Vaux's swifts forage on insects above the canopy and above rivers and lakes.

Nest trees tend to be large; Bull and Hohmann (1993) found that the dbh of nest trees in their study area averaged 32 inches. They found active nests in logged areas, however, suggesting that retained hollowed trees and snags provide habitat in logged areas.

WHR analysis indicates that Vaux's swifts primarily use medium- to large-tree and multistoried stands (WHR size classes 5 and 6) for nesting and all types and age classes for foraging.

Study Area Occurrence. No Vaux's swifts have been reported on the ownership. Suitable habitat exists primarily in late successional stands along the McCloud River that support large snags.

Purple Martin

Status and Distribution. The purple martin is designated by DFG as a species of special concern (Remsen 1978). In California, the species is distributed sporadically through the northern and central coastal mountains, through the foothills of the Sierra Nevada, and in isolated pockets in the coastal and transverse ranges of southern California. A small, isolated colony also occurs along the Sacramento River in the Central Valley. The species is considered rare to uncommon throughout its range in California (Remsen 1978, Zeiner et al. 1990, Harris 1991).

Reasons for Decline. Statewide population declines are attributed primarily to nest site competition with the introduced European starling (which is particularly intense in lands converted to agricultural use, where starlings preferentially feed). However, because purple martins use snags and hollowed trees as nesting and roosting sites, timber harvest has undoubtedly reduced available habitat for this species in forested regions.

Habitat Requirements. Purple martins nest in woodland habitats, including foothill and montane hardwood, valley and montane hardwood-conifer, riparian, and conifer forest. This species usually nests in old woodpecker cavities, often in large-diameter, tall, old trees and snags near water.

Nest sites are often found in older, multilayered, open forests and woodlands (Zeiner et al. 1990a). This species also has been observed nesting in drainage holes beneath overpasses in several north coast areas (Williams pers. comm.). Although the species requires old trees or snags, it does not otherwise require late successional forests.

According to WHR analysis, purple martin nesting habitat requirements would be met on the ownership in late seral ponderosa pine and montane riparian forests (WHR size classes 5 and 6).

Study Area Occurrence. No purple martins have been reported on the ownership. Late successional stands along the McCloud River provide suitable habitat for martins as for the Vaux's swift.

Yellow-Breasted Chat

Status and Distribution. The yellow-breasted chat is designated by DFG as a species of special concern (Remsen 1978). Once a fairly common summer resident and breeder in riparian woodlands throughout most of California, exclusive of the higher mountains (Grinnell and Miller 1944), the chat is now an uncommon resident in the coastal and Klamath regions and in the Sierra Nevada foothills (Zeiner et al. 1990a) and is particularly uncommon along the northern coast (McCaskie et al. 1979). From the coast inland to western-central Shasta County, the species occurs in well-developed riparian cover along streams (Harris 1991).

Reasons for Decline. The yellow-breasted chat population has decreased throughout most of the United States (Robbins et al. 1986). As with the California yellow warbler, there are two primary reasons for declines in populations: loss of riparian forests, particularly in the Sacramento and San Joaquin Valleys, and nest parasitism by the introduced brown-headed cowbird. These causes have primarily affected populations in the interior lowlands and southern coasts. In northwest California, populations are thought to not have suffered severe declines and to be relatively stable (Remsen 1978). There is no evidence implicating timber harvesting in the decline of this species within northern forested areas.

Habitat Requirements. Yellow-breasted chats nest in riparian woodlands where they build their nests in dense, brushy thickets and tangles consisting most commonly of willows, tall weeds, blackberry vines, and grapevines (Grinnell and Miller 1944). Song perches are often high in the concealing crowns of tall willows or cottonwoods, but foraging and nesting activities usually occur within 3 meters of the ground. Nests are often built near or over water (Zeiner et al. 1990a) in dense vegetation that provides shade and concealment (Grinnell and Miller 1944).

Study Area Occurrence. No observations of yellow-breasted chats have been reported in Hearst Forests. Portions of several watercourses that support hardwood riparian vegetation (e.g., Huckleberry Creek and Battle Creek) provide at least marginally suitable conditions for chats, however.

California Wolverine

Status and Distribution. The California wolverine is state listed as threatened. This species is considered a scarce resident of the northern Coast Ranges, the southern Cascade Range, and the high Sierra Nevada. Little is known regarding the distribution, density, habitat preferences, or population trends of the wolverine. Grinnel (1913) described its range in California as extending from Monache Meadows in Tulare County north to the vicinity of Mount Shasta. More recent sightings have expanded its known range to include Del Norte and Trinity Counties (California Department of Fish and Game 1994).

Reasons for Decline. Because wolverines are scarce and wide ranging, very little information is available to assess the reasons for possible population declines. Wolverines could be sensitive to timber harvest, grazing, and other human disturbances (e.g., off-road vehicle use) in remote areas (California Department of Fish and Game 1994).

Habitat Requirements. Very little habitat relationship data are available on wolverines in California. The species is wide ranging, with male territories exceeding 750 square miles. Wolverines typically are found in mixed conifer, red fir, and lodgepole habitats in northern California. Wolverines also use meadows and riparian habitats. Wolverines den in caves, cliffs, hollow logs, rock outcrops, and other cavities (Zeiner et al. 1990b) and usually hunt in open areas, such as mountain meadows, forest openings, and above the treeline.

Study Area Occurrence. DFG's NDDB records indicate the possible detection of a wolverine on the ownership in 1976, based on a sighting of tracks in snow. There are no other records of wolverines on the ownership. The nearest historical records are from the Burney area, southeast of the ownership (Schempf and White 1977). Habitat conditions on portions of the ownership are suitable for wolverines, and given the elusiveness of this species, it is believed they could occur (although rarely and most likely transiently) on the ownership.

Pacific Fisher

Status and Distribution. The Pacific fisher is designated as a species of special concern by DFG (Williams 1986). This subspecies of *Martes pennanti* is found along the Pacific Coast from northern British Columbia to California. In California, fishers are found in mid- to upper-elevation forest habitats in the Sierra Nevada, Cascade, and Klamath Ranges and are found less frequently in low-elevation coastal forests (Williams 1986). Although California populations reach their highest reported density in Trinity County, the species is apparently rare to the west in the coastal redwood belt (Grinnel et al. 1937, Schempf and White 1977).

Reasons for Decline. Timber harvesting is often reported as the primary reason for the decline in fisher populations, but, largely because the species is usually too rare to study, little empirical evidence supports this conclusion. The most significant declines have been reported in the Sierra Nevada populations (Williams 1986). Looking at various types of silvicultural practices (e.g., clearcutting and selective logging) and their effects on fisher populations, Buck (1982) speculated that the density and distribution of the fisher is limited to mature forest habitat and that fisher populations would decline as late succession stands were intensively managed.

Habitat Requirements. In the Cascade Range, fishers are most often associated with the mixed conifer forest type (Schempf and White 1977) and usually occur between 2,000 and 5,000 feet in elevation (Grinnel et al. 1937, Ingles 1965). Very little research has been conducted, however, on the specific habitat relationships of fishers in California. In response to a petition to list the fisher as endangered in California, UFSWS concluded that insufficient habitat use information was available to support reliable conclusions regarding habitat preferences or to provide for determination of population status or trends (U.S. Fish and Wildlife Service 1990).

The few available studies from California indicate that the species is associated with habitat structures typically found in mature and old-growth forests, including moderate or dense canopy cover and abundant snags and down logs (Buck 1982, Powell and Zielinski 1994). Buck (1982) also found a strong preference for mature, dense-canopy conifer forest, particularly multiple-species stands, and avoidance of hardwood forests. Denning and cover habitat includes cavities in large trees, snags, logs, and brush piles. Fishers have also been reported in managed forests with sparse canopy cover, particularly in northern California (Golightly and Self in Powell and Zielinski 1994). Forest openings and early- and mid-seral stages are also apparently used for foraging, particularly during the summer months (Freel 1991). Fishers also have been associated with riparian habitat and use riparian areas disproportionately more than their occurrence (Aubrey and Houston 1992, Buck et al. 1983, Self and Kerns 1992). They are known to use riparian corridors and saddles between drainages as travel corridors, enabling them to move through clearcut areas between stands (Heinemier pers. comm.). Home ranges are typically large, exceeding 5 square miles (Buck 1982). The average home range of two fishers radiotagged by Self and Kerns (1992) was 3,425 acres.

Although the available literature indicates a preference for old-growth forest components, definitive information is lacking concerning minimum stand sizes, canopy closure, stand structure, and other elements of suitable habitat for a fisher's home range. Freel (1991) established habitat parameters for fisher using limited available information for California. According to Freel (1991), fishers generally require large stands of mature forest (minimum stand size >60 acres with at least 120 adjacent acres of open-canopy forest), with high canopy closure, vertical diversity, and abundant snags and downed wood.

WHR analysis indicates that the fisher is most likely to be found in mid- to late successional stands with moderate to dense canopy closure (WHR types 4M, 4D, 5M, 5D, and 6).

Study Area Occurrence. Observations of the fisher on the ownership have not been reported. There are scattered historical reports from Shasta County (Schempf and White 1977) and few recent records (Self and Kerns 1992). Self and Kerns (1992) detected fisher in the Buck Mountain and Castle Creek areas of Shasta County, both of which are approximately 13 miles from the ownership. At least marginally suitable habitat for fisher occurs throughout the ownership. The McCloud River drainage supports suitable denning, foraging, and dispersal habitat, and most other drainages provide at least suitable dispersal corridors. Based on historical and recent records of fisher in Shasta county and southern Siskiyou County, it is believed that the species probably occurs on the ownership occasionally and at low densities.

Shasta Salamander

Status and Distribution. The Shasta salamander is state listed as threatened. This species has been recorded at only 12 sites in Shasta County, most of which were near Shasta Lake and only two of which were on private land (California Department of Fish and Game 1994).

Reasons for Decline. The Shasta salamander has a very localized distribution and appears to exist within a narrow range of habitat tolerances. There is currently no evidence of population declines in this species; it may have always been localized and rare. However, because the species occurs in or adjacent to conifer forest habitats, timber harvest operations could affect occupied sites.

Habitat Requirements. Shasta salamanders inhabit limestone formations, particularly fissures, crevices, and caves, and are also found under surface rocks and leaf litter in the immediate vicinity of rock formations during wet weather (Gorman and Kemp 1953, California Department of Fish and Game 1994). Data from Lewendal (1995) suggest that Shasta salamanders occupy limestone outcroppings with area as small as 0.4 hectare year round and seasonally use adjacent forested habitats up to 91 meters downslope of the outcroppings during wet weather. Typical adjacent vegetation varies from dense Douglas-fir forest with California black oak, wild currant, thimbleberry, and maidenhair fern with mosses blanketing the substrate (Gorman and Kemp 1953) to open canopies of black oak, Douglas-fir, foothill pine, and California buckeye (Bury et al. 1969).

Study Area Occurrence. There are no recorded occurrences of the Shasta salamander on the ownership. Limestone outcroppings that probably constitute suitable habitat are present in the Star City Creek drainage. No other suitable habitat for this species is known to exist on the ownership.

Foothill Yellow-Legged Frog

Status and Distribution. The foothill yellow-legged frog is designated as a species of special concern by DFG (Jennings and Hayes 1994). This species is found in stream habitats in the northern and central Coast Ranges and Sierra Nevada foothills.

Reasons for Decline. Population declines of the foothill yellow-legged frog are attributed primarily to human disturbance in the Sierra Nevada foothills, including dam building, flood control, mining, farming, canal building, urbanization, and introductions of predatory fish (Jennings 1988). There is no information that indicates timber harvesting has contributed to statewide declines. However, egg masses are known to accumulate suspended particulates, leading Jenning and Hayes (1994) to hypothesize that increased sedimentation resulting from grazing and logging may potentially have a negative impact on frog populations.

