DEPARTMENT OF FORESTRY AND FIRE PROTECTION
NORTHERN REGION HEADQUARTERS REDDING
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OFFICIAL RESPONSE OF THE DIRECTOR OF THE CALIFORNIA DEPARTMENT OF FORESTRY AND FIRE PROTECTION TO SIGNIFICANT ENVIRONMENTAL POINTS RAISED DURING THE TIMBER HARVESTING PLAN EVALUATION PROCESS

THP NUMBER: 2-20-00159-SHA

SUBMITTER: Sierra Pacific Industries

COUNTY: Shasta

END OF PUBLIC COMMENT PERIOD: March 12, 2021

DATE OF OFFICIAL RESPONSE/DATE OF APPROVAL: June 14, 2021

The California Department of Forestry and Fire Protection has prepared the following response to significant environmental points raised during the evaluation of the above-referenced plan. Comments made on like topics were grouped together and addressed in a single response. Where a comment raised a unique topic, a separate response is made. Remarks concerning the validity of the review process for timber operations, questions of law, or topics or concerns so remote or speculative that they could not be reasonably assessed or related to the outcome of a timber operation, have not been addressed.

Sincerely,

John Ramaley

John Ramaley, RPF #2504
Forester III
Cascade, Sierra & Southern Regions

cc: Unit Chief
RPF
Plan Submitter
Dept. of Fish & Wildlife, Reg. 1
Water Quality, Reg. 5
Public Comment Writers

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Summary of Review Process

Common Forest Practice Abbreviations

AB 32	Assembly Bill 32
ARB	Air Resources Board
BOF	Board of Forestry
CAA	Confidential Archaeological Addendum
CAL FIRE	Department of Forestry & Fire Protection
CAPCOA	Calif. Air Pollution Control Officers Assoc.
CCR	Calif. Code of Regulations
CDFW/DFW	California Dept. of Fish & Wildlife
CEQA	California Environmental Quality Act
CESA	California Endangered Species Act
CGS	California Geological Survey
CIA	Cumulative Impacts Assessment
CO_2	Carbon Dioxide
CO_2e	Carbon Dioxide equivalent
CSO	California Spotted Owl
DBH/dbh	Diameter Breast Height
DPR	Department of Pesticide Regulation
EPA	Environmental Protection Agency
FPA	Forest Practice Act
FPR	Forest Practice Rules
GHG	Greenhouse Gas
ha^{-1}	per hectare
LBM	Live Tree Biomass
LTO	Licensed Timber Operator
LTSY	Long Term Sustained Yield
m^{-2}	per square meter
MAI	Mean Annual Increment
MMBF	Million Board Feet
$MMTCO_2E$	Million Metric Tons CO_2 equivalent
NEP	Net Ecosystem Production
NEPA	National Environ. Policy Act
NMFS	National Marine Fisheries Service
NPP	Net Primary Production
NSO	Northern Spotted Owl
NTMP	NonIndust. Timb. Manag. Plan
OPR	Govrn's Office of Plan. & Res.
PCA	Pest Control Advisor
Pg	Petagram = 10^{15} grams
PHI	Pre-Harvest Inspection
PNW	Pacific NorthWest
PRC	Public Resources Code
RPA	Resource Plan. and Assess.
RPF	Registered Professional Forester
[SIC]	Word used verbatim as originally printed in another document
SPI	Sierra Pacific Industries
SYP	Sustained Yield Plan
tC	tonnes of carbon
Tg	Teragram = 10^{12} grams
THP	Timber Harvest Plan
TPZ	Timber Production Zone
USFS	United States Forest Service
USFWS	U.S. Fish & Wildlife Service
WAA	Watershed Assessment Area
WLPZ	Watercourse. & Lake Prot. Zone
WQ	California Regional Water Quality Control Board
yr^{-1}	per year

Notification Process

In order to notify the public of the proposed timber harvesting, and to ascertain whether there are any concerns with the plan, the following actions are automatically taken on each THP submitted to CAL FIRE:

- Notice of the timber operation is sent to all adjacent landowners if the boundary is within 300 feet of the proposed harvesting, (As per 14 CCR § 1032.7(e))
- Notice of the Plan is submitted to the county clerk for posting with the other environmental notices. (14 CCR § 1032.8(a))
- Notice of the plan is posted at the Department's local office and in Cascade Area office in Redding. (14 CCR § 1032))
- Notice is posted with the Secretary for Resources in Sacramento. (14 CCR § 1032.8(c))
- Notice of the THP is sent to those organizations and individuals on the Department's current list for notification of the plans in the county. (14 CCR § 1032.9(b))
- A notice of the proposed timber operation is posted at a conspicuous location on the public road nearest the plan site. (14 CCR § 1032.7(g))

Plan Review Process

The laws and regulations that govern the timber harvesting plan (THP) review process are found in Statute law in the form of the Forest Practice Act which is contained in the Public Resources Code (PRC), and Administrative law in the rules of the Board of Forestry (rules) which are contained in the California Code of Regulations (CCR).

The rules are lengthy in scope and detail and provide explicit instructions for permissible and prohibited actions that govern the conduct of timber operations in the field. The major categories covered by the rules include:

*THP contents and the THP review process
*Silvicultural methods
*Harvesting practices and erosion control
*Site preparation
*Watercourse and Lake Protection
*Hazard Reduction
*Fire Protection
*Forest insect and disease protection practices
*Logging roads and landing

When a THP is submitted to the California Department of Forestry and Fire Protection (CAL FIRE) a multidisciplinary review team conducts the first review team meeting to assess the THP. The review team normally consists of, but is not necessarily limited to, representatives of CAL FIRE, the Department of Fish and Game (DFW), and the Regional Water Quality Control Board (WQ). The California Geological Survey (CGS) also reviews THP's for indications of potential slope instability. The purpose of the first review team meeting is to assess the logging plan and determine on a preliminary basis whether it conforms to the rules of the Board of Forestry. Additionally, questions are formulated which are to be answered by a field inspection team.

Next, a preharvest inspection (PHI) is normally conducted to examine the THP area and the logging plan. All review team members may attend, as well as other experts and agency personnel whom CAL FIRE may request. As a result of the PHI, additional recommendations may be formulated to provide greater environmental protection.

After a PHI, a second review team meeting is conducted to examine the field inspection reports and to finalize any additional recommendations or changes in the THP. The review team transmits these recommendations to the RPF, who must respond to each one. The director's representative considers public comment, the adequacy of the registered professional forester's (RPF's) response, and the recommendations of the review team chair before reaching a decision to approve or deny a THP. If a THP is approved, logging may commence. The THP is valid for up to five years, and may be extended under special circumstances for a maximum of 2 years more for a total of 7 years.

Before commencing operations, the plan submitter must notify CAL FIRE. During operations, CAL FIRE periodically inspects the logging area for THP and rule compliance. The number of the inspections will depend upon the plan size, duration, complexity, regeneration method, and the potential for impacts. The contents of the THP and the rules provide the criteria CAL FIRE inspectors use to determine compliance. While CAL FIRE cannot guarantee that a violation will not occur, it is CAL FIRE's policy to pursue vigorously the prompt and positive enforcement of the Forest Practice Act, the forest practice rules, related laws and regulations, and environmental protection measures applying to timber operations on the timberlands of the State. This enforcement policy is directed primarily at preventing and deterring forest practice violations, and secondarily at prompt and appropriate correction of violations when they occur.

The general means of enforcement of the Forest Practice Act, forest practice rules, and the other related regulations range from the use of violation notices which may require corrective actions, to criminal proceedings through the court system. Civil, administrative civil penalty, Timber operator licensing, and RPF licensing actions can also be taken.

THP review and assessment is based on the assumption that there will be no violations that will adversely affect water quality or watershed values significantly. Most forest practice violations are correctable and CAL FIRE's enforcement program seeks to assure correction. Where non-correctable violations occur, civil or criminal action may be taken against the offender. Depending on the outcome of the case and the court in which the case is heard, some sort of supplemental environmental corrective work may be required. This is intended to offset non-correctable adverse impacts. Once a THP is completed, a completion report must be submitted certifying that the area meets the requirements of the rules. CAL FIRE inspects the completed area to verify that all the rules have been followed including erosion control work.

Depending on the silvicultural system used, the stocking standards of the rules must be met immediately or in certain cases within five years. A stocking report must be filed to certify that the requirements have been met. If the stocking standards have not been met, the area must be planted annually until it is restored. If the landowner fails to restock the land, CAL FIRE may hire a contractor to complete the work and seek recovery of the cost from the landowner.

General Discussion and Background

The following summary is provided for some of the over-arching concerns expressed in public comment. Specific issues raised within comments will be addressed in the next section.

Watersheds as the Focal Point for Cumulative Impacts Evaluation

Because they have defined boundaries and a single outlet, watersheds are an appropriate way to measure impacts to many resources (e.g. watershed, soil productivity) because these resources are bound primarily by the effects of gravity. For example: water flows downhill, landslides move down and not up slope such that upslope or resources in an adjacent watershed would not expect impacts. Most of the early environmental concerns rest upon the choice of assessment area and its appropriateness.

For other resources (e.g. recreation, noise, traffic, visual, fire hazard, greenhouse gas), the watershed boundary is not necessarily a limiting factor. For instance, deer and wolves move between watersheds easily and birds traverse large areas during their normal life cycle. Thus, it makes sense that some other delineation of assessment area for these specific resources would be used. While early THPs typically used the watershed boundary as the basis for evaluating all cumulative effects, contemporary analysis acknowledges the need for more refined boundaries, based upon the resource being evaluated. Even so, in some instances, areas such as the watershed (or multiple watersheds) are used to define the assessment area for resources such as fire hazard or greenhouse gas, because there is a requirement to have some defined boundary (e.g. carbon exchange occurs on a global scale but projects must evaluate site-specific impacts so a smaller area of evaluation is required in order to have a relevant analysis).

The Forest Practice Rules and Technical Rule Addendum #2 provide guidance in the determination of the size and shape of the assessment areas. 14 CCR §898 provides the general direction and reference to the evaluation of significant impacts and states:

> *"Cumulative impacts shall be assessed based upon the methodology described in Board Technical Rule Addendum Number 2, Forest Practice Cumulative Impacts Assessment Process and shall be guided by standards of practicality and reasonableness. The RPF's and plan submitter's duties under this section shall be limited to closely related past, present and reasonably foreseeable probable future projects within the same ownership and to matters of public record."*

Further, 14 CCR §897(b)(2) [Implementation of Act Intent] provides additional context for evaluating timber harvesting plans:

> *Individual THPs shall be considered in the context of the <u>larger forest and planning watershed</u> in which they are located, so that biological diversity and watershed integrity are maintained within larger planning units and adverse cumulative impacts, including impacts on the quality and beneficial uses of water are reduced.*

Although the Rules acknowledge that different assessment areas may be chosen based upon the resource under consideration, the designation of the planning watershed as an appropriate spatial scale is consistent with 14 CCR §15130(b)(1)(B)(3), which states that:

> *"Lead agencies should define the geographical scope of the area affected by the cumulative effect and provide a reasonable explanation for the geographic limitation used."*

There are, however, two different systems for classifying watersheds in California.

The CalWater System

The Natural Resource Conservation service established the nationwide classification of watersheds from 1992-1996 (Wikipedia, 2020). The California Resources Agency began a digitization project in 1993 based upon the Hydrologic Basin Planning Maps developed by the State Water Resources Control Board in 1986 (CAL FIRE, 2004). The state and federal systems in California were moved closer together over time, through multi-agency MOUs and integrated into the CalWater system, managed by the California Department of Water Resources (DWR). In 2017, DWR notified the original members of the MOU that going forward the National Hydrography Dataset (NHD) would be the new authoritative dataset (DWR, 2021). The CalWater 2.2.1 system is widely used in California, although the boundaries vary in some cases from the federal designations. Most notably, some watersheds in the Calwater system are broken up using administrative or political boundaries.

The California Forest Practice Rules first included a definition of "Watershed" in the 1992 Rules:

> ***planning watershed** means the contiguous land base and associated watershed system that forms a fourth order or other watershed typically 10,000 acres or less in size. Where a watershed exceeds 10,000 acres, the Director may approve subdividing into smaller planning watersheds which shall be a composite of contiguous lower order watersheds and areas draining into the main channel but not supporting a first order tributary. Smaller planning watersheds shall not be less than 3,000 acres nor exceed 10,000 acres in size as proposed by a plan submitter and approved by the Director. Plan submitters with approval of the director may allow a larger size planning watershed when 10,000 acres or less is not a logical planning unit, such as on the Eastside Sierra Pine type, as long as the size in excess of 10,000 acres is the smallest that is practical. Third order basins flowing directly into the ocean shall also be considered an appropriate planning watershed. This section will stay in effect until such time as the Director prepares and distributes maps identifying planning watersheds using the above criteria.*

The 1997 Rules were revised as follows:

> ***Planning Watershed** means the contiguous land base and associated watershed system that forms a fourth order or other watershed typically 10,000 acres or less in size. Planning watersheds are used in planning forest management and assessing impacts. The Director has prepared and distributed maps identifying planning watersheds plan submitters must use. Where a watershed exceeds 10,000 acres, the*

> *Director may approve subdividing it. Plan submitters may propose and use different planning watersheds, with the director's approval. Examples include but are not limited to the following: when 10,000 acres or less is not a logical planning unit, such as on the Eastside Sierra Pine type, as long as the size in excess of 10,000 acres is the smallest that is practical. Third order basins flowing directly into the ocean shall also be considered an appropriate planning watershed.*

Initially, plan preparers were directed to come up with their own watersheds, based upon the 10,000 acre target. The California Resources Agency (CRA) Department of Forestry and Fire Protection (CDF) contracted with Tierra Data Systems for the original digital production in 1993, based on Hydrologic Basin Planning Maps published in hardcopy (CAL FIRE, 2004). Once this was finished, it was distributed to RPFs for use in plans. The system was then maintained by an interagency group called the "California Interagency Watershed Mapping Committee". Changes were made to boundaries and information over time, with the newest changes made in 2004 (version 2.2.1).

The CalWater system is broken down into 6 categories:

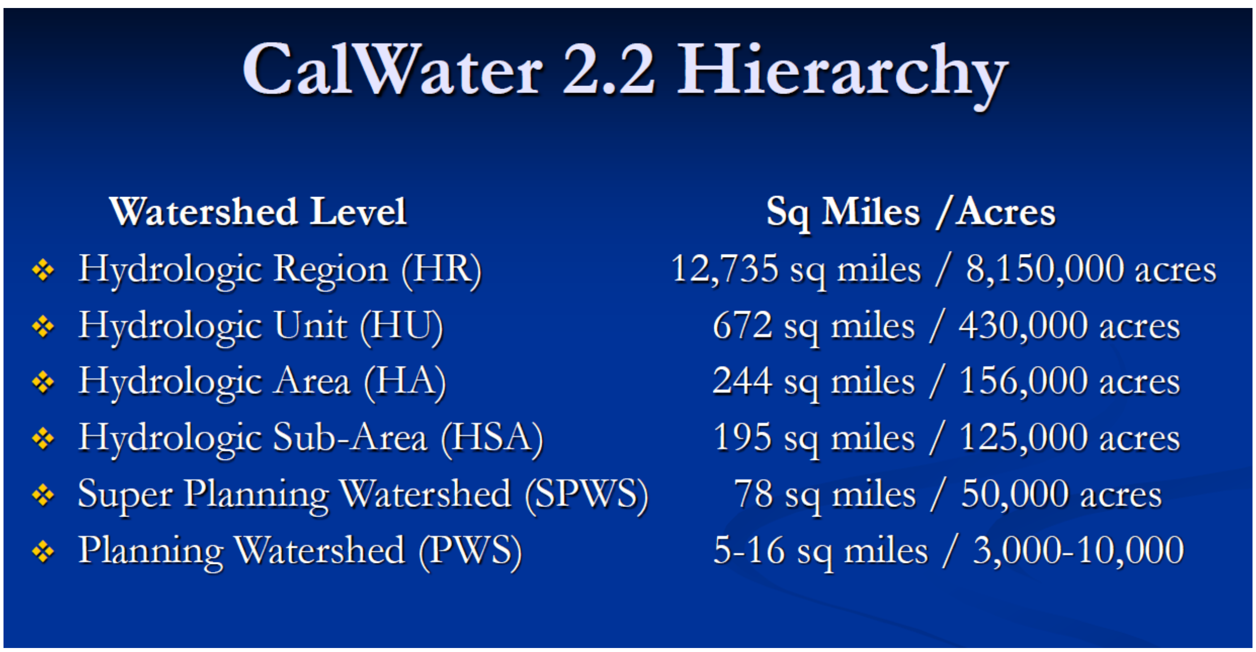


Figure 1 CalWater 2.2.1 Hierarchy (Meyers, 2004)