Habitat Requirements. The foothill yellow-legged frog inhabits partly shaded, shallow streams with rocky substrate that is at least cobble-sized (Hayes and Jennings 1988). This species is typically associated with valley-foothill hardwood, valley-foothill hardwood-conifer, valley-foothill riparian, ponderosa pine, mixed conifer, and wet meadow habitat types (Zeiner et al. 1988). The foothill yellow-legged frog is often observed in riffle areas along streams but has also been seen in pools that persist in otherwise dry streams. This species is rarely found far from permanent water (Zeiner et al. 1988).

Study Area Occurrence. The foothill yellow-legged frog has not been detected on the ownership. The species could occur in suitable habitat found along many watercourses on the ownership, however.

Tailed Frog

Status and Distribution. The tailed frog is designated by DFG as a species of special concern (Jennings and Hayes 1994). Its range extends from southwestern British Columbia to northwestern California. Disjunct populations also exist in Montana and Idaho. In California, the tailed frog is found from Del Norte County south to central Sonoma County and east into Shasta County (Bury 1968, Stebbins 1985). A disjunct population exists in the McCloud River basin (Jennings and Hayes 1994).

Reasons for Decline. Timber harvesting resulting in reduced overstory canopy and increased temperature is considered the primary reason for decline of tailed frog populations (Jennings and Hayes 1994).

Habitat Requirements. Tailed frogs are restricted to areas in and around clear, cool, fast-moving, permanent streams in conifer-dominated forests. They have been found in forests dominated by Douglas-fir, sitka spruce, redwood, ponderosa pine, and western hemlock (Jennings and Hayes 1994). Highly specialized larvae are found attached to rocky substrates in fast-flowing water. Adults are found both in streams and in upland habitats along streambanks.

Although no correlation between tailed frog abundance and forest type has been demonstrated, several studies have shown a correlation between tailed frog distribution and abundance and late seral-stage forests (Welsh 1990, Welsh et al. 1993, Aubrey and Hall 1991). However, no experimental studies have been conducted to determine which attributes of older forests are required for tailed frog persistence.

Welsh (1990) and Welsh et al. (1993) hypothesized that forest structure and not stand age determined tailed frog occurrence. Attibutes of stand structure hypothesized to be important for tailed frogs include low ambient temperatures resulting from high canopy closure; downed woody debris, particularly in and around streams, which contribute to greater habitat diversity within streams, trap fine sediments, prevent cementation of aquatic substrates, and may provide hiding and thermal cover for adults; and a deep duff layer that filters clearer, cooler water and maintains cool, moist streamside microclimates.

Gilbert and Allwine (1991) also suggested that tailed frogs are dependent on ambient temperature and not on stand age. At their three survey locations in central Oregon, they found that tailed frogs selected streams within old-growth forests at the warmest locations, mature stands at the intermediate-temperature location, and young forest at the cooler location. This further suggests that tailed frogs may occur within a wider range of timber age classes than previously believed, particularly in the cool temperatures of the coastal redwood forest belt. However, Corn and Bury (1989) found significantly higher densities and biomass of tailed frogs in old growth than in logged forest stands, despite similar temperature regimes and higher canopy closure in logged stands.

Welsh et al. (1993) reported a positive correlation between tailed frog distribution and abundance and several attributes of late seral-stage forests, including high canopy cover, downed woody material, ground cover consisting of ferns and herbs, litter depth, stream width, and flow rate. Tailed frogs also exhibit a preference for extremely low ambient light levels, a finding that suggests selection for darker microsites (Hailman 1982, Welsh et al. 1993).

According to WHR analysis, tailed frogs are most likely to occur on the ownership along watercourses in dense, medium- to large-tree and multistoried stands.

Study Area Occurrence. The tailed frog has not been detected on the ownership. However, Jennings and Hayes (1994) report detections of tailed frogs in the McCloud River drainage upstream from the ownership. This appears to be an isolated, disjunct population. Nonetheless, portions of the McCloud River and possibly other watercourses on the ownership support suitable habitat for the tailed frog.

Northwestern Pond Turtle

Status and Distribution. The northwestern pond turtle is designated as a species of special concern by DFG (Jennings and Hayes 1994). It is one of two subspecies of the western pond turtle, the other being the southwestern pond turtle, also a species of special concern.

The western pond turtle occurs in suitable aquatic habitats west of the crest of the Sierra Nevada in California and in parts of Oregon, Washington, and Mexico (Stebbins 1985, Zeiner et al. 1988). The northwestern subspecies is generally found from San Francisco Bay north to the Columbia River drainage in Oregon and Washington, and the southwestern subspecies is generally found from San Francisco Bay south to northwestern Baja California, Mexico (57 FR 45761-45762, October 5, 1992). The two subspecies intergrade in portions of the range (Stebbins 1985).

Reasons for Decline. Western pond turtle populations have declined primarily because of loss of wetland habitats to agricultural and urban uses and flood control and water diversion projects. More than 90% of the wetlands that historically existed within the species' range in California have been eliminated. (57 FR 45761-45762, October 5, 1992.) Habitat fragmentation, commercial harvest, and predation by introduced species have also contributed to the decline of the western pond turtle.

Habitat Requirements. The western pond turtle inhabits a wide range of fresh or brackish rivers, streams, lakes, ponds, and permanent or ephemeral wetlands. It typically occurs in slow-moving streams, pools, and ponds. In most cases, emergent basking sites, such as rocks, logs, or emergent vegetation, are present. Although occasionally observed in reservoirs, abandoned gravel pits, stock ponds, and sewage treatment plants, most western pond turtles in such sightings are displaced individuals and do not represent viable populations (Holland 1994, Jennings and Hayes 1994).

Nesting typically occurs on gentle slopes in compact soils with a large proportion of silt or clay. Vegetation is usually sparse and consists of grass or forbs. Nests can be from 3 to 402 meters or more from aquatic habitats (Holland 1994).

Overwintering habitat and terrestrial habitats used at other times of the year are highly variable. Presence of a duff layer seems to be a general characteristic of such habitats (Holland 1994). Aquatic overwintering sometimes occurs in mud bottoms, in undercut banks, under logs, or in areas of emergent vegetation. Movements between overwintering sites does occur, and turtles have been observed swimming under ice in water at temperatures as low as 1°C.

Study Area Occurrence. Although there are no recorded observations of the northwestern pond turtle on the ownership, the turtle could occur in suitable habitat found along several study area watercourses.

IMPACTS AND MITIGATION MEASURES

Impact Assessment Methodology

The first step in conducting this impact analysis involved identifying and describing the wildlife resources of Hearst Forests, including occurrences and potential occurrences of special-status species. Impacts were then assessed based on the extent to which proposed timber operations would affect the wildlife resources. The relative importance of the effect on the species or resource was evaluated based on its legal protection, agency regulations and policies, and documented resource scarcity and sensitivity to disturbance. For example, disturbing less than 1 acre of habitat may not adversely affect an abundant, wide-ranging species but could result in a significant effect on a rare, localized species. Site-specific information (e.g., information on nest site locations) was not analyzed for this program EIR; site-specific impacts of subsequent activities will be assessed at the project level.

This assessment focused on the effects of the proposed project on the relative abundance of various habitats and on related impacts on special-status wildlife species. It compares the effects of the proposed project and of the Intensive Management Alternative with those of the No-Project Alternative.

Criteria for Determining Significant Impacts

Species That Are Federally or State Listed, Proposed for Listing, or Candidates for Listing as Threatened or Endangered

Implementation of the project or a project alternative was considered to have a significant impact if it would result in any of the following adverse effects on a species that is federally or state listed, proposed for listing, or a candidate for listing as threatened or endangered:

- direct mortality,
- permanent loss of existing or potential habitat having a direct or indirect effect on individuals or populations,
- temporary loss of habitat that could result in increased mortality or reduced reproductive success, or
- avoidance of biologically important habitat for substantial periods at the risk of increased mortality or reduced reproductive success.

Other Special-Status Species

The following impacts on other special-status species were also considered significant:

- direct mortality,
- permanent loss of existing or potential habitat having a direct or indirect effect on populations, or
- temporary loss of habitat that could result in increased mortality or reduced reproductive success of populations.

No-Project Alternative

Termination of commercial logging activities would result in gradual increases in the extent and continuity of late seral stages (i.e., WHR types 5M, 5D, and 6) and decreases in early seral stages. This trend would benefit species that require or otherwise use late seral forests, and reduce habitat for those species that use younger age classes. However, younger-age-class forests and the wildlife species generally associated with them are common throughout the region, and therefore would not be significantly affected under the No-Project Alternative. Termination of commercial logging would also lead to stabilization and improvement of watersheds and stream channels, providing additional benefit to wildlife species associated with aquatic and riparian habitats.

Proposed Project

General Wildlife

Timber operations on the ownership could potentially result in changes in wildlife use, including declines in wildlife diversity, specific wildlife populations, or amounts of suitable habitat. Conditions potentially affecting wildlife use that could change in response to timber management are discussed below.

- **Forest age class distribution and structure**. Wildlife species are generally suited to particular forest age classes. Timber harvesting could change the abundance and distribution of age classes and thereby alter wildlife use of the ownership.

- **Extent and continuity of functional late successional habitat**. Timber harvesting could reduce the extent of late successional forests on the ownership and reduce the specific characteristics that attract late successional wildlife species (e.g., tree size, overstory structure, and canopy closure).

- **Abundance of snags, den trees, and nest trees**. Timber management could reduce overstory canopy, average tree size, and the abundance of snags and down wood. These structural changes would reduce habitat for species that prefer or require these habitat elements (e.g., woodpeckers and secondary cavity nesters, terrestrial salamanders, rodents, northern spotted owl, northern goshawk).

- **Recruitment of terrestrial large woody debris**. Large downed logs are an important forest habitat component, providing cover and breeding habitat for rodents; habitat for salamanders; and denning habitat for larger mammals, such as black bear and marten. Timber management could reduce the number of large downed logs on the forest floor.

- **Declining abundance of early seral habitats**. Deer, bear, and other large mammals often occur at higher densities in early seral habitats. Proposed harvesting prescriptions to promote development of late seral habitat could gradually reduce habitat suitability for these species by decreasing the extent of early seral forest on the ownership.

- **Degradation of riparian and aquatic habitats**. Aquatic amphibians, invertebrates, and other aquatic wildlife species, and numerous riparian-associated species could be affected by stream sedimentation, loss of overstory cover, increased temperatures, reduction of woody debris in streams, and loss of streamside habitat resulting from timber harvest activities.

Landscape-Level Analysis. Table 6-1 describes the landscape-level changes in age-class distribution and corresponding WHR types that would occur on the ownership during the next 20 years. After 20 years, late successional types would increase and early successional types would decrease. The total acreage in late successional forest types would increase by 85%, from 3,082 acres to 5,713 acres. Most of this increase would result from the growth of small-sized sawtimber stands (WHR size class 4) into large-sized sawtimber stands (WHR size class 5) as pole-sized, understory trees grow into the overstory. Late successional forests would be retained or developed over time through the following practices:

- late seral habitat is retained and promoted in LSMZs and in WLPZs throughout the ownership (Figure 2-2);
- selective harvesting is implemented to accelerate late seral habitat development on other lands; and
- snags (except those extending above the general canopy or posing a safety hazard), large woody debris, and other late successional habitat elements are retained.

The most extensive change in habitat type projected under the proposed project involves the growth of relatively open, small-sized sawtimber stands (WHR types 4S and 4P) into relatively closed, small-sized sawtimber stands (WHR types 4M and 4 D). The acreage of 4M and 4D stands would increase from 18,499 acres to 30,202 acres (by 63%) (Table 6-1). Thus, at the landscape level, wildlife species that require or prefer mid- to late successional forest age classes would benefit as these types increase over time.