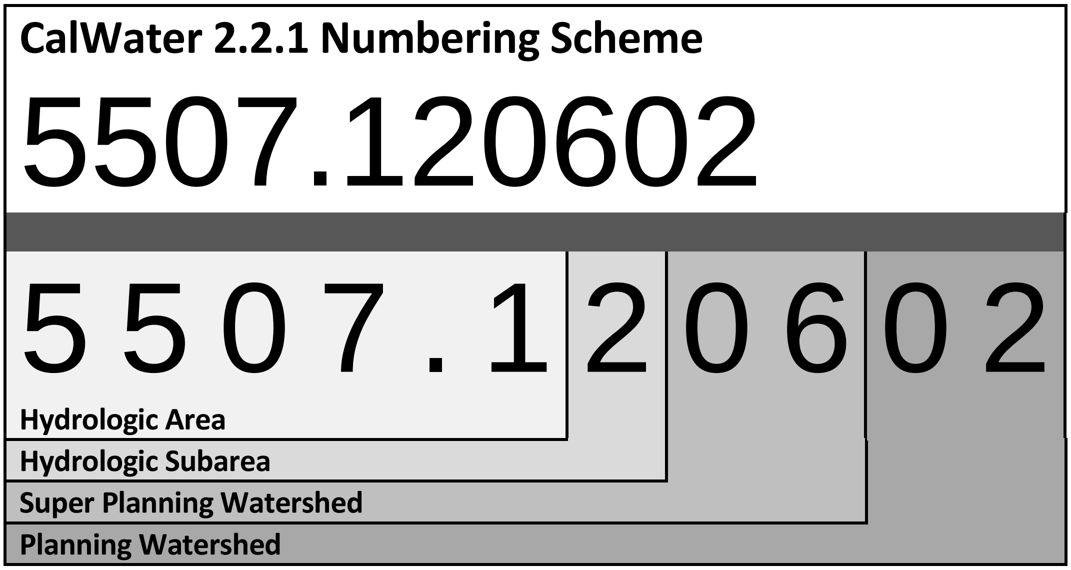
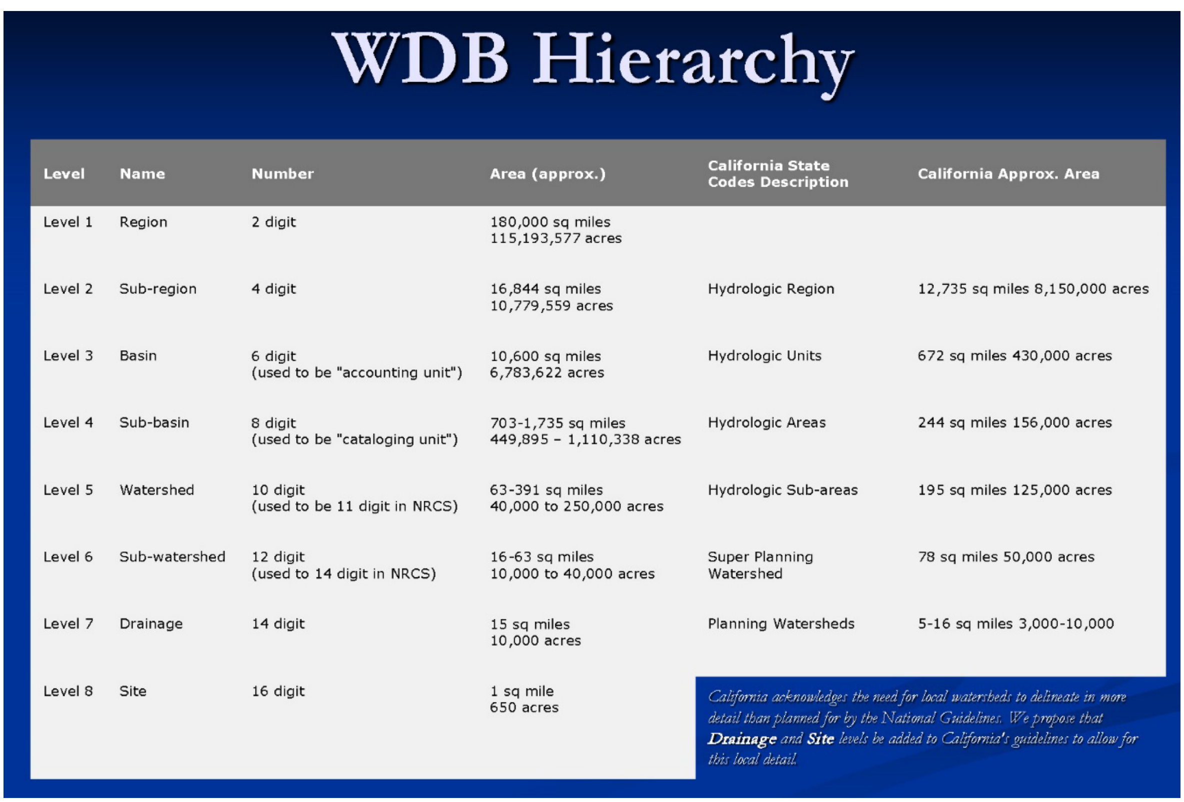


Figure 2 A breakdown of the CalWater 2.2.1 numbering scheme

The Federal Hydrologic Unit Maps (HUC)

Initially begun in 1978 by the USGS, this is an ongoing project to designate all hydrologic units in the US (USGS, 2020). In 1999, a multi-agency MOU was formed between state and federal agencies to bring the CalWater system into compliance with the federal model. There are still differences between the watershed boundaries established by both systems, but both represent logical approaches to watershed delineation that are widely used for assessment purposes.


WDB Hierarchy

Level	Name	Number	Area (approx.)	California State Codes Description	California Approx. Area
Level 1	Region	2 digit	180,000 sq miles 115,193,577 acres		
Level 2	Sub-region	4 digit	16,844 sq miles 10,779,559 acres	Hydrologic Region	12,735 sq miles 8,150,000 acres
Level 3	Basin	6 digit (used to be "accounting unit")	10,600 sq miles 6,783,622 acres	Hydrologic Units	672 sq miles 430,000 acres
Level 4	Sub-basin	8 digit (used to be "cataloging unit")	703-1,735 sq miles 449,895 – 1,110,338 acres	Hydrologic Areas	244 sq miles 156,000 acres
Level 5	Watershed	10 digit (used to be 11 digit in NRCS)	63-391 sq miles 40,000 to 250,000 acres	Hydrologic Sub-areas	195 sq miles 125,000 acres
Level 6	Sub-watershed	12 digit (used to 14 digit in NRCS)	16-63 sq miles 10,000 to 40,000 acres	Super Planning Watershed	78 sq miles 50,000 acres
Level 7	Drainage	14 digit	15 sq miles 10,000 acres	Planning Watersheds	5-16 sq miles 3,000-10,000
Level 8	Site	16 digit	1 sq mile 650 acres		

*California acknowledges the need for local watersheds to delineate in more detail than planned for by the National Guidelines. We propose that **Drainage** and **Site** levels be added to California's guidelines to allow for this local detail.*

Figure 3 Federal Watershed Boundary Hierarchy (Meyers, 2004)

Differences Between Federal & CalWater Systems in Battle Creek

Within the context of the "Battle Creek" watershed, the differences between the two systems become more apparent.

Battle Creek Hydrologic Unit Designations [CalWater]

Hydrologic Area #	Hydrologic Area Name	Hydrologic Sub Area #	Hydrologic Sub Area Name	Super Planning Watershed #	SPWS Name	PWS #	PWS Name	Acres
55071	Manton							225,724
		550712	Battle Creek					222,368
				55071201	Manzanita Creek			38,539
						5507.1201	Bridges Creek	5,812
						5507.1201	Lower Manzanita Creek	9,977
						5507.1201	Upper Manzanita Creek	11,480
						5507.1201	Upper Battle Creek	11,270
				55071202	Long Hay Flat			48,038
						5507.1202	Bailey Creek	13,671
						5507.1202	Canyon Creek	15,360
						5507.1202	Bear Creek	11,347
						5507.1202	Blue Lake Canyon	7,660
				55071203	Millseat Creek			7,149
						5507.1203	Millseat Creek	7,149
				55071204	Digger Creek			27,130
						5507.1204	Lower Digger Creek	13,902
						5507.1204	Upper Digger Creek	13,228
				55071205	Battle Creek Meadows			23,751
						5507.1205	Martin Creek	7,612
						5507.1205	Cold Creek	7,840
						5507.1205	Nanny Creek	8,298
				55071206	Snoqualmie Gulch			18,926
						5507.1206	Grapevine Spring	7,929
						5507.1206	Panther Creek	10,997
				55071207	Union Canal			22,349
						5507.1207	Ripley Creek	12,032
						5507.1207	Soap Creek	10,317
				55071208	Lanes Valley			36,486
						5507.1208	Spring Gardens	6,398
						5507.1208	Baldwin Creek	8,868
						5507.1208	Morgan Creek	11,906
						5507.1208	Upper Spring Branch	9,312

Figure 4 CalWater 2.2 Watersheds of the Battle Creek HSA

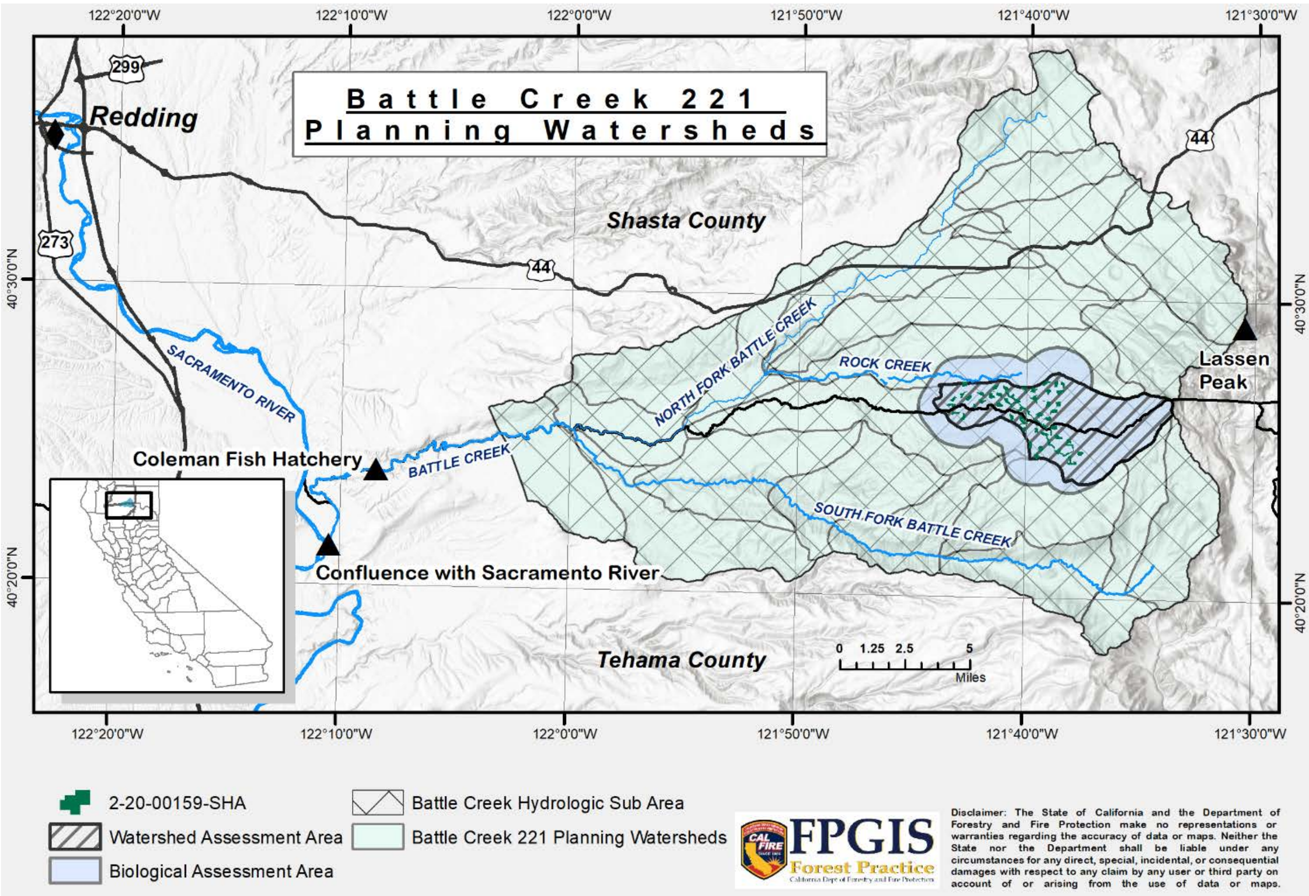


Figure 5 CalWater 2.2 Watersheds of the Battle Creek HSA

Battle Creek Hydrologic Unit Designations [Federal]

HUC8	HUC 8 Name	HUC10	HUC 10 Name	HUC 12	HUC 12 Name	Acres
18020153	Battle Creek					236,367
		1802015302	South Fork Battle Creek			76,687
				180201530201	Panther Creek	10,926
				180201530203	Morgan Creek	10,125
				180201530204	Lower South Fork Battle Creek	31,793
				180201530202	Upper South Fork Battle Creek	23,842
		1802015303	Battle Creek			35,351
				180201530301	Baldwin Creek	11,735
				180201530302	Spring Branch-Battle Creek	23,616
		1802015301	North Fork Battle Creek			124,329
				180201530106	Millseat Creek-North Fork Battle Creek	19,287
				180201530101	Deer Creek	22,245
				180201530104	Bailey Creek	20,752
				180201530102	Bridges Creek-North Fork Battle Creek	20,513
				180201530105	Digger Creek	26,805
				180201530103	Rock Creek	14,727