Younger forest stands (WHR size classes 1, 2, and 3) would decline from 3,055 acres to 2,787 acres (by 9%) over the next 20 years. In addition, land in small, open sawtimber stands (WHR types 4S and 4P) would decline from 28,334 acres to 8,147 acres (by 71%) (Table 6-1). However, these forest age classes and the species that use them are abundant throughout the region. Furthermore, most bird species that currently use the open, sawtimber stands for nesting or foraging are also well suited to using denser sawtimber stands for these purposes. Therefore, at the landscape level, wildlife species that require early- or mid-successional forest types would not be significantly affected by proposed timber operations.

Stand-Level Analysis. At the stand level, habitat elements such as snags and large woody debris will be retained according to the specifications outlined in the northern spotted owl management plan (Hearst 1993a). These specifications are incorporated into the project description.

Snags are associated with structural diversity in a stand, providing nest sites for primary cavity-nesting birds as well as spotted owls and other secondary cavity-nesting birds. All snags of various size classes and tree species will be retained unless they are considered hazards or exceptions as described under the CFPRs and BMPs.

Down wood also provides structural complexity in the stand and provides habitat for prey species. The management objective is to retain sufficient down woody material to allow prey populations to maintain existing abundances. All dead and down material greater than 23 inches in diameter and 10 feet in length will be retained.

The effects of the timber operations on wildlife populations and diversity would be limited by tree retention standards in the CFPRs associated with the use of selective type management that will apply in at least 95% of all harvested areas; more stringent tree retention in the LSMZs established adjacent to Class I streams and elsewhere; and BMPs promoting recruitment and retention of snags, cavity trees, and LWD.

Implementation of proposed timber operations would not substantially change general wildlife use on the ownership. This impact is less than significant.

Special-Status Species: General Use

This section assesses the effects of proposed timber management on each potentially occurring special-status species. Impacts on special-status wildlife species could occur as a result of disturbance to nest sites or through destruction of suitable nesting or foraging habitat.

Northern Spotted Owl. No northern spotted owls are known to nest on the ownership. Suitable nesting, roosting, and foraging habitat does exist, however. Measures have been implemented to protect spotted owl nest sites and to retain suitable owl habitat across the landscape. These measures were initially implemented through the northern spotted owl management plan prepared for the ownership (Hearst 1993a) and have been incorporated into the project description. The northern spotted owl management plan uses WHR to analyze habitat conditions across the planning area landscape, and stand-level management to retain specific habitat components, as describe above. The WHR analysis indicates that 21,581 acres of nesting/roosting habitat and 268 additional acres of foraging habitat currently exist on the ownership. It also indicates that by year 20 nesting/roosting habitat and foraging habitat will increase by 66% across the ownership. Stand-level management will ensure that specific habitat components important to nesting, roosting, and foraging spotted owls will be retained across the landscape. Therefore, implementation of the proposed project would have no significant impact on the northern spotted owl.

Bald Eagle. One bald eagle nest is present on the ownership. Timber harvesting activities conducted in the vicinity of bald eagle nests could disrupt birds attempting to use them. Other adverse affects could occur through the modification of habitat that renders such sites unsuitable to eagles.

Measures have been implemented to protect the existing bald eagle nest site and to monitor this and other future nest sites. These measures were initially established as part of the MOU between Hearst and DFG, pursuant to Section 2090 of the Fish and Game Code, and have been incorporated into the project description. These measures will ensure that timber harvesting operations will not result in disturbance to nesting bald eagles. In addition, other measures (i.e., WLPZ and LSMZ protection, and stand-level management described in the northern spotted owl management plan) will ensure that substantial suitable nesting and roosting habitat for bald eagles will be retained during the lifetime of this EIR. Finally, WHR analysis indicates that mature and late successional forests will increase by 85% over the next 20 years, providing additional potential nesting and roosting habitat for bald eagles across the planning area landscape. Therefore, implementation of the proposed project would have no significant impacts on the bald eagle.

American Peregrine Falcon. The American peregrine falcon is not known to occur on the ownership and no potential cliff nesting habitat exists on the ownership. Potential wetland and grassland foraging habitat will not be affected by timber harvest under the proposed project. Therefore, implementation of the proposed project would have no significant impacts on the peregrine falcon.

Osprey. All known osprey nests on the ownership are within areas designated LSMZs or along the edge of McCloud Reservoir. All existing osprey nest trees will be retained and protected, and substantial additional future nesting habitat will be retained within the LSMZs, particularly along the McCloud River. In addition, WHR analysis indicates that mature and late successional forests will increase during the planning period, providing additional nesting and roosting habitat for ospreys across the planning area landscape. Therefore, implementation of the proposed project would have no significant impacts on the osprey.

Northern Goshawk. The goshawk is known to occur on the ownership. Measures described in the northern goshawk adaptive management plan (Hearst Corporation 1993b) will be implemented to protect existing and potential future goshawk nest sites, monitor nesting activity on the ownership, and ensure that timber operations do not disturb nesting goshawks. Additional measures (i.e., WLPZ and LSMZ protection, and stand-level management described in the northern spotted owl management plan) further ensure that substantial suitable habitat for goshawks will be retained. WHR projections indicate that mature and late successional forests will increase by 85%, providing additional potential nesting, roosting, and foraging habitat for goshawks across the planning area landscape. Therefore, implementation of the proposed project would have no significant impacts on the goshawk.

Cooper's Hawk. The Cooper's hawk is known to occur on the ownership. At the landscape level, Cooper's hawk nesting habitat exists in a variety of stand types, including WHR size classes 3-6. Over the next 20 years, the area in these forest size classes will increase by 5%, at which time it will encompass 87% of the entire ownership. Therefore, landscape-level changes will benefit nesting Cooper's hawks. In addition, other measures have been implemented (i.e., WLPZ and LSMZ protection, and stand-level management described in the northern spotted owl management plan) that will ensure that specific habitat elements (e.g., snags, down wood) will be retained during the permit period. Measures have also been established to avoid disturbance to active Cooper's hawk nests (addressed later in this impact analysis). Therefore, implementation of the proposed project would have no significant impacts on the Cooper's hawk.

Sharp-Shinned Hawk. The sharp-shinned hawk is known to occur on the ownership. At the landscape level, sharp-shinned hawk nesting habitat exists in WHR size classes ranging from pole-sized to large sawtimber-sized trees, and moderate to dense canopy closure (WHR types 3M, 3D, 4M, 4D, 5M, and 5D). Over the next 20 years, the acreage in these WHR types on the ownership will increase by 66%. Therefore, landscape-level changes will benefit sharp-shinned hawks. In addition, other measures have been implemented (i.e., WLPZ and LSMZ protection, and stand-level management described in the northern spotted owl management plan) that will ensure that specific habitat elements (e.g., snags, down wood) will be retained. Measures have also been established to avoid disturbance to active sharp-shinned hawk nests (addressed later in this impact analysis). Therefore, implementation of the proposed project would have no significant impacts on the sharp-shinned hawk.

Great Gray Owl. The decline in suitable habitat for the great gray owl has been attributed to logging and grazing of montane meadow habitats (Gould 1991). Timber harvest activities can adversely affect great gray owls through changes in vegetation structure that make habitat unsuitable for this species, or through disturbance to active nest sites. To minimize the potential for timber operations to adversely affect the great gray owl or its habitat, measures were implemented to protect great gray owl nests and retain suitable habitat conditions. These measures were initially established as part of the MOU and have been incorporated into the project description. These measures will ensure that timber harvesting operations will not result in disturbance to nesting great gray owls, that suitable great gray owl habitat will be protected around nests, and that suitable nesting habitat, such as broken-top trees and snags adjacent to meadow habitats, will be retained. Therefore, implementation of the proposed project would have no significant impact on the great gray owl.

California Yellow Warbler. The yellow warbler could occur on the ownership. This species could occur in montane riparian forests along several of the watercourses on the ownership and in adjacent upland conifer forests. Montane riparian forest habitat will be protected within WLPZs as well as within the LSMZs. Timber management of adjacent conifer forest is not expected to substantially reduce the potential for yellow warbler occurrence. Therefore, implementation of the proposed project would have no significant impacts on the yellow warbler.

Greater Sandhill Crane. The greater sandhill crane is not known to occur on the ownership, and timber harvest activities would not directly affect potential meadow habitat for this species. However, if cranes inhabit the ownership in the future, timber harvest activities occurring adjacent to occupied meadow habitat during the breeding season could disrupt nesting birds. To avoid potential future impacts, Hearst has agreed to implement the measures described in the MOU to ensure that nesting birds are protected from disturbances. These measures are incorporated into the project description. Therefore, implementation of the proposed project would have no significant impacts on the greater sandhill crane.

Willow Flycatcher. The willow flycatcher is not known to occur on the ownership. Willow flycatcher habitat is confined to nonforested areas within meadows, where logging activity is prohibited by the CFPRs and Hearst internal management policy. Thus, it is unlikely that timber harvesting activity will directly affect this species. However, to further reduce the potential for affecting the willow flycatcher and its habitat should it occur on the ownership in the future, Hearst has agreed to implement the measures described in the MOU. These measures are incorporated into the project description. Thus, implementation of the proposed project would have no significant impacts on the willow flycatcher.

Vaux's Swift. The Vaux's swift could occur on the ownership. This species could occur in late successional stands or younger stands with residual old trees or snags. Substantial late successional habitat will be retained on the ownership within the WLPZs and LSMZs. At the landscape level, late successional habitats (WHR types 5M, 5D, and 6) will increase over the next 20 years. Also, at the stand level, snags will be retained according to guidelines specified in the northern spotted owl management plan. Therefore, implementation of the proposed project would have no significant impacts on the Vaux's swift.

Purple Martin. The purple martin could occur on the ownership. This species could occur in late successional stands or younger stands with residual old trees or snags. Substantial late successional habitat will be retained on the ownership within the WLPZs and LSMZs. At the landscape level, late successional habitats (WHR size classes 5 and 6) will increase over the next 20 years. Also, at the stand level, snags will be retained according to guidelines specified in the northern spotted owl management plan. Therefore, implementation of the proposed project would have no significant impacts on the purple martin.

Yellow-Breasted Chat. The yellow-breasted chat could occur on Hearst Forests. This species could occur in montane riparian forests and occasionally in adjacent upland conifer forests. Montane riparian forest habitat will be protected within WLPZs as well as within the LSMZs and elsewhere. Timber management of adjacent conifer forest is not expected to substantially reduce the potential for yellow-breasted chat occurrence. Therefore, implementation of the proposed project would have no significant impacts on the yellow-breasted chat.

California Wolverine. Although there is only a low probability that timber harvesting operations will adversely affect wolverines, the species could potentially occur on Hearst Forests. On the ownership, wolverines are more likely to occur in late successional stands because of the increased cover and denning opportunities. Management for wolverine habitat includes retaining late successional habitat within the LSMZs, increasing mid- and late successional habitat over time as indicated by WHR analysis, emphasizing uneven-age management, and retaining habitat elements such as snags and large down woody material according to guidelines specified in the northern spotted owl management plan. These measures will ensure that substantial habitat for the wolverine is retained on the ownership over time. However, impacts on wolverines resulting from timber harvesting operations could occur if a den containing a female and/or her young were disturbed or damaged. To avoid direct impacts on wolverine dens, measures described in the MOU (e.g., establishing no-harvest buffers around identified active dens and retaining snags and large down logs) would be implemented consistent with the project description. Therefore, implementing the proposed project would have no significant impacts on the wolverine.

Pacific Fisher. The Pacific fisher could occur on the ownership. This species could occur throughout the ownership, particularly along watercourses in late successional habitat. Management for fisher habitat on the ownership includes retaining late successional habitat within the LSMZs, increasing mid- and late successional habitat over time as indicated by WHR analysis, emphasizing uneven-age management, and retaining habitat elements such as large down woody debris according to guidelines specified in the northern spotted owl management plan. These measures will ensure that substantial habitat for the Pacific fisher is retained on the ownership over time. However, impacts on fishers resulting from timber harvesting operations could occur if a den containing an adult female or juveniles were disturbed or damaged. Large-diameter logs or snags or piles of down woody material are the most likely locations for dens on Hearst Forests. The den site protection measures described for the wolverine will be implemented to avoid direct impacts on active fisher dens. Therefore, implementation of the proposed project would have no significant impacts on the Pacific fisher.