Figure 6 Battle Creek HUC 8 and Subwatersheds

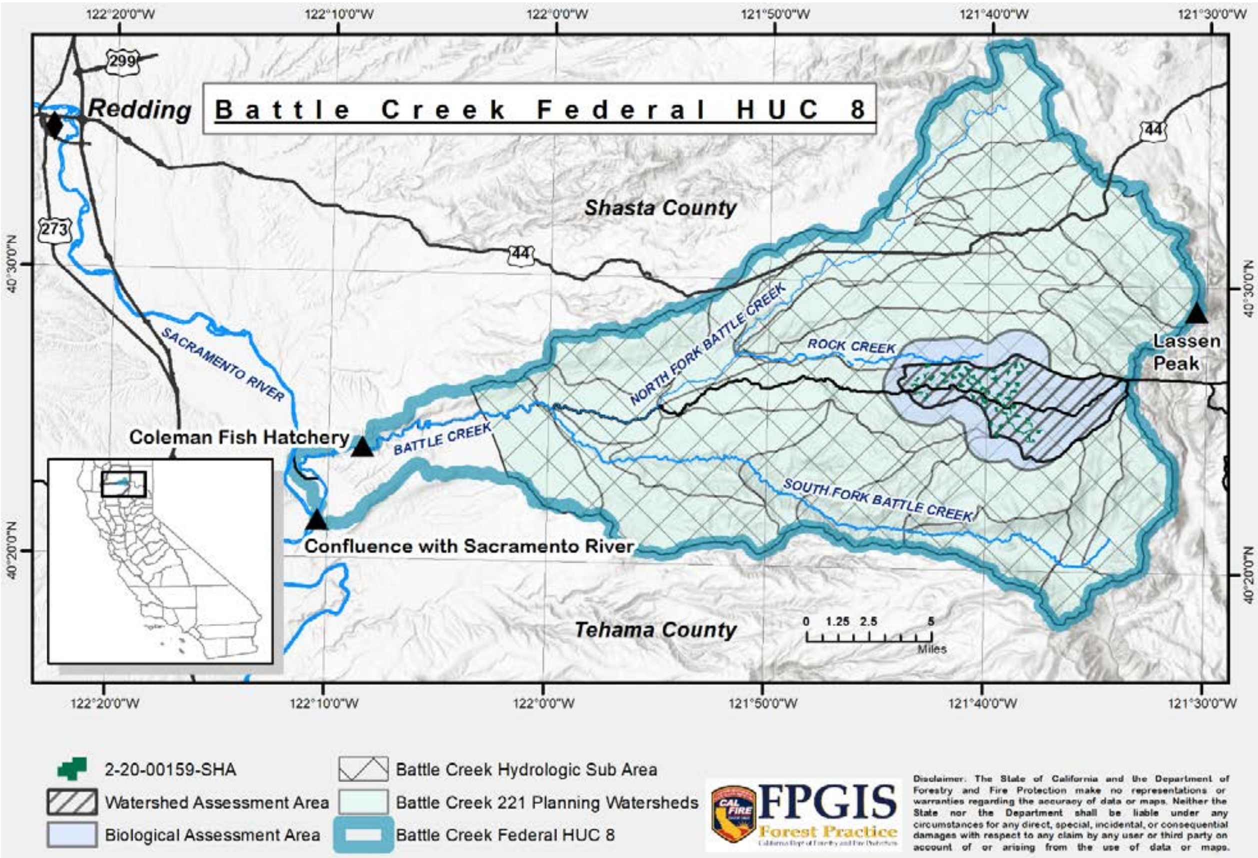


Figure 7 Battle Creek HUC 8 Watershed

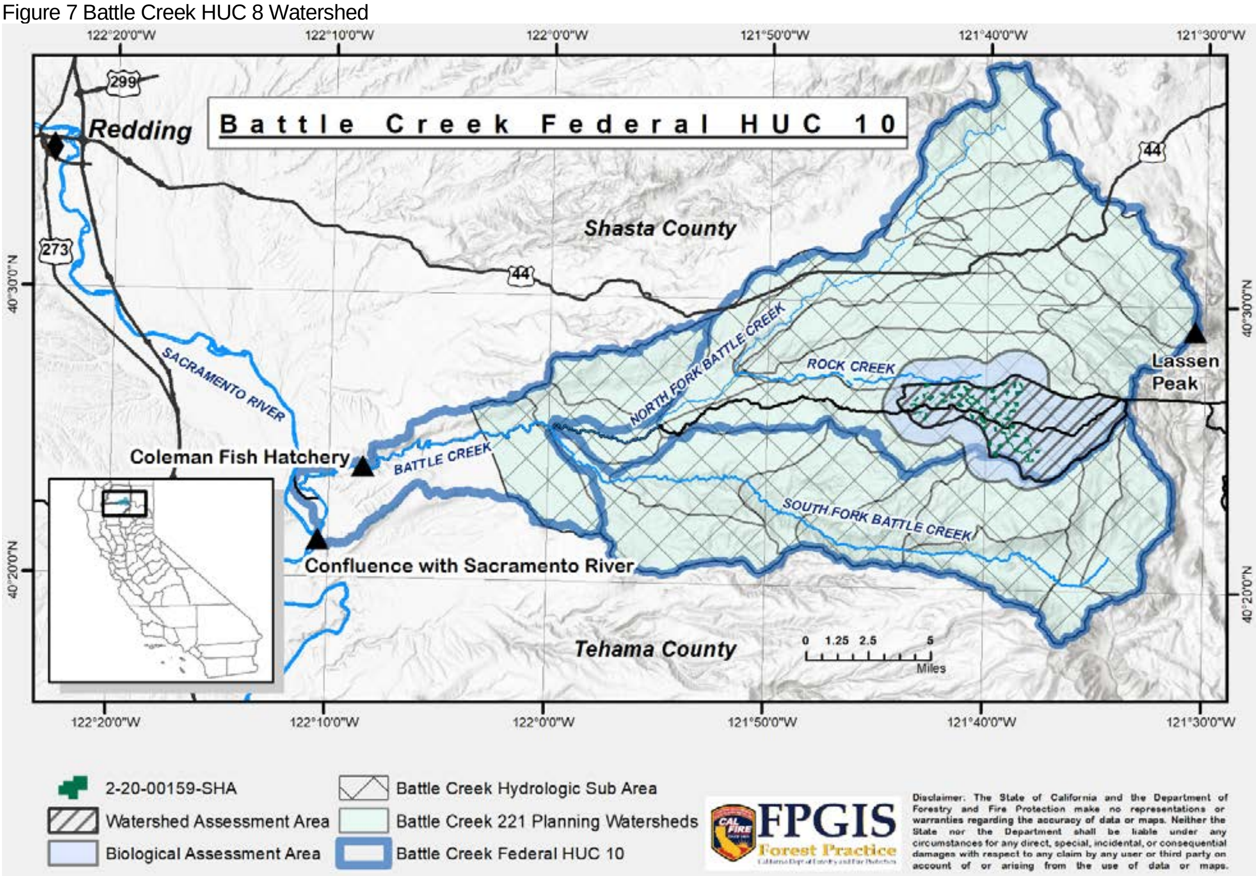


Figure 8 Battle Creek HUC 10 Watersheds

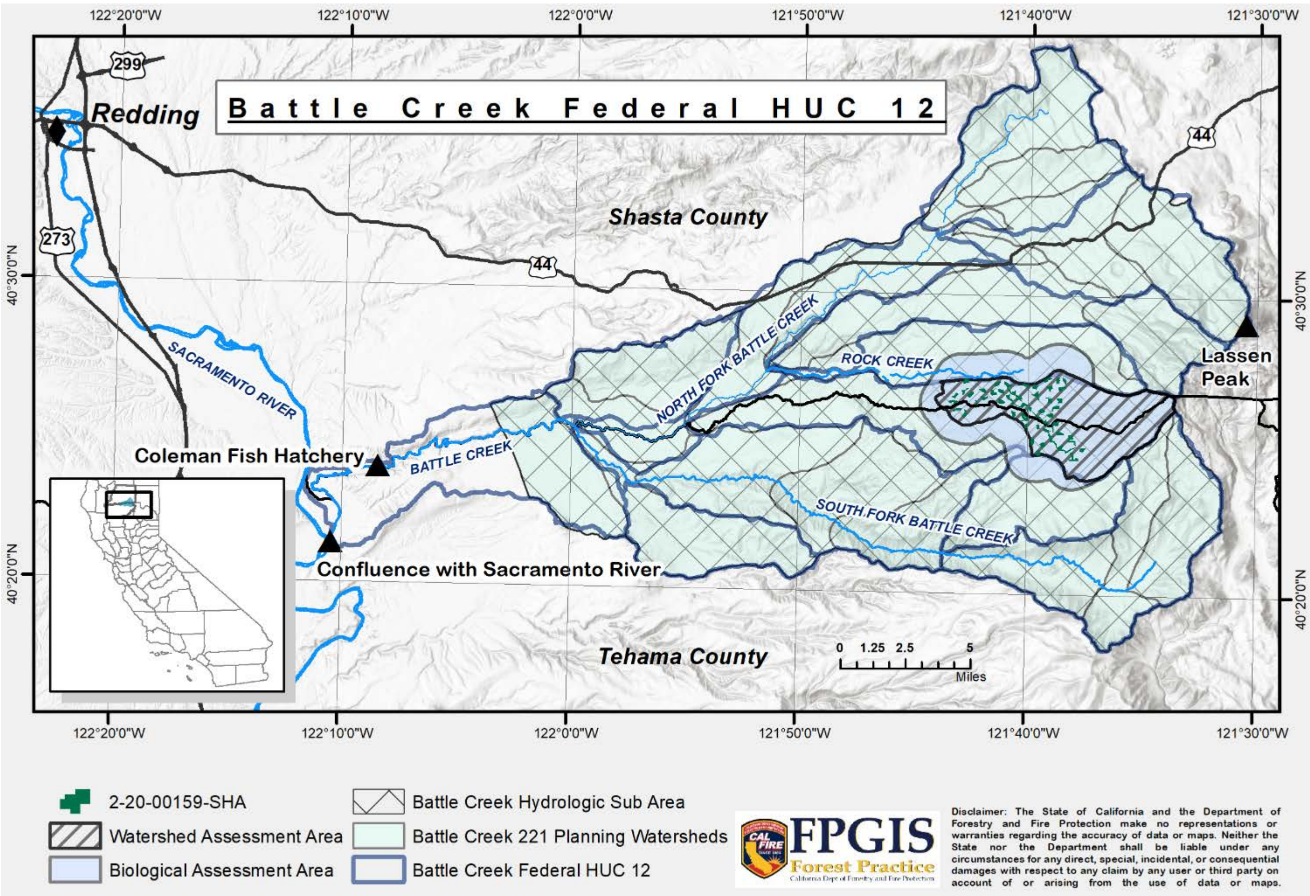


Figure 9 Battle Creek HUC 12 Watersheds

The use of CalWater Planning Watersheds (14 CCR §895.1) is an accepted method for determining the impacts of proposed timber operations on Watershed Resources. The rationale is that all impacts from the proposed operation will only be seen within the area that is drained by that watershed, and areas downstream of that watershed. Areas that do not receive drainage from the watershed (i.e. adjacent or upstream watersheds), would not be impacted.

Planning watersheds are defined in 14 CCR §895.1 as:

> *"the contiguous land base and associated watershed system that forms a fourth order or other watershed typically 10,000 acres or less in size. Planning watersheds are used in planning forest management and assessing impacts. The Director has prepared and distributed maps identifying planning watersheds plan submitters must use. Where a watershed exceeds 10,000 acres, the Director may approve subdividing it. Plan submitters may propose and use different planning watersheds, with the Director's approval."*

The methodology used in the Board's rules to determine the size of the Watershed Assessment Area (WAA) was clarified by a letter to all RPFs and LTOs from the Director on January 7, 1992. This letter states on page 4 that:

> *The watershed assessment area for assessing cumulative watershed effects (CWEs) should be selected to include an area of manageable size relative to the THP (usually an order 3 or 4 watershed) that maximizes the opportunity to detect an impact. Where there is a choice of*

> *combining watersheds with different disturbance levels, the assessment area should be based on the smallest watershed area that includes the most disturbances. The intent is to focus on an area of manageable size, where the presence of cumulative effects related to the proposed project and the benefits or failings of the proposed practices can be reasonably considered.* (CAL FIRE, 1992)

The size of the assessment area quoted in the letter above is supported in the Board rules described in 14 CCR § 897(b)(2) and in the definition for "Planning Watershed" found in 14 CCR §895.1. The size of the watershed assessment area found in these regulations is a recommended third or fourth order watershed size, and therefore, the letter from the Director is consistent with the regulations of the Board.

Watersheds may also be used as the basis for other assessment areas. The California Forest Carbon Plan (Forest Climate Action Team, 2018) discusses using watersheds as the basis for Greenhouse Gas emission and sequestration assessments:

> *The watershed level has proven to be an appropriate organizing unit for analysis and for the coordination and integrated management of the numerous physical, chemical, and biological processes that make up a watershed ecosystem. Similarly, a watershed can serve as an appropriate reference unit for the policies, actions, and processes that affect the biophysical system, and providing a basis for greater integration and collaboration. Forests and related climate mitigation and adaptation issues operate across these same biophysical, institutional, and social gradients.*
>
> *Because of these factors, the Forest Carbon Plan proposes working regionally at the landscape or watershed scale. The appropriate scale of a landscape or watershed to work at will vary greatly depending upon the specific biophysical conditions, land ownership or management patterns, and other social or institutional conditions.*

However, it should be noted that the detailed analysis for the Watershed Assessment Area selected by the RPF does not limit CAL FIRE with respect to consideration of other activities outside the assessment area. The watershed assessment area is more like a window which CAL FIRE can see through to view the combined effects of other related projects, rather than a wall or barrier. CAL FIRE recognizes that environmental elements cannot be truly and completely separated one from another. It is the limitations of analytical processes that require infinitely complex systems to be subdivided into reasonably manageable components.

Further, the RPF is expected to explain and justify the rationale for the chosen assessment area. CAL FIRE must then review this rationale and either accept or reject the defined assessment areas. This occurs with every THP reviewed.

The Board's rules do not require a specific method of cumulative impacts assessment, because the Board determined that no single, available procedure adequately addresses the wide range of site conditions and THP activities found in California. Technical Rule Addendum No. 2, provides the framework of what should be considered and what to look for with respect to conditions that may be at or near some level of concern. As stated in the Addendum, *"The watershed impacts of past upstream and on-site projects are often reflected in the condition of stream channels on the project area."* This is a critical element as it guides the RPF to focus on areas where cumulative watershed effects are known to accumulate. The Addendum then describes factors that can be used to evaluate the potential project impacts. Such factors include gravel embeddedness, pool filling, stream aggrading, bank cutting, bank mass wasting, downcutting, scouring, organic debris, stream-side vegetation, and recent floods. Taken together, they help inform the RPF about the status of the Environmental Setting (14 CCR §15125[1]) with respect to the impacts of past projects, and will form the basis of a determination on the impacts of the proposed project.

Assessment Area Size and Appropriateness

There exists a fundamental disagreement between the Plan Submitter and the concern writer relative to the size of areas that are appropriate for the evaluation of Cumulative Impacts. This disagreement cannot be understated, as it forms the basis upon which many of the comments rest. Without understanding this, the outside observer can become confused about the issues, as they are discussed from each side's perspective.

[1] **15125. ENVIRONMENTAL SETTING**
(a) An EIR must include a description of the physical environmental conditions in the vicinity of the project. This environmental setting will normally constitute the baseline physical conditions by which a lead agency determines whether an impact is significant. The description of the environmental setting shall be no longer than is necessary to provide an understanding of the significant effects of the proposed project and its alternatives. The purpose of this requirement is to give the public and decision makers the most accurate and understandable picture practically possible of the project's likely near-term and long-term impacts.
(1) Generally, the lead agency should describe physical environmental conditions as they exist at the time the notice of preparation is published, or if no notice of preparation is published, at the time environmental analysis is commenced, from both a local and regional perspective. Where existing conditions change or fluctuate over time, and where necessary to provide the most accurate picture practically possible of the project's impacts, a lead agency may define existing conditions by referencing historic conditions, or conditions expected when the project becomes operational, or both, that are supported with substantial evidence. In addition, a lead agency may also use baselines consisting of both existing conditions and projected future conditions that are supported by reliable projections based on substantial evidence in the record.
(2) A lead agency may use projected future conditions (beyond the date of project operations) baseline as the sole baseline for analysis o.nly if it demonstrates with substantial evidence that use of existing conditions would be either misleading or without informative value to decision-makers and the public. Use of projected future conditions as the only baseline must be supported by reliable projections based on substantial evidence in the record.
(3) An existing conditions baseline shall not include hypothetical conditions, such as those that might be allowed, but have never actually occurred, under existing permits or plans, as the baseline.
(b) When preparing an EIR for a plan for the reuse of a military base, lead agencies should refer to the special application of the principle of baseline conditions for determining significant impacts contained in Section 15229.
(c) Knowledge of the regional setting is critical to the assessment of environmental impacts. Special emphasis should be placed on environmental resources that are rare or unique to that region and would be affected by the project. The EIR must demonstrate that the significant environmental impacts of the proposed project were adequately investigated and discussed and it must permit the significant effects of the project to be considered in the full environmental context.
(d) The EIR shall discuss any inconsistencies between the proposed project and applicable general plans, specific plans, and regional plans. Such regional plans include, but are not limited to, the applicable air quality attainment or maintenance plan or State Implementation Plan, area-wide waste treatment and water quality control plans, regional transportation plans, regional housing allocation plans, regional blueprint plans, plans for the reduction of greenhouse gas emissions, habitat conservation plans, natural community conservation plans and regional land use plans for the protection of the Coastal Zone, Lake Tahoe Basin, San Francisco Bay, and Santa Monica Mountains.
(e) Where a proposed project is compared with an adopted plan, the analysis shall examine the existing physical conditions at the time the notice of preparation is published, or if no notice of preparation is published, at the time environmental analysis is commenced as well as the potential future conditions discussed in the plan.

The Battle Creek Alliance believes that the appropriate scale for the evaluation of cumulative effects is what they call the “Battle Creek watershed”. This area comprises roughly 236,800 acres and runs from the Sacramento River in the West to Lassen Peak in the East, and is roughly bounded by State Highway 44 and 36 to the North and South, respectively.

The RPF has designated the Upper Digger Creek CalWater 2.2.1 planning watershed (15,352 acres) as her Watershed Assessment Area (WAA) (see page 169) (Also Figures 5 & 7). Further, she designated the area contained within the WAA, plus any additional areas within 1 mile of the THP boundary, as the Biological Assessment Area (BAA) for the plan. A rationale for this assessment areas was provided on page 169. Additional areas were defined for the Soil Productivity, Recreational, Visual, Traffic, Wildfire and GHG Assessment Areas. CAL FIRE determined these areas to be acceptable.

It is important to point out that the impacts analysis for the proposed THP are conducted within the context of the defined assessment areas. The comment writers point out what they believe to be serious omissions on the part of the RPF with respect to the cumulative impacts analysis. However, the RPF was not required to evaluate these as they fall outside of the defined assessment areas, although they could be discussed at her discretion.

Because the RPF chose a smaller area within which to evaluate impacts, the watershed related impacts are limited to this area. Concern letters note that by splitting up the larger areas into smaller ones, cumulative impacts could be obscured. The argument being that small, insignificant changes within this smaller area would combine with other small impacts to create a significant cumulative effect. This is, in fact, the very definition as contained in CEQA[2].

Indeed, if there were individual, unmitigated impacts occurring as a result of an individual project within a smaller assessment area, then concerns about potential downstream impacts becomes germane. Because individual THPs are designed (and revised during review) to eliminate potential impacts to below the level of significance, there is no reason to believe that a downstream impact would occur. The Forest Practice Rules have been designed to result in no impacts to natural resources, and the interdisciplinary site-specific review of plans is conducted in order to determine additional measures which are necessary to achieve this goal. Once this goal has been achieved, it is not necessary to conduct additional evaluations of these proposals. [3]

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[2] **15355. Cumulative Impacts**

"Cumulative impacts" refers to two or more individual effects which, when considered together, are considerable or which compound or increase other environmental impacts.

(a) The individual effects may be changes resulting from a single project or a number of separate projects.

(b) The cumulative impact from several projects is the change in the environment which results from the incremental impact of the project when added to other closely related past, present, and reasonably foreseeable probable future projects. Cumulative impacts can result from individually minor but collectively significant projects taking place over a period of time.

Note: Authority cited: Section 21083, Public Resources Code; Reference: Section 21083(b), Public Resources Code; *Whitman v. Board of Supervisors*, 88 Cal. App. 3d 397, *San Franciscans for Reasonable Growth v. City and County of San Francisco* (1984) 151 Cal. App. 3d 61, Formerly Section 15023.5.

Discussion: The definition of the term "cumulative impacts" is provided because the term is related to one of the mandatory findings of significant effect required by Section 21083. A common understanding of the term is needed in order to implement the section. Further, this definition is needed to codify the court rulings in *Whitman v. Board of Supervisors* and *San Franciscans for Reasonable Growth v. City and County of San Francisco*.

[3] **15145. Speculation**

As a result, CAL FIRE does not agree with the comment writer that the "Battle Creek Watershed" is the required scale at which Cumulative Impacts must be evaluated. Rather, CAL FIRE believes that the guidance established by the Board is a valid methodology for assessing impacts. It is not the only assessment area that could have been chosen, but CAL FIRE has determined it to be adequate to evaluate the potential cumulative impacts that could result from the proposed project when combined with other past, present and reasonably foreseeable future projects.

Assessment at the Scale of the "Battle Creek" Watershed

The comment letters argue that the appropriate scale for evaluation is the Battle Creek Hydrologic Subarea (HSA)[4]. At this scale, they contend, the impacts to the "Battle Creek" watershed can be fully understood and evaluated. That by relying on a much smaller scale, SPI and CAL FIRE are intentionally ignoring or obscuring significant adverse impacts that would otherwise require mitigations. Remarkably, their chosen assessment area does not include the lower 11 miles of the main stem of Battle Creek (See Figure 10 below). These lower reaches, where the Coleman National Fish Hatchery is located, are referenced as having impacts, yet would not be included in the assessment area they want SPI to use.

If, after thorough investigation, a Lead Agency finds that a particular impact is too speculative for evaluation, the agency should note its conclusion and terminate discussion of the impact.

Note: Authority cited: Section 21083, Public Resources Code; Reference: Sections 21003, 21061, and 21100, Public Resources Code; Topanga Beach Renters Association v. Department of General Services, (1976) 58 Cal. App. 3d 712.

Discussion: This section deals with a difficulty in forecasting where a thorough investigation is unable to resolve an issue and the answer remains purely speculative. This section is necessary to relieve the Lead Agency from a requirement to engage in idle speculation. Once an agency finds that a particular effect is too speculative for evaluation, discussion of that effect should be terminated. This section provides authority to do so.