Shasta Salamander. The Shasta salamander has not been detected on the ownership. However, the species could potentially occur in limestone rock formations on the ownership. Sites that could potentially support Shasta salamanders will be protected according to avoidance measures specified in the MOU. These measures are incorporated into the project description. Therefore, implementation of the proposed project would have no significant impacts on the Shasta salamander.

Foothill Yellow-Legged Frog. The foothill yellow-legged frog has not been detected on the ownership; however, it could occur in suitable habitats along several Class I and Class II drainages. Timber harvesting could affect potential habitat by reducing canopy cover along watercourses, affecting streamflows, and reducing the recruitment of woody debris into streams. A variety of measures have been implemented to minimize potential impacts on yellow-legged frogs, including establishing variable-width WLPZs and nonvariable 200-foot LSMZs along all Class I and Class II watercourses. These areas will be managed for development of late seral attributes, including large trees, high canopy closure, and stream shading. Compliance with the CFPRs and development of a mitigation and monitoring plan to mitigate the potential effects of sedimentation of streams, as described in Chapter 4, "Fisheries", will also reduce the potential for impacts on the foothill yellow-legged frog. Implementation of these measures will reduce potential impacts on the foothill yellow-legged frog to a less-than-significant level.

Tailed Frog. The tailed frog has not been detected on the ownership; however, it could occur in suitable habitats along several Class I drainages. Timber harvesting could affect potential tailed frog habitat by reducing canopy cover along watercourses, affecting streamflows, and reducing the recruitment of woody debris into streams. A variety of measures have been implemented to minimize potential impacts on tailed frogs, including establishing variable-width WLPZs and nonvariable 200-foot LSMZs along all Class I and Class II watercourses. These areas will be managed for development of late seral attributes, including large trees, high canopy closure, and stream shading. Compliance with the CFPRs and development of a mitigation and monitoring plan to mitigate the potential effects of sedimentation of streams, as described in Chapter 4, "Fisheries", will also reduce the potential for impacts on the tailed frog. Implementation of these measures will reduce potential impacts on the tailed frog to a less-than-significant level.

Northwestern Pond Turtle. The northwestern pond turtle has not been detected on the ownership; however, it could occur along all Class I watercourses. Timber harvesting could affect potential habitat by affecting streamflows, reducing the recruitment of woody debris into streams, and disturbing upland breeding sites. A variety of measures have been implemented to minimize potential impacts on the pond turtle, including establishing variable-width WLPZs and nonvariable 200-foot LSMZs along all Class I and Class II watercourses. These areas will be managed for development of late seral attributes, including large trees, high canopy closure, and stream shading. Ground disturbances resulting from timber harvest activities will be minimized in these zones, minimizing the potential for impacts in upland breeding sites. In addition, compliance with the CFPRs and development of a mitigation and monitoring plan to mitigate the potential effects of sedimentation of streams, as described in Chapter 4, "Fisheries", will also reduce the potential for impacts on the northwestern pond turtle. Implementation of these measures will reduce potential impacts on the pond turtle to a less-than-significant level.

Special-Status Species: Active Nest Sites

Nests of several special-status species could be subject to disturbance or direct removal during the breeding season as a result of timber harvest activities. Potentially affected species include northern spotted owl, northern goshawk, bald eagle, great gray owl, willow flycatcher, Cooper's hawk, sharp-shinned hawk, purple martin, California yellow warbler, yellow breasted chat, and Vaux's swift. Measures to ensure adequate nest protection for northern spotted owl, northern goshawk, bald eagle, great gray owl, and willow flycatcher will be implemented in accordance with direction contained in the northern spotted owl management plan, the northern goshawk adaptive management plan, and the MOU with DFG, as described in Chapter 2, "Proposed Project and Alternatives". Timber operations, however, could result in the loss of young in the nest and a reduction in reproductive performance for the remaining special-status species listed above.

Impact: Potential Loss of an Active Nest. The potential for loss of active nests for Cooper's hawk, sharp-shinned hawk, purple martin, California yellow warbler, yellow breasted chat, and Vaux's swift is a potentially significant impact.

Mitigation Measure: Conduct Preharvest Surveys for Active Nests of Special-Status Species. To avoid removing active nests of forest-nesting special-status birds, stand-level surveys will be conducted prior to timber operations to determine whether these species are nesting onsite. Surveys should be conducted throughout the stand by an appropriately trained RPF or the RPF's designee to identify nest locations of these species. If nests are found, the nest trees should be retained to protect the nests. Implementing this mitigation measure would reduce this impact to a less-than-significant level.

Intensive Management Alternative

Under the Intensive Management Alternative, the area receiving regeneration harvest (e.g., clearcutting) would increase and the period between selective harvest entries would be reduced on most other timberlands relative to the proposed project. The northern spotted owl management plan would not be implemented, and LSMZs would not be established under this alternative. The extent of late seral habitats (WHR types 5M, 5D, and 6) would decline by 20% throughout the ownership over the next 20 years.

The proportionate reduction in late seral habitats under the Intensive Management Alternative, due in part to the absence of LSMZs under this alternative, would result in the gradual decline of potential habitat for a variety of species associated with late seral habitat, and would reduce the potential for recruitment of certain habitat elements such as large broken-top trees, which could reduce the potential for future osprey and bald eagle nesting.

In addition, in the absence of LSMZs, timber operations would have relatively substantial adverse effects on aquatic and riparian species. Because the CFPRs and other BMPs designed to protect watercourses and streamside habitats would be implemented, however, potential effects on riparian and aquatic species would not be substantial under this alternative.

Measures to protect northern goshawks specified in the northern goshawk adaptive management plan would be implemented under this alternative. Implementing these measures would avoid adverse impacts on this species. Similarly, because the MOU with DFG would be in effect under this alternative, no significant changes in use of Hearst Forests by state-listed species would occur.

Impact: Potential Take of the Northern Spotted Owl. The northern spotted owl management plan would be not implemented under this alternative. Potential loss of or disturbance to nests or nesting pairs is considered potentially significant.

Mitigation Measure: Implement the No-Take Provisions for the Northern Spotted Owl Specified in the California Forest Practice Rules. The CFPRs (14 CCR 939.5) require implementation of measures to avoid take of northern spotted owls during planning and execution of timber operations. These measures include preharvest surveys to identify active nests, and subsequent protection of nest trees and adjacent stands. Conforming with these measures would reduce this impact to a less-than-significant level.

Impact: Reduction of Late Seral Habitat. Implementing the Intensive Management Alternative would result in a 20% reduction of late seral habitat over the next 20 years. This impact is considered significant.

Mitigation Measure: Retain Late Successional Habitat. As part of PTHP preparation, the RPF should determine whether the proposed timber operations would reduce the extent of late successional habitat. If so, the operations should be modified to retain existing late successional habitat throughout the harvest area. Implementing this mitigation measure would reduce this impact to a less-than-significant level.

Impact: Potential Loss of an Active Nest. The potential for loss of active nests for Cooper's hawk, sharp-shinned hawk, purple martin, California yellow warbler, yellow breasted chat, and Vaux's swift is a potentially significant impact.

Mitigation Measure: Conduct Preharvest Surveys for Active Nests of Special-Status Species. This mitigation measure was described above under "Proposed Project". Implementing this mitigation measure would reduce this impact to a less-than-significant level.

Chapter 7. Cultural Resources

CULTURAL SETTING

Prehistory

No definitive chronology has been agreed upon for the study area surroundings (i.e., the McCloud River and Kosk Creek basins). Consequently, the cultural chronologies assigned to the study area have been largely borrowed from the surrounding region. For example, Clewett and Wohlgemuth (1980) proposed a chronology for the Upper Central California Archaeological Region as follows:

- **Early Archaic (7500-5500 BP).** This period is characterized by small to medium-sized village sites located along major and minor streams, large-stemmed projectile points, atlatls and spears, and the possible introduction of manos and metates.

- **Classic Archaic (4500-2500 BP).** This period is characterized by small to medium-sized village sites along major and minor streams; manos and metates; and atlatls, darts, and various unifacial leaf-shaped and bifacial stemmed types of projectile points.

- **Transitional (2500-1500 BP).** This hypothesized period may be characterized by the possible abandonment of foothill and low mountain sites for valley and riverine locations, medium side- and corner-notched points, atlatls, and the possible introduction of mortars and pestles.

- **Shasta Complex (1500-150 BP).** This period is characterized by large village sites near major streams with smaller specialized sites near collecting or hunting areas, an economy heavily based on salmon and acorn procurement, small Gunther and Desert Side-Notched points of obsidian, large bi-pointed blades, hopper mortars, and pestles.

Ethnography

Three ethnographically known Native American groups are thought to have occupied portions of the study area. The exact territorial boundaries of each group are not known, and it is likely that territories both overlapped and changed through time. The northern and eastern portions of the project area were occupied by the Shasta and the Achumawi, respectively; and the western and southern portions of the project area were inhabited by Wintu.

The Shasta peoples were originally thought to be associated with the Achumawi (Kroeber 1925) but are now considered separate from them. The Shasta peoples inhabited the area roughly between the Rogue River on the north to the New River (near Cecilville) on the south, and the Marble and Salmon Mountains on the west to Mount Shasta and the Cascade Range on the east. The territory of the Achumawi extended roughly south to Mount Lassen, west to Mount Shasta, northeast to Goose Lake, and east to the Warner Range (Kroeber 1925, Olmstead and Stewart 1978). The Wintu are culturally and linguistically distinct from the Achumawi and inhabited portions of what are now Trinity, Shasta, Siskiyou, and Tehama Counties. Within the study area, the Wintu territory included the lower McCloud River Valley, below the present location of McCloud Reservoir (Jones & Stokes Associates 1988).

History

As a result of the rugged terrain and the absence of any major gold mines in the study area, early settlement occurred relatively late compared with settlement of the rest of California. A few settlers and entrepreneurs, however, occupied the area by the 1850s. They included Joaquin Miller, E. W. Conner, Jerry Hackathorn, Ross McCloud, Judge J. S. Beard, and W. S. Cunningham. Small towns, including Bartle and Elk Lawn, sprang up in the area in the 1890s. Although Elk Lawn had the first post office in the McCloud River Valley, the town was abandoned by 1901. (Martin 1981, Cranfield 1984.)

In 1886 the first railway line to Strawberry Valley was completed, effectively opening the McCloud River area for logging. Twenty-one lumber mills began operating in the area between 1894 and 1920. The most successful of these was the McCloud River Lumber Company, which operated from 1896 to 1964. The present town of McCloud, northwest of the study area and originally named Vandale, was built by the McCloud River Lumber Company to serve the needs of its employees. (Martin 1981, Cranfield 1984). McCloud Dam was built in 1965 to provide water for the Pit River Powerhouse (Cranfield 1984). Historic resources in this area could include archaeological and architectural resources related to the McCloud-based lumber and railroad companies and early settlement.

IMPACTS AND MITIGATION MEASURES

Impact Mechanisms

Proposed timber operations could disturb and damage known cultural resources or buried, unidentified archaeological sites. Impacts could result from ground disturbance associated with road construction, movement of heavy equipment, timber falling and yarding, or debris piling and movement.