In Laurel Heights Improvement Association v. Regents of the University of California (1988) 47 Cal. 3d 376, the court noted that where future development is unspecified and uncertain, no purpose can be served by requiring an EIR to engage in sheer speculation as to future environmental consequences.

[4] See, for example, Page 4 of the March 5, 2021 comment letter.

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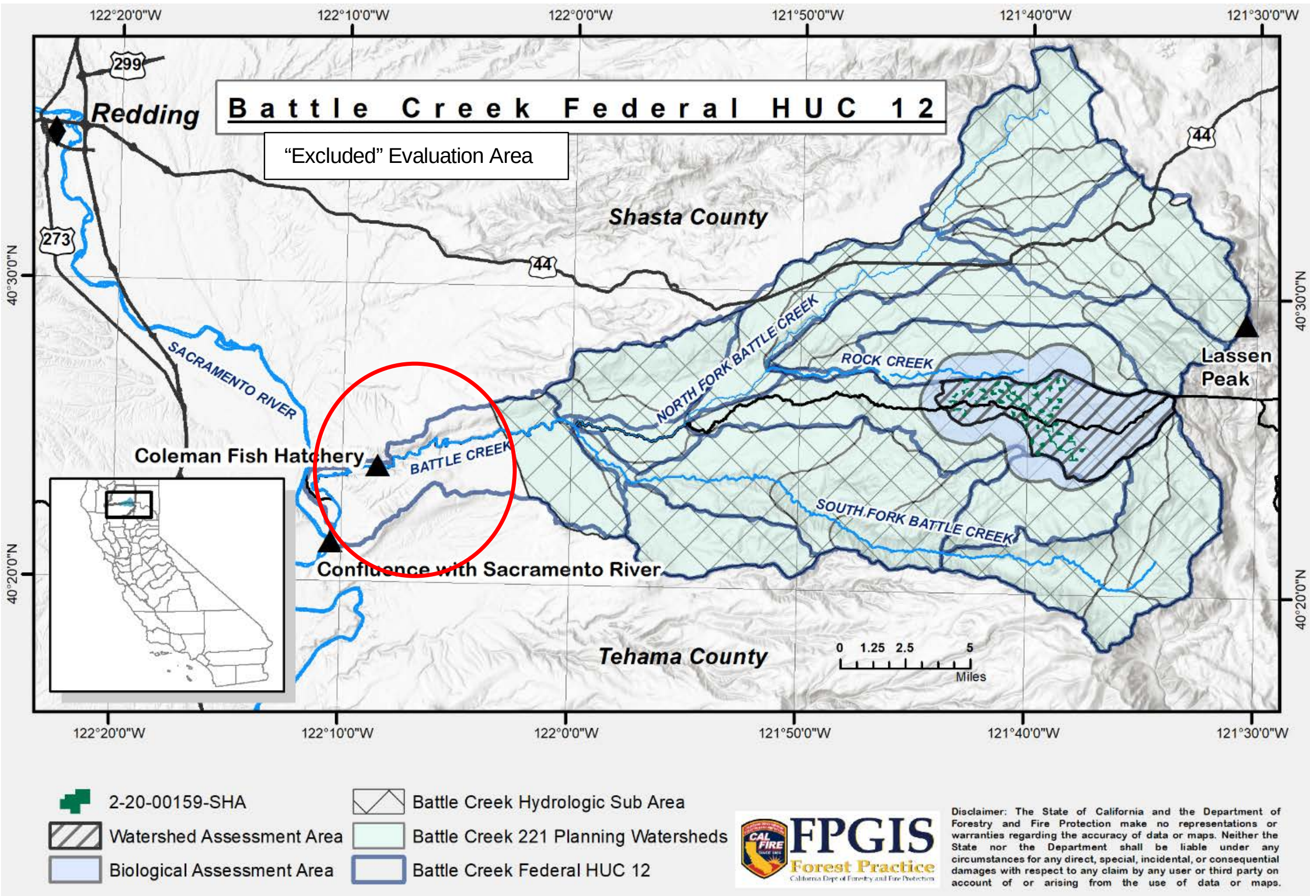

Figure 10. Comparison of the THP assessment areas, the Battle Creek HSA and the area not included in comments preferred assessment area.

When you examine both the Federal and State watershed delineations, the federal HUC 8 "Battle Creek" seems like the most appropriate boundary for examining all impacts to the main stem of Battle Creek (see Figure 10 above, where the Battle Creek HUC 8 is made up of all the HUC 12 watersheds shown).

Neither SPI nor BCA chose this area, although it could be argued that this is the best possible choice if you wanted to assess the entire "Battle Creek watershed". Ultimately, the RPF has the discretion to choose and justify the chosen assessment area. Furthermore, the chosen assessment area is based upon distinct hydrologic units that have been designated and refined by state and federal agencies since 1992. So, if the goal was to evaluate the entire "Battle Creek" watershed, not even the comment writers preferred area appears appropriate. This, of course, was not the Plan Submitters intent and CAL FIRE has determined that the chosen assessment area was adequate to evaluate impacts.[5]

[5] ref. 14 CCR §15151: *"The courts have looked not for perfection but for adequacy, completeness, and a good faith effort at full disclosure."*

Why Limiting Assessment Area Size is a Critical and Required Element

The assessment area chosen to evaluate cumulative effects must end at some point. The standard that CAL FIRE must use for evaluating is not if it the "best" assessment area was selected, but rather if it is reasonable to evaluate impacts from the proposed plan. The goal is to define an assessment area small enough to detect impacts but not so small that impacts are exaggerated.

Regulations pertaining to sizing of assessment areas:

14 CCR §895.1
Planning Watershed *means the contiguous land base and associated watershed system that forms a fourth order or other watershed typically 10,000 acres or less in size. Planning watersheds are used in planning forest management and assessing Impacts. The Director has prepared and distributed maps identifying planning watersheds plan submitters must use. Where a watershed exceeds 10,000 acres, the Director may approve subdividing it. Plan submitters may propose and use different planning watersheds, with the Director's approval. Examples include but are not limited to the following: when 10,000 acres or less is not a logical planning unit, such as on the Eastside Sierra Pine type, as long as the size in excess of 10,000 acres is the smallest that is practical. Third order basins flowing directly into the ocean shall also be considered an appropriate planning watershed.*

14 CCR §898 Feasibility Alternatives
After considering the Rules of the Board and any mitigation measures proposed in the plan, the RPF shall indicate whether the operation would have any significant adverse Impact on the environment. On TPZ lands, the harvesting per se of trees shall not be presumed to have a significant adverse Impact on the environment. If the RPF indicates that significant adverse Impacts will occur, the RPF shall explain in the plan why any alternatives or additional mitigation measures that would significantly reduce the Impact are not feasible.

Cumulative Impacts shall be assessed based upon the methodology described in Board Technical Rule Addendum Number 2, Forest Practice Cumulative Impacts Assessment Process and shall be guided by standards of practicality and reasonableness. The RPF's and plan submitter's duties under this section shall be limited to closely related past, present and Reasonably Foreseeable Probable Future Projects within the same ownership and to matters of public record. The Director shall supplement the information provided by the RPF and the plan submitter when necessary to ensure that all relevant information is considered.

Technical Rule Addendum #2
B. Identification of Assessment Areas
The RPF shall establish and briefly describe the assessment area within or surrounding the Plan for each resource subject and shall briefly explain the rationale for establishing the resource area. This shall be a narrative description and each established assessment area shall be shown on a map when a map adds clarity.

CAL FIRE released guidelines for conducting a cumulative impacts analysis which provides additional insight relative to the sizing of assessment areas:

1994 CIA Guidelines (CAL FIRE, 1994)

A. Biological Resource Inventory

The biological assessment area will vary with the species being evaluated and its habitat requirements. In addition, more than one species may be evaluated and the assessment area may be different for each species.

Part B. Watershed Assessment Area
The watershed resources assessment area for this analysis should be selected to include an area of manageable size relative to the THP (usually an order 3 or 4 watershed) that maximizes the opportunity to detect an impact. Where there is a choice of combining watersheds with different disturbance levels, the assessment area should be based on the smallest area that includes the more disturbed watershed. For example, the assessment area for a THP located in a heavily logged watershed that combines with a stream from a relatively undisturbed watershed should not include the less disturbed watershed. In contrast, where logging is planned in a relatively undisturbed watershed that combines with a more disturbed drainage, both watersheds should be included in the assessment area.

Where first and second order streams flow directly into order five or larger streams, the watershed assessment area may be limited to the watershed of the order one or two streams and the channel of the larger stream adjacent to these watersheds. When the plan area includes an area that drains into a large river (5th order or greater), but does not support even a first order tributary for an assessment area (generally called "face" areas, as opposed to tributary basins), the plan alone will be considered as the CWE assessment area, since these areas do not concentrate runoff that could export watershed products such as sediment or heat. The CWE assessment area must always include, at the very minimum, the entire THP area.

This criteria is intended to focus the assessment on an area of manageable size, where the presence of cumulative impacts related to the proposed project and the benefits or failings of proposed mitigation measures can be reasonably considered.