Regulatory Framework

The requirements of CEQA pertaining to cultural resources apply to the proposed project. CDF is responsible for complying with the CEQA requirements for identification and mitigation of significant effects on historic and prehistoric cultural resources. The BOF has provided such direction for preparation of PTHPs, a certified functional-equivalent program under CEQA. According to the CFPRs, during preparation of a PTHP, the RPF will:

- conduct an archaeological record search at the appropriate State Archaeological Information Center;
- contact local Native Americans identified by the Native American Heritage Commission and allow for their participation;
- provide a professional archaeologist or a person with archaeological training (in accordance with 14 CCR 929.4, 949.4, 969.4) to conduct a field survey for archaeological and historical sites in the area covered by the PTHP; previous archaeological surveys within the site survey area may also be used to partially or entirely satisfy this requirement;
- prepare a confidential addendum to the PTHP, including a survey coverage map showing the locations of identified cultural resources and describing record-search and survey methods, results of contacts with Native Americans, qualifications of the surveyor, a description of identified archaeological and historical sites, and a description of specific enforceable protection measures to be implemented both within the site boundaries and within 100 feet of the site, and prepare a preliminary determination of significance of identified archaeological and historical sites if damaging effects from timber operations cannot be avoided; and
- submit completed site records for each site determined to be a significant archaeological or historical site in a manner consistent with the recording standards identified in the State Office of Historic Preservation's Instructions for Recording Historical Resources.

Criteria for Determining Significance

The CFPRs (14 CCR 895.1) define a significant archaeological or historical site as a specific location that may contain artifacts or objects and where evidence clearly demonstrates a high probability that the site meets one or more of the following criteria:

- contains information needed to answer important scientific research questions;
- has a special and particular quality, such as the oldest of its type or best available example of its type;

- is directly associated with a scientifically recognized important prehistoric or historic event or person;
- involves important research questions that historical research has shown can be answered only with archaeological methods;
- has significant cultural or religious importance to California Indians as identified by the Native American Heritage Commission or Native American organizations or individuals in concurrence with the Native American Heritage Commission, or local federally recognized tribal governments (14 CCR 895.1).

The State CEQA Guidelines define a significant historical resource as "a resource listed or eligible for listing on the California Register of Historical Resources [CRHR]" (Pub. Res. Code, Section 5024.1). An historic resource may be eligible for inclusion in the CRHR if it:

- is associated with events that have made a significant contribution to the broad patterns of California's history and cultural heritage;
- is associated with the lives of persons important in our past;
- embodies the distinctive characteristics of a type, period, region, or method of construction; represents the work of an important creative individual; or possesses high artistic values; or
- has yielded, or may be likely to yield, information important in prehistory or history.

The State CEQA Guidelines (Pub. Res. Code, Section 5097) also specify the procedure to be followed if human remains are discovered on nonfederal land. The disposition of Native American burials falls within the jurisdiction of the Native American Heritage Commission. In the event of discovery or recognition of any human remains outside a dedicated cemetery, no further disturbance of the site or any nearby area will occur until the county coroner has determined that no investigation of the cause of death is required and, if the remains are of Native American origin:

- the descendants of the deceased Native Americans have made a recommendation to the landowner or the person responsible for the excavation work for means of treating or disposing of, with appropriate dignity, the human remains and any associated grave goods as provided in Pub. Res. Code, Section 5097.98, or
- the Native American Heritage Commission was unable to identify a descendant or the descendant failed to make a recommendation within 24 hours after being notified by the commission.

No-Project Alternative

No impacts on cultural resources would result under this alternative.

Proposed Project and Intensive Management Alternative

Impact: Potential Damage to Identified Archaeological or Historical Sites

Timber operations could result in impacts on known cultural resources. These activities could affect both surface and underground portions of archaeological sites and historical properties. If the archaeological or historical site is considered to be significant based on the above CRHR criteria, then this impact would also be potentially significant.

Mitigation Measure: Implement Protection Measures or Determine Significance of the Site

PTHPs will include a confidential archaeological addendum that documents satisfactory completion of all archaeological research, notification, and survey requirements pursuant to the CFPRs. The RPF will prepare an addendum to the PTHP that identifies protection measures for any significant archaeological or historical site within the PTHP area. For example, avoidance of activities that may cause site disturbance is an appropriate protection measure. Site-specific protection measures may be implemented for known archaeological or historical sites without the significance of the site being determined.

A determination of significance will be made pursuant to the CFPRs (14 CCR 949.7) for any archaeological or historical site for which disturbance by the proposed timber operations cannot be avoided. For significant cultural sites that cannot be avoided, site-specific mitigation measures must be approved by the CDF Director. Implementing this mitigation measure would reduce this impact to a less-than-significant level.

Impact: Potential Damage to Previously Unidentified Archaeological or Historical Sites

Ground-disturbing activities could result in impacts on previously unidentified, buried cultural resources. Such activities could affect underground portions of archaeological sites or historical properties. If the archaeological or historical site is significant (see CRHR criteria, above), this impact would be potentially significant.

Mitigation Measure: Stop Timber Operations and Implement Protection Measures or Determine Significance of the Site

If an archaeological or historical site that was not identified in a PTHP is discovered during timber operations, the licensed timber operator (LTO) will immediately stop operations within 100 feet of the site and notify the CDF Director, and the mitigation measure described above addressing resource protection and determination of resource significance should be implemented. Implementing this mitigation measure would reduce this impact to a less-than-significant level.

Chapter 8. Timber Resources

This chapter describes the timber resources of Hearst Forests and analyzes trends in these resources under the proposed project and the other alternatives to demonstrate that projected harvesting levels are consistent with meeting the Forest Practice Act's requirements for achieving MSP of high-quality timber products.

ENVIRONMENTAL SETTING

The following sections describe the methodology used in estimating existing resource conditions and projecting future conditions, and summarize the timber resource data for Hearst Forests.

Timber Resource Inventory

Hearst Forests' timber resource inventory was designed and implemented during 1994 through 1996. The inventory used a sampling design based on a stratified random sample of forest plots. Hearst forestry staff members and VESTRA analysts worked together to design the inventory system and cruise specifications. Hearst conducted the field cruise.

The sampling design involved two levels of stratification. The first level divided the ownership into its two tracts, Wyntoon and Kosk Creek, based on their contrasting geomorphology and forest types. The second level stratified vegetation types within tracts. This stratification was based on the WHR system categories of species type, size class, and canopy closure class. Stand polygon boundaries were originally delineated in 1981 from aerial photographs and were updated for this inventory in 1994 and 1995.

Field plots were allocated to vegetation types based on the estimated average timber volume per acre within each stratum, the variance of the volume estimate, and the total acreage within each stratum. Stands were selected at random to represent each stratum, and plots were located along randomly selected transects on a 5-chain (330-foot) grid superimposed on each selected stand. Plots were arranged in clusters of three 0.1-acre plots oriented in an "L" shape. For operational efficiency, at least three clusters (nine plots) were allocated to each selected stand.

Crews collected plot measurements during the 1994, 1995, and 1996 field seasons. The following data were collected:

- species, dbh, total height, height to crown base, crown position, defect by log, and damage types were recorded for each standing live tree or snag at least 9.6 inches dbh and
- two to five trees per stand were cored with an increment borer to estimate breast-height tree age.

In addition to data collected for the 0.1-acre plot, the following additional data were collected within a 0.01-acre subplot within the larger plot:

- tallies of trees less than 9.6 inches dbh, by species;
- tallies of downed logs, by size class and condition (hard or soft); and
- fuel load in tons per acre.

The extent and intensity of the inventory are described in Table 8-1.

Table 8-1. Timber Resource Inventory Summary

	Wyntoon Tract	Kosk Creek Tract	Total
Number of forested strata	29	9	38
Total forested stands	1,017	322	1,349
Number of stands in which field plots were installed	95	29	124
Total field plots installed	927	324	1,251

Growth and Yield Modeling

Timber growth and yield were modeled using a three-step process. First, a geographic information system (GIS) database was developed containing data sets spatially characterizing land conditions throughout the ownership, including timber conditions based on the timber inventory. Second, timber growth was simulated based on data sets linked to land types. Third, alternative harvest schedules were modeled based on allocations of polygons (stands) to management prescriptions (sequences of activities over time) using a linear program.

Land-Stratum Types

Land-stratum types were defined in the GIS to comprise aggregations of polygons with similar land and timber attributes from throughout the ownership. Land types are spatially explicit units to which management prescriptions are assigned. An attribute was considered important if it (1) affected how timber stands would respond to management activities; (2) affected the range of management activities that could be applied to a land type; (3) affected the amount, timing, or cost of any applicable management activity; or (4) was required to demonstrate MSP.

The stratum component of the land-stratum type compiles information on vegetation type (WHR class and related timber attributes) derived from the timber inventory, and on site quality derived from the McCloud Area Soil and Vegetation Survey (California Department of Forestry and Fire Protection and U.S. Soil Conservation Service 1992). A 50-year Biging site index value was estimated for each site class based on breast-height tree age measurements from the inventory. Strata were created by overlaying GIS coverages for vegetation type and site quality, resulting in mapping units (polygons) that were generally required to consist of at least 6 acres. The principal exception to the 6-acre minimum polygon size involved smaller polygons defined to retain accurate ownership or PW boundaries.

The land component of the land-stratum type compiled locational information, including PW; areas precluded from being scheduled for harvest within the next 15 years by the linear program because they are active THP areas or were harvested recently; and LSMZs.

Growth and Yield Projection

The Forest Resource Inventory, Growth, and Harvest Tracking System (FREIGHTS) simulator was used to model growth and yield of all land-stratum types for 22 5-year periods, for a total planning period of 110 years. FREIGHTS operates by simulating growth and harvest of each type between midpoints of successive periods based on plot-level tree lists. The plot data are aggregated for each period to generate type-level statistics, including volume, basal area, trees per acre, and WHR class.

To run FREIGHTS, the user specifies various alternative management prescriptions to be simulated in a FREIGHTS script file. A prescription refers to one or more management sequences that include the same sequence of harvest types, but may vary with regard to the timing of individual harvests, such as the period when the first harvest occurs. The main prescriptions to be implemented are described in Table 8-2. Although other prescriptions (e.g., clearcutting and sanitation-salvage, and salvage harvesting) that were not modeled could also be implemented, the resulting forest structures are not expected to differ substantially from those shown in Table 6-1.

Table 8-2. Standard Silvicultural Prescriptions			
Prescription Number	Silvicultural Activities	Residual Basal Area/Acre (ft^2)	Cutting Cycle or Rotation
1	No harvest		
151-152	Alternative prescription selection	80 for first two harvests, 100 thereafter (site 1)	10 years
161-163	Alternative prescription selection	60 for first two harvests, 75 thereafter (sites 2,3) 40 for first two harvests, 50 thereafter (site 4)	15 years
191-197	Selection	100 (site 1)	10 years
201-207	Selection	125 (site 1)	10 years
231-237	Selection	75 (sites 2,3) 50 (site 4)	15 years
241-247	Selection	100 (sites 2,3) 75 (site 4)	15 years
271-277	Late seral selection	150 (site 1) 125 (sites 2,3) 100 (site 4)	20 years
281-287	Late seral selection	170 (site 1) 150 (site 2) 140 (site 3) 120 (site 4)	20 years
351-357	Seed tree, thin at 55 yrs		75 years
401-408	Clearcut		70 years
411-418	Clearcut		85 years
441-448	Thin (age 50), clearcut		70 years
451-458	Thin (ages 45 and 65), clearcut		85 years

The last digit of the prescription number indicates the 5-year period in which the initial harvest occurs. Thus, prescription 241 includes an initial harvest in the first period; prescription 246 allows the type to grow with no harvest until the sixth period. If insufficient volume or basal area is available to allow a particular harvest in a given time period, that prescription is considered infeasible and is not applied. As suggested in Table 8-2, prescriptions 191-207, which involve 10-year cutting cycles, were applied only to site class 1 lands. Prescriptions 241-247, with 15-year cutting cycles, could be applied to site class 2, 3, and 4 lands. Prescriptions 281-287, with 20-year cutting cycles, apply to all site classes.

CATS, the growth and yield model used in FREIGHTS, is applicable to all commercial forest types and species in California. FREIGHTS/CATS has been evaluated relative to two other leading growth and yield models (CACTOS and Forest Vegetation Simulator [FVS] [formerly known as PROGNOSIS]) to assess the relative reliability of its projections. It was found to be generally reliable for projections of up to several decades; for longer projections, FREIGHTS was found to be the most conservative (i.e., producing the lowest estimated stand volumes and basal areas) of the three simulators.

Modeling and Evaluation of Harvest Scheduling Alternatives

Yields projected for each prescription over the 110-year planning period, together with the available acreage of each land-stratum type, are stored in a database. A linear programming (LP) problem specifying management objectives and operational and environmental constraints was specified for each alternative analyzed in this EIR. The solution to each LP problem assigns prescriptions to land-stratum types, or portions of types. Solutions are efficient in that they optimize achievement of the specified management objective, subject to meeting all applicable constraints.

LTSY was calculated for each alternative as the periodic annual increment (PAI) of timber volume for lands to which uneven-aged management prescriptions were assigned, plus the mean annual increment (MAI) for lands to which even-aged prescriptions were assigned. Uneven-aged prescriptions are generally associated with selection harvesting, and even-aged prescriptions are associated with regeneration harvesting (e.g., clearcutting) systems. PAI is calculated for the last 40 years of the planning period; MAI is averaged over the complete rotation.

IMPACTS AND MITIGATION MEASURES

The Forest Practice Act authorizes regulations to achieve the goal of MSP of high-quality timber products, while giving consideration to various other forest benefits and amenities. The CFPRs specify that, for lands for which neither a nonindustrial timber management plan or a SYP has been approved, MSP will be achieved by meeting three standards: balancing growth and harvest over time, maintaining a timber inventory capable of sustaining the LTSY, and having the projected annual harvest level for all future rolling 10-year periods not exceed the LTSY.

Projected inventory, growth, and yield statistics for the ownership have been provided to CDF in a confidential addendum to this EIR. Information in this document evaluates compliance with the three standards for demonstrating MSP specified in the CFPRs, as described above. Subsequently, as described in Appendix B, monitoring reports will be submitted to CDF to validate the growth and yield projections contained in this EIR and the confidential addendum.

No-Project Alternative

Under the No Project Alternative, no commercial timber harvesting would occur. As a result, the proportion of land in late successional habitats would increase relatively rapidly, along with total timber volume and average volume per acre. Table 6-1 shows projected acreages by habitat type and decade under the No-Project Alternative. Projected acreages by habitat are shown only through year 60 because of the inability of any available growth model to reliably project stand growth in the absence of harvests for longer periods. In the absence of catastrophic events (e.g., major fires or insect outbreaks), however, timber volumes and late successional habitat acreage would steadily increase throughout the planning period. Because of the absence of commercial harvesting, harvest and growth would not be in balance, contrary to the intent of the Forest Practice Act and the CFPR's MSP standards.

Proposed Project

Table 8-3 shows the projected annual timber harvest for Hearst Forests as percentages of inventory and growth. The results indicate that harvesting would be in balance with growth and that adequate inventory to maintain the projected harvest levels would be maintained over the next 100 years. As discussed above, confidential data on projected harvest and inventory levels have been submitted to CDF that conclusively demonstrate conformance with applicable MSP standards.

Table 8-3. Projected Annual Timber Harvest as Percentage of Inventory and Growth by Future Decade, Proposed Project

	Harvest	
Decade	Percentage of Inventory	Percentage of Growth
1	2.0	67
2	2.3	76
3	2.5	85
4	2.5	86
5	2.1	75
6	1.8	71
7	1.7	74
8	1.8	80
9	1.7	79
10	1.8	88

Table 8-4 shows projected harvest areas by decade for each of the standard silvicultural prescription groups described in Table 8-2. All harvesting conducted under this alternative would meet the minimum stocking standards specified in 14 CCR 932.7. In some cases, however, alternative prescriptions (as described in 14 CCR 933.6) would be applied to enhance the species distribution, stand structure, and growth of low basal-area stands dominated by trees of low vigor or undesirable species. Such alternative prescriptions could result in residual stands that do not meet the after-harvest stocking standard for the standard silvicultural method most nearly appropriate or feasible to apply to a specified stand. Between 1992 and 1997, alternative prescriptions were applied on approximately 3,000 acres of Hearst Forests; not all of these acres had residual stands with substandard after-harvest stocking levels, however. The use of alternative prescriptions resulting in substandard after-harvest stocking levels would be limited to stands where their use will be demonstrated in a PTHP to result in either an increase in long-term sustained yield relative to the most nearly appropriate or feasible standard silvicultural method, or an increase in yield over 20 years relative to the no-harvest alternative. As shown in Table 8-2, alternative prescriptions resulting in substandard stocking levels (i.e., prescriptions 151-152 and 161-163) following the initial harvest have estimated residual basal areas ranging from 80 square feet per acre for site 1 to 40 square feet per acre for site 4.

Table 8-4. Projected Harvest Acres by Prescription Group and Decade, Proposed Project

Prescription Group	Decade 1	2	3	4	5	6	7	8	9	10
1	3,050	3,050	3,050	3,050	3,050	3,050	3,050	3,050	3,050	3,050
151-152	0	0	0	0	0	0	0	0	0	0
161-163	332	89	68	0	0	0	0	0	0	0
191-197	3,306	3,682	4,699	5,550	5,550	5,550	5,550	5,550	5,550	5,550
201-207	27	738	738	3,136	3,136	3,136	3,136	3,136	3,136	3,136
231-237	1,765	2,662	3,008	1,109	2,928	3,008	1,109	2,928	3,008	1,109
241-247	3,822	10,859	11,065	12,898	13,857	11,065	12,898	13,857	11,065	12,898
271-277	2,343	4,061	3,476	4,930	3,476	4,930	3,476	4,930	3,476	4,930
281-287	2,233	1,554	3,256	3,509	3,256	3,509	3,256	3,509	3,256	3,509
351-357	0	0	2,566	104	0	0	0	1,729	941	0

Intensive Management Alternative

Table 6-1 shows the projected distribution of habitats under the Intensive Management Alternative. Under the Intensive Management Alternative, acreage in late successional habitats would decrease during years 10-30 and again during years 70-80. Late successional habitat acreage would increase in all other decades of the planning periods. Despite the intermittent decline in late successional habitat, this alternative meets the MSP standards specified in the CFPRs. (Information substantiating this finding is contained in a confidential document reviewed by CDF.) In fact, providing a harvest schedule that would maximize the cumulative volume harvested over the 110-year planning period while meeting the CFPR's MSP standards was the basis for developing this alternative.

Chapter 9. Traffic Assessment

ENVIRONMENTAL SETTING

Nearly all vehicles associated with management of Hearst Forests enter and exit the ownership via State Highway 89 east of McCloud. Traffic levels on State Highway 89 and other public roads in the vicinity are generally low relative to their capacities, and instances of congestion are rare. For example, the average daily traffic (ADT) on State Highway 89 in McCloud in 1994 was 3,100 vehicles, or 43% of its rated capacity (California Department of Transportation 1994, 1995). ADTs for 1994 for other highways that receive traffic related to management of Hearst Forests include 18,200 vehicles (57% of capacity) on Interstate 5 in Redding and 3,250 vehicles (48% of capacity) on State Highway 299 at Big Bend Road, 20 miles east of Redding.

Most of the traffic associated with management of Hearst Forests consists of log trucks traveling between the ownership and various sawmills in northern California and southern Oregon. It occurs primarily during the May-November period.

IMPACTS AND MITIGATION MEASURES

Criteria for Determining Significant Impacts

Traffic impacts were considered significant if the project or an alternative would:

- increase traffic volumes on any highway by more than 15% or
- result in traffic volumes that exceed a highway's capacity.

No-Project Alternative

Under the No-Project Alternative, no log loads would be shipped from Hearst Forests. Traffic volumes on regional highways would decline slightly relative to existing conditions.

Proposed Project

Under the proposed project, log-truck traffic generated by Hearst Forests would average approximately 50 loads per day during the logging season, and could be as high as 90 loads per day during infrequent, short periods when helicopter logging operations are in progress. This traffic would increase the traffic volume on State Highway 89 by approximately 3%-5% relative to the No-Project Alternative (i.e., to levels approximately equal to existing conditions), which could easily be accommodated by existing highway facilities. No substantial changes in traffic volumes would occur on any other highways.

Intensive Management Alternative

Under the Intensive Management Alternative, Hearst Forests would generate approximately 100 loads of logs per day during the logging season. This traffic would increase traffic volumes on State Highway 89 by approximately 6% relative to the No-Project Alternative. Traffic volumes on State Highway 89 and other regional highways would remain well below their rated capacities, however, and Hearst-related traffic would not result in a substantial increase in highway congestion.

Chapter 10. Visual Resource Assessment

ENVIRONMENTAL SETTING

Views of Hearst Forests by the general public consist primarily of panoramas of nearly continuous forest cover obtained by looking southward from State Highway 89. Visitors to Lower Falls picnic site and nearby locations on the upper McCloud River may view Hearst Forests at its boundary with the national forest. A small portion of the property is also visible from Primary Forest Road 11, which follows the southwestern shoreline of McCloud Reservoir before heading northwestward toward McCloud (Figure 3-1), and from other public roads primarily in the Kosk Creek Tract. The remainder of the ownership is not publicly accessible and may be viewed only by the owners and their guests.

IMPACTS AND MITIGATION MEASURES

Impact Assessment Methodology

Impacts on visual resources were assessed qualitatively by analyzing project-related changes in the landscape quality, the frequency with which such changes would be perceived, and the likely sensitivity of viewers to the landscape changes.

Criteria for Determining Significant Impacts

Visual resource impacts were considered significant if:

- a moderately intensive degradation in landscape quality would be seen by a large number of relatively sensitive viewers or
- a highly intensive degradation in landscape quality would be seen by any relatively sensitive viewers.

No-Project Alternative

Views of Hearst Forests would remain largely intact. Forest structure would gradually become denser, more decadent, and less visually penetrable.

Proposed Project

Timber operations would consist almost entirely of selective harvesting, which would not substantially alter the visual composition of forest stands or be noticeable from State Highway 89. Although the reduced density of trees resulting from selective harvesting would probably be imperceptible to most viewers, those who notice such changes are likely to perceive them as having either a beneficial or neutral effect on the landscape's visual quality.

Short-term visual effects of logging would include the presence of fresh-cut stumps and slash accumulations. In the context of commercial forests, including the national forest lands surrounding Hearst Forests, such effects are common and consistent with most viewers' expectations. In addition, they would be visible only at the few locations within the ownership accessible by public roads.

Intensive Management Alternative

In addition to selective harvests, a substantial acreage within the ownership would receive regeneration harvests, which would create clearings of up to 40 acres. Such clearings are required by the CFPRs to be interspersed with visually intact forest stands. Regenerated stands would be substantially revegetated within 1-3 years following harvest. Because of the contextual consistency of such clearings with management of adjacent private timberlands, however, and the fact that few locations within Hearst Forests are accessible to the public, such visual effects would be relatively minor.

Chapter 11. Fuels and Wildfire Safety Assessment

ENVIRONMENTAL SETTING

Wildfire has occurred only rarely on Hearst Forests, primarily because of the near absence of public use on the ownership, the most common source of wildfire ignitions. Only one fire, the Devils Fire of 1990, has occurred on the ownership over the past 15 years. It burned 674 acres of the Devils Canyon PW, primarily at low intensity. A more intensive fire, the Lick Fire, occurred in McCloud Reservoir PW in 1966, burning 415 acres (Figure 11-1).

CDF has primary responsibility for suppressing fires on the ownership; Hearst and its employees and contractors provide suppression support to CDF. CDF engines and related suppression resources available to protect Hearst Forests are based in McCloud, Pondosa, and Burney. Emergency response time for CDF would range from 15 minutes to 1 hour, depending on the location of the fire within the ownership.

In 1994, Hearst and CDF signed an MOU implementing a preattack fire plan for Hearst Forests. This plan specifies roles and responsibilities, communication channels, access routes, water sources, staging areas, incident bases, special control and treatment areas, and suppression resources to be used in case of a fire emergency.

IMPACTS AND MITIGATION MEASURES

Impact Assessment Methodology

Impacts on fuels and wildfire safety were assessed by analyzing the effects of proposed forest managment on fuel loads and continuity and on the expected frequency of wildfire ignitions.

Criteria for Determining Significant Impacts

Impacts were considered significant if the proposed project or an alternative would result in a substantial increase in either:

- the frequency in wildfire ignitions (fire risk)on the ownership or

- the likelihood that an extensive, severe wildfire would result from a specified ignition (fire hazard).

No-Project Alternative

Fuel loads (tons per acre of flammable biomass) and their vertical and horizontal continuity would gradually build up throughout the ownership as timber volumes and tree densities increase in the absence of harvesting. In the event of a lightning-caused ignition, fewer staff would be onsite than currently patrol the forest, so detection and response time would increase. As a result, risks of damaging wildfires would increase relative to existing conditions.

Proposed Project

The CFPRs require that logging slash located within 100 feet of public roads or within 50 feet of private roads accessible to the public be treated by lopping, piling and burning, chipping, or burying. Hearst goes beyond these requirements by implementing BMPs that include:

- lopping and scattering of slash down to a 4-inch top, regardless of location;
- conducting biomass thinning operations to remove small trees and tops that are otherwise unmerchantable, as market conditions allow; and
- felling of all snags in harvest areas that extend above the height of the general forest canopy and thus are particularly likely to attract lightning strikes or that otherwise pose a safety hazard; all other snags will be retained for wildlife.

Because of the highly restricted access of the public to Hearst Forests, the fuel management practices and standards specified above, and ongoing implementation of a comprehensive preattack fire plan, proposed timber operations would not increase wildfire hazards relative to existing conditions and would reduce such hazards relative to the No-Project Alternative.

Intensive Management Alternative

Because of the relatively high harvest levels under this alternative, in conjunction with the BMPs specified above, fuel loads would generally be less than under the proposed project, particularly in regeneration harvest areas. Wildfire hazards would be reduced relative to existing conditions and the No-Project Alternative.

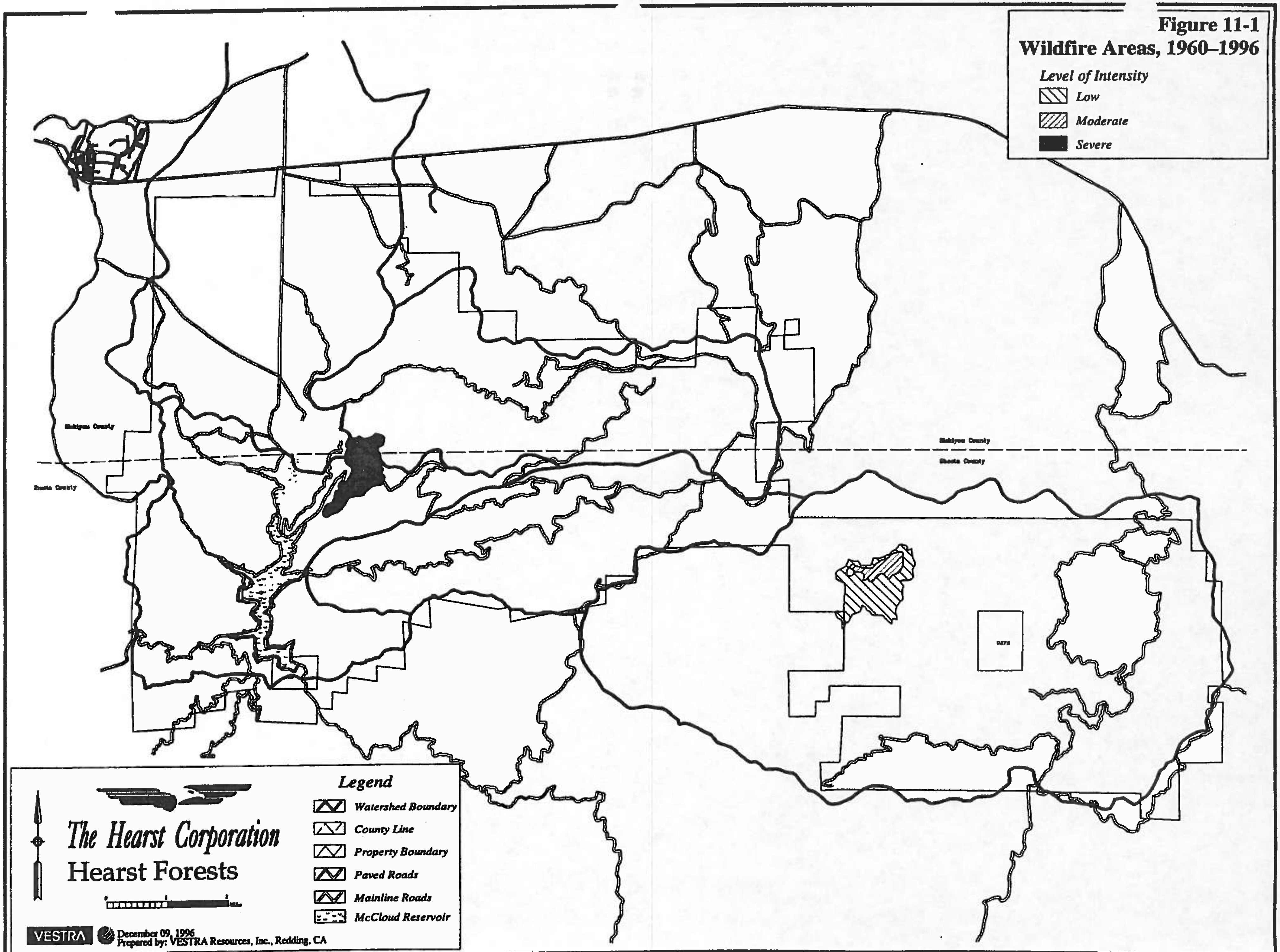


Figure 11-1
Wildfire Areas, 1960–1996
Level of Intensity
Low
Moderate
Severe
Siskiyou County
Shasta County
Legend
Watershed Boundary
County Line
Property Boundary
Paved Roads
Mainline Roads
McCloud Reservoir
The Hearst Corporation
Hearst Forests
VESTRA
December 09, 1996
Prepared by: VESTRA Resources, Inc., Redding, CA

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Appendix A. Public Scoping Report

Appendix A. Public Scoping Report

This appendix summarizes public comments submitted on the scope of the program environmental impact report (EIR) for Hearst Forests.

COMMENTERS

The public scoping period for the EIR extended from July 25, 1996 through September 9, 1996. Scoping letters were received from the following:

1. Richard L. Elliot, Regional Manager, California Department of Fish and Game - Region I;
2. Ivan Young, Chairman, Siskiyou County Board of Supervisors; and
3. Mark H. Harvey, Associate WRC Staff Engineer, Shasta Cascade Watershed, California Regional Water Quality Control Board, Central Valley Region.

COMMENTS RECEIVED

This section summarizes scoping comments regarding information to be addressed in the EIR. Numbers in parentheses following the comments indicate the letter or letters from the above list that contained the comment.

Project Description

1. If timber operations are conducted prior to approval of the programmatic timber harvesting plan rules by the Board of Forestry, specific forest practices to be used need to be stated in the EIR. Specific operational and performance standards should be specified in the EIR. (3)

Project Alternatives

2. The EIR should evaluate a full range of alternatives, including a moderate timber management alternative, in addition to the No-Project Alternative, the proposed project, and the intensive management alternative outlined in the NOP. (1)

Resource Monitoring

3. Parameters and methods for sampling and reporting should be specified in the EIR (3)

4. The project proponent should specifically address how each element of the proposed resource monitoring program will incorporate quantifiable baseline data and include a systematic inventory program using standard statistical methodologies, including provisions to adaptively manage resources that do not meet predetermined management goals. For example, the baseline abundance of snags and large woody debris should be identified and management goals established and justified. A credible method for monitoring the persistence and recruitment of these resources should be thoroghly outlined, including mitigation measures that will be implemented if management goals are not met.

Cumulative Watershed Impacts, Soil Erosion, and Water Quality

5. The EIR should address possible offsite impacts on watershed protection. (2)

6. The areas in question are mapped by the Siskiyou County General Plan as a Woodland Productivity area; Policy 32 states that the permitted uses will not create erosion or sedimentation problems. This general plan policy should be addressed through the EIR by project design and mitigation for the protection of watershed values. (2)

7. Roads, landings, and skid trails in and near watercourses in the Wyntoon Tract formerly contributed and continue to contribute large amounts of sediment to streams during past logging, creating significant impacts on many watercourses and on riparian habitat. The EIR should address restoration activities or provide a methodology to address restoration opportunities as areas are entered. (3)

8. The transportation system should be addressed in detail, particularly with regard to impacts of sediment on watercourses. Objectives for land management should include establishing a stable, permanent road system that facilitates appropriate yarding systems with minimal sediment discharge. Roads that contribute sediment

should be properly abandoned or stabilized if they are to remain for administrative use. (3)

9. Waste Discharge Requirements may be required pursuant to the California Water code for operations on the property, depending on the rules adopted by the Board of Forestry for programmatic timber harvest plans (PTHPs). (3)

Biotic Resources

10. The EIR should evaluate the maintenance and management of wildlife habitats on a landscape basis and evaluate the potential for significant cumulative impacts on fish and wildlife resources that would result from implementation of the proposed project, even if significant impacts would not result from individual projects. In particular, impacts on late seral forest stands and the wildlife species dependent on this increasingly rare habitat type should be addressed; this assessment should include a baseline inventory and management strategy for the management and recruitment of late seral forest stand resources over time. (1)

11. All habitats on the project site should be evaluated to determine their potential to support rare aquatic and terrestrial flora and fauna, and habitat types supporting rare species should be thoroughly surveyed by qualified individuals with specific expertise in the appropriate disciplines; surveys should be conducted during the time and the season when the target species is most detectable, and watercourse classification should be conducted in spring. (1)

12. Hearst Forests will be managed to promote development of uneven-aged forest stands; potential impacts (beneficial and adverse) on wildlife resources of converting existing even-aged stands to uneven-aged stands should be addressed. (1)

13. The EIR should evaluate how application of the current forest Practice Rules adequately protects fish and wildlife resources. (1)

14. The EIR should address possible offsite impacts on management of forest pathogens. (2)

15. Special consideration should be given to riparian areas for the protection of fisheries and wildlife values. (2)

Fire Safety

16. The EIR should address possible offsite impacts on fire hazards. (2)

Visual Resources

17 The EIR should address possible offsite impacts on aesthetic concerns. (2)

Appendix B. Hearst Forests Resource Monitoring Plan

Appendix B. Hearst Forests Resource Monitoring Plan

AQUATIC HABITAT AND FISH ABUNDANCE ASSESSMENT

Monitoring Locations: Angel and Kosk Creeks.

Baseline Data Collection: One additional sediment survey will be conducted in the two geomorphic reference sites established in Angel Creek within 2 years following certification of the Hearst Forests Program Timberland Environmental Impact Report (PTEIR). Habitat typing surveys will be conducted for a 3-mile accessible reach of Kosk Creek within 2 years of PTEIR certification. Sediment surveys will be conducted in two selected subreaches of Kosk Creek in two of the three years following PTEIR certification. Continuous stream temperature recording will also be conducted throughout the summer at one accessible location in the lower portion of each study area during two of the three years following certification.

Subsequent Surveys: Following completion of the baseline aquatic surveys, The Hearst Corporation (Hearst) and the California Department of Forestry and Fire Protection (CDF) will develop, with input from the California Department of Fish and Game (DFG), a schedule for conducting subsequent aquatic surveys involving at least one additional sediment survey in the stream geomorphic reference sites. If results indicate that no substantial habitat degradation (i.e., thresholds exceedances) has occurred, the aquatic monitoring program will be discontinued.

Survey Parameters: Surveys will collect the following data:

- mean weekly average temperature (MWAT) over an initial 2-year period near the lower geomorphic reference site in each stream monitored,
- V* and D50 particle sizes for surface and subsurface materials during each survey period, and
- fish populations to estimate fish densities by species and size class.

Adaptive Management Commitment: Exceedance thresholds for determining whether substantial aquatic habitat degradation has occurred will be developed cooperatively by Hearst and CDF, with input from DFG, following completion of baseline data collection and analysis. If the V* or D50 measures indicate that aquatic habitat in the geomorphic reference site has been substantially degraded over the previous period (i.e., thresholds have been exceeded for V* or D50 particle sizes), the reasons for the degradation will be explained. Habitat typing may be conducted in selected stream reaches. If the reasons for the habitat degradation are not readily apparent, additional surveys will be conducted in tributary streams and on hillslopes to determine the source (see "4. Road-Related Watershed Hazard Assessment", below) of the habitat damage. If deemed necessary by Hearst and CDF, additional measures (e.g., reducing harvesting in streamside areas, increasing road abandonment, or increasing stabilization of active erosion sites) will be implemented to restore aquatic habitat quality.

Reporting Requirement: A report summarizing monitoring results will be prepared and submitted to CDF following completion of baseline data collection and following subsequent surveys.

WILDLIFE SURVEYS

Species for Which Protocol-Level Surveys Will Be Conducted: great gray owl, northern goshawk, northern spotted owl, Shasta salamander, willow flycatcher.

Species for Which Reconnaissance Surveys Will Be Conducted as Part of Program Timber Harvesting Plan (PTHP) Preparation: California yellow warbler, Cooper's hawk, greater sandhill crane, purple martin, sharp-shinned hawk, Vaux's swift, yellow breasted chat.

Authority for Survey Procedures, Locations, and Management Responses to Observations:

- Northern Spotted Owl Management Plan: northern spotted owl
- Northern Goshawk Adaptive Management Plan: northern goshawk
- DFG Biological Opinion: greater sandhill crane, great gray owl, willow flycatcher, Shasta salamander
- California Forest Practice Rules: California yellow warbler, Cooper's hawk, purple martin, sharp-shinned hawk, Vaux's swift, yellow breasted chat

Adaptive Management Commitment: If surveys indicate that a sensitive species is present and could be affected by proposed timber operations, the affected habitat or site will be protected consistent with direction specified in the PTEIR or other authorizing document.

Reporting Requirement: Survey data will be kept on file at the Hearst Forests office and will be made available to CDF upon request.

SPECIAL-STATUS PLANT SURVEYS

Species for Which Surveys Will Be Conducted: Scott Mountain phacelia and long-haired star tulip

Survey Procedure: As part of PTHP preparation, a registered professional forester (RPF) or a trained designee will conduct a reconnaissance-level survey for potential habitat for the above species. Scott Mountain phacelia grows at high elevations in mixed-conifer forest stands on soils derived from serpentine rock. Long-haired star tulip grows in grassy meadows within ponderosa-Jeffrey pine forest stands.

Adaptive Management Commitment: If potential habitat for one or both species is located within the PTHP area, either the habitat will be flagged and avoided, or surveys will be conducted for the indicated species during the appropriate survey season, before commencement of timber operations, by a trained, qualified individual. If the species is observed, a protection plan will be developed for the population cooperatively by Hearst and CDF, with input from DFG, and the population will be protected consistent with this plan.

Reporting Requirement: Survey data will be kept on file at the Hearst Forests office and will be made available to CDF upon request.

ROAD-RELATED WATERSHED HAZARD ASSESSMENT

Assessment Procedure: During the 2 years following certification of the PTEIR, Hearst RPFs or their designees will conduct reconnaissance surveys throughout Hearst Forests to identify substantial road-related watershed hazards. Hazardous conditions to be surveyed for include features indicating high landslide or erosion potential and active landslide features:

- oversteepened fill slopes;
- oversteepened cut slopes;
- stream crossings with high diversion potential;
- undersized culverts;
- partially blocked culverts;
- skid trail crossing (fill) in ephemeral stream channels;
- bare soil areas;
- cut slope failures;
- fill slope failures;
- gullying or surface erosion of a road, landing, or skid trail surface; and
- gullying or surface erosion resulting from a road, landing, or skid trail discharge.

Other conditions to be surveyed for include:

- areas with inside ditches that should be outsloped;
- areas where water bars should be replaced by rolling dips;
- watercourse and lake protection zone (WLPZ) road segments that should be relocated outside the WLPZ;
- unneeded road segments that should be abandoned and/or replaced; and
- culverts that should be replaced by bridges.

Following completion of the baseline inventory, an RPF or a properly trained designee will continue to record road-related watershed hazards they observe during the course of their normal work responsibilities.

Adaptive Management Commitment: For each substantial road-related watershed hazard identified, Hearst will determine whether the hazard involves road damage that needs to be repaired to facilitate short-term timber operations. If so, the hazard will be remediated within 2 years. If not, an RPF will:

- estimate the additional volume of material that could be mobilized at the site;
- estimate the stream sediment discharge that would be avoided by implementation of the recommended remediation;
- assess the feasibility of hazard remediation;
- describe the recommended remediation approach;
- estimate the cost of the remediation project;
- estimate the cost effectiveness (in dollars per cubic yard of sediment discharge avoided) of the proposed remediation project;
- prioritize remediation projects based on their cost effectiveness; and
- schedule and implement remediation projects based on their priority.

Reporting Requirement: The hazard inventory will be maintained as part of the Hearst Forests geographic information system. Data on hazard locations, evaluations, treatment priorities, and treatment accomplishments will be maintained at the Hearst Forests office and will be made available to CDF upon request.

LANDSLIDE IDENTIFICATION AND CLASSIFICATION

Procedure: As part of PTHP preparation, a certified engineering geologist (CEG) or a trained RPF will visit each landslide shown on the Hearst Forests "Known Unstable and Eroded Areas" map in areas where tractor-based timber operations are planned. Each landslide classified as "possible/probable" (p) or "questionable" (q) will be examined to verify whether it is a landslide. If so, its certainty-of-identification status will be changed to "definite" (d); if not, it will be deleted from the map. The type of landslide and its relative stability will also be verified and, if necessary, corrected.

Additional landslides observed by RPFs or their designees during PTHP preparation or the course of their normal work responsibilities will also be mapped and classified as to type and relative stability.

Adaptive Management Commitment: Landslide areas will be managed consistent with the guidelines specified in "Geology, Landslides, and Geologic Guidelines for Managing Hearst Forests".

Reporting Requirement: Landslide location, type, and stability classification data will be maintained as part of the Hearst Forests geographic information system, maintained at the Hearst Forests office, and will be made available to CDF upon request.

HILLSLOPE PRACTICE EFFECTIVENESS EVALUATION

Procedure: Within 1 year following PTEIR certification, a survey form will be completed for use in hillslope practice effectiveness evaluation, and Hearst RPFs and their designees will be trained in completing the form.

An RPF or RPF's designee will survey each PTHP area annually for 3 years following completion of timber operations. Survey areas will be selected to focus on sites where in-lieu or alternative practices were implemented. At least one road, skid trail, and landing will be surveyed within each PTHP area. The surveyor will evaluate practices for their effectiveness in avoiding erosion, concentrated runoff, landslides, sediment discharge, and damage to facilities.

Adaptive Management Commitment: If practices (particularly in-lieu and alternative practices) are found to be ineffective, the reasons for their ineffectiveness will be explained, and, if deemed necessary by CDF, alternative practices known to be more effective (e.g., standard practices specified in the California Forest Practice Rules [CFPRs]) will be used instead of the ineffective practice in future applications.

Reporting Requirement: Survey results will be kept on file at the Hearst Forests office and will be made available to CDF upon request.

TIMBER INVENTORY AND MAXIMUM SUSTAINED PRODUCTION ASSESSMENT

Procedure: Annual and periodic inventory maintenance will be conducted as described in Appendix B to the draft PTEIR. Actual past harvest levels will be assessed periodically in relation to levels projected in the confidential addendum to the PTEIR to determine whether harvesting has been consistent with the maximum sustained production (MSP) requirements of the California Forest Practice Act and the CFPRs.

Adaptive Management Commitment: If the cumulative harvest level over the previous period is determined to have substantially exceeded the projected level, reasons for the departure will be explained. If deemed necessary by CDF, appropriate adjustments will be made to harvest levels over the subsequent period to ensure that harvesting over time is consistent with the MSP requirements.

Reporting Requirement: A report summarizing Hearst Forests attributes and statistics will be provided periodically to CDF.

FOREST HABITAT ASSESSMENT

Procedure: Based on the results of the timber inventory, the extent of late successional habitat on Hearst Forests will be estimated.

Adaptive Management Commitment: If the extent of late successional habitat (i.e., California Wildlife Habitat Relationship [WHR] System classes 5M, 5D, and 6) is determined to be substantially less than the acreage projected in Table 6-1, the reasons for the departure will be explained. If deemed necessary by Hearst and CDF, with input from DFG, appropriate adjustments will be made in scheduled harvests within late successional and other WHR size class 5 and 4 stands over the subsequent period to ensure that adequate late successional habitat is maintained.

Reporting Requirement: Inventory results will be kept on file at the Hearst Forests office and will be made available to CDF upon request.

SNAG AND DOWNED LOG ASSESSMENT

Procedure: Based on the results of the timber inventory, the average density (i.e., number per acre) of snags and large downed logs, and their distribution by size and quality class, will be estimated.

Adaptive Management Commitment: If the average density of snags or large downed logs, or the average density of any class thereof, is determined to have decreased substantially over the preceding period, the reasons for the decline will be explained. If deemed necessary by Hearst and CDF, with input from DFG, appropriate adjustments will be made to the salvage harvesting program on Hearst

Forests over the subsequent period to ensure that adequate supplies of snags and large downed logs are maintained.

Reporting Requirement: Inventory results will be kept on file at the Hearst Forests office and will be made available to CDF upon request.

ADDITIONAL COMMITMENTS

In addition to the resource monitoring and adaptive management commitments discussed above, Hearst will comply with the following commitments specified in the PTEIR.

- By June 15 of each year, or within 2 weeks of when a road becomes traversable, whichever occurs later, reconnaissance surveys will be conducted of all mainline haul roads to identify structural damage and related soil erosion and sedimentation hazards. Particular attention will be given to:

    - ruts, chuckholes, and washes in a road surface;
    - cut slopes;
    - watercourse crossings and drainage structures;
    - trash racks appurtenant to inlet structures;
    - inlet structures, outlet structures, and appurtenant energy dissipators;
    - outside berms;
    - ditches; and
    - slides and slumps.

  Damaged structures and related erosion and sedimentation hazards on or along mainline haul roads will be repaired or stabilized to prevent accelerated erosion and sedimentation in conformance with applicable Hearst Forests Best Management Practices by November 15 of the same year.

- Damaged structures and related erosion and sedimentation hazards identified on or along secondary roads will be repaired or stabilized on an ongoing basis. Major maintenance on secondary roads will be conducted as needed to facilitate access or in conjunction with timber operations.

- Road signage will be maintained annually to facilitate management and emergency response.

- Existing wet fords on roads receiving regular and frequent traffic will be replaced with permanent culvert or bridge crossings by 2006.

- Existing outside berms that do not protect fill slopes or divert road surface runoff from sensitive areas will be removed or breached by 2011 on all roads and landings not currently scheduled for reconstruction.

- Existing drainage structures on all roads and landings not currently scheduled for reconstruction will be assessed for adequacy to conduct flows expected to result from a 50-year storm event by 2006. Drainage structures inadequate to conduct such flows will have overflow structures installed or will be replaced by structures meeting 50-year-storm specifications by 2016.

- Existing drivable road segments with insloped road prisms will be inventoried and reconstructed to outslope specifications, or will have adequate cross-drainage structures and facilities installed or constructed by 2016.

Appendix C. Hearst Forests Best Management Practices