Significant cumulative watershed impacts on identified beneficial uses that are known to occur at locations downstream from the assessment area must also be addressed, but do not enter into the assessment of project conditions.

In the case of this THP, the chosen Watershed Assessment Area did not include downstream areas containing more of the Ponderosa Fire burn. By limiting the area impacted by the Ponderosa Fire to just the area contained within the chosen assessment area, the environmental baseline is more consistent than it would if the larger fire area was included. Using this smaller area allows for the detection of impacts that would not be possible if the larger area disturbed by the Ponderosa Fire was included.

Another standard that is referenced within the rules relative to the evaluation of cumulative effects is "Practicality and reasonableness." [6]

In the Board of Forestry Rulemaking files, section 1037.5(g)(3) is repeatedly referenced when discussing "Practicality and reasonableness" of requests for additional information from the Plan Submitter:

> *Requests, if any, for additional information, from the plan submitter during the review period shall be as prescribed by Section 1034 and other conditions in the Rules. Such requests shall be supported by reasons for the request. During the review period, the Director shall be responsible for determining whether requests for information not contained in the plan as filed or developed in preharvest inspection by review team members, reviewing agencies and members of the public, are consistent with the Forest Practice Rules, are reasonably necessary and should be requested from plan submitters. The Director's determination of additional information to be provided by plan submitters shall be guided by standards of practicality and reasonableness, recognizing the statutory review period s of 14 CCR 1034 and the availability of information from alternative sources.*

Based upon this section, in order for CAL FIRE to request additional information from the Plan Submitter, the following is required:

1. The request must be substantiated.
2. CAL FIRE must concur with the request.
3. The statutory timeframes for review must be considered when making the request.

For the evaluation of cumulative effects, the Board uses the same concept as described in the CEQA Guidelines (See 14 CCR §15130 under discussion of "CEQA Analysis")

Ultimately, expanding the size and scope of an assessment area is a double-edged sword: You include the potential for consideration of more past activities, but you dilute the impacts of the proposed project. As has been expressed using other words, you cannot say to the waters of Battle Creek, "At this point, you cease to be Battle Creek and become the Sacramento River." The water does not care about our human compulsion to classify and subdivide. One could argue that the proper scale upon which to assess impacts to Salmonids is the entire Sacramento River Hydrologic Region of 17,406,872 acres. However, at that point it flows into the San Francisco Bay and into the Pacific Ocean. This entire area effects the survivability and health of salmonids. How can one ignore the prey and environmental impacts of juveniles in the Sacramento River system, or the predation they face from harbor seals as they move into the ocean, or the impact of variable ocean temperatures or commercial fishing? We must because the ability to assess impacts becomes impossibly complex at large scales and, most importantly, the impacts of the individual project become undetectable. If the Plan Submitter was to choose such a large area for evaluation, it would not meet the standards for a reasonable analysis.

[6] "...Cumulative Impacts shall be assessed based upon the methodology described in Board Technical Rule Addendum Number 2, Forest Practice Cumulative Impacts Assessment Process and shall be guided by standards of practicality and reasonableness."

It is also valuable to point out that if the entire Battle Creek HSA was included in the analysis, the effects and impacts of the downstream hydrologic modification would also significantly complicate the ability to assess the impacts of projects. For example, water diversions and dams downstream influence temperature and either trap or attenuate sediment such that upstream impacts cannot be adequately evaluated. Ultimately, limiting the size of the assessment areas is necessary and appropriate in order to detect and mitigate potential impacts from proposed projects.

Qualitative Versus Quantitative Assessments

Another concern noted by comment writers is the specific lack of quantitative data in the plan, or more specifically, the lack of quantitative data in specific areas. Commenters note the lack of site-specific scientific studies or research, along with the data used to reach scientific conclusions. Comment writers take exception to the use of qualitative information, based upon the observations of Registered Professional Foresters claiming it to be subjective and not sufficient upon which to make determinations on potential plan impacts.

Faced with similar comments, the Board of Forestry addressed this issue during the rulemaking for Technical Rule Addendum #2 in 1991:

> Final Statement of Reasons (FSOR) for Technical Rule Addendum #2 (1/18/91)
>
> Pages 56-57 (In response to concerns on the need for Quantitative Data for establishing baselines):
>
> *Response - The Board reviewed several drafts of regulations before noticing the proposed language. One of the drafts offered to the Board by the Department contained a set of required measurements which could be reproduced as suggested.*
>
> *Public comment received by the Board from the agencies and public convinced the Board that there is not a set of quantitative values which can withstand peer review in all areas which are affected by cumulative effects. The breadth of this expertise ranges from geologists, hydrologists, soils scientists, and various biologists.*
>
> *Given this, the Board relied upon the experience of others in the field of cumulative effects and decided that a qualitative method would be most reliable for the decision maker. Most other agencies currently use the qualitative method which means that an independent analysis is conducted on each project. In this method available data is collected and evaluated to determine that defined topic and issue areas (i.e. stream bank or bed condition) are considered and a condition identified. There then are certain conditions which can be identified. One example is a lack of certain stream biota which indicate the threshold of significant cumulative effects has been reached.*
>
> *To date, the quantitative methods identified by the Board rely upon numbers which are assigned on the basis of professional judgment. This means that it is only a modified qualitative analysis at best. An example of this is the Chatoian Method of Equivalent Roaded Acres being developed for use by the United States Forest Service. Recent field evaluations have shown that there is little*

relationship between Equivalent Roaded Acres and the conditions of the water quality in a watershed.

For these reasons the Board did not believe it could require a standardized set of data measurements in the THP regulations. Further, the data collected would have to be entered into a common data base if any analytical value is to be gained. This would be a costly proposition for the State. The Board believes that such a data base will ultimately be developed and will be invaluable but it should be sought at this time in a nonregulatory manner.

Proceeding with the development of a data base in this manner will allow the necessary data to be identified, the analysis process to be developed, the funding to be identified, and most of all the necessary peer acceptance of such a system to be nurtured.

Also page 70

Response - Refer to response No. 1 in the letter dated August 1, 1990 by Mr. Benjamin Kor, Northcoast Regional Water Quality Control Board. Further, the Board conducted an extensive review of cumulative effects methodologies during 1988 and 1989 most recently and has had at least two previous reports prepared on the topic. The Board in developing this proposal released several draft cumulative effects methodologies for peer review. These methods were originally quantitative to the extent numerical values were assigned to professional judgments. Those values were then totaled and used to estimate whether a cumulative effects threshold had been crossed. The peer review always resulted in criticism of the time required to develop determinations which still relied upon best professional judgment. In response the Board chose to pursue development of the adopted proposal which relies on an independent analysis which provides guidance on what measures must be considered when judging if a cumulative impact will occur. This method as is now currently used by most planning departments and other lead agencies. Use of this method requires information of sufficient detail to support a record of decision.

Even though the inclusion of quantitative information is not required, the Plan Submitter has included a substantial amount of quantitative data relative to the proposed THP. Below are a few examples:

- Site-specific greenhouse gas calculations: 195-197
- Digger Creek Tributaries Water Quality and Road Erosion Report 212-215 and 570-587
- Road Inventory and Road Erosion and Delivery Index (READI) data: 227-228
- Bioassessment and Water Quality for the South and North Forks of Digger Creek 426-438

Requirements for the THP to contain all information necessary to demonstrate efficacy of Rules

An often repeated theme throughout public comment is the concern that the plan does not include sufficient detail for the public to adequately evaluate the proposal. The idea seems to be that the entire Record must contain all of the information necessary to make the determination including all of the supporting documentation to conclude that the mitigation measures employed are effective in avoiding significant impacts. In some respects, this makes sense, as the Record should be clear enough that its conclusions can be supported by information within the record itself. There is, however, a significant problem with this idea, as the Record is truly made up of much more than what appears within the THP. In fact, including all of the information as desired by the comment writers would be entirely cumbersome and contrary to the intent of CEQA.

For example, commenters desire evidence that the Forest Practice Rules are effective in reducing significant adverse effects on the environment. It is important to point out that the rulemaking process used by the Board of Forestry is itself a CEQA analysis. Instead of evaluating impacts at the plan-specific level, the environmental impacts of the Rules are evaluated at the scale where the Rules are to be applied (e.g. State, District, Subdistrict, etc.). So in effect, the "Record" demonstrating the CEQA process for rulemaking is also part of each THP. If one was required to include this information in the THP, it would require 129,500 pages (and that is just up to the 2018 Rules).

Fortunately, this is not what CEQA intended and there is sufficient information available to be assured that the THP is more than just what appears within the harvest document:

> ***14 CCR §21003. PLANNING AND ENVIRONMENTAL REVIEW PROCEDURES; DOCUMENTS; REPORTS; DATA BASE; ADMINISTRATION OF PROCESS***
>
> *The Legislature further finds and declares that it is the policy of the state that:*
>
> - *Local agencies integrate the requirements of this division with planning and environmental review procedures otherwise required by law or by local practice so that all those procedures, to the maximum feasible extent, run concurrently, rather than consecutively.*
> - *Documents prepared pursuant to this division be organized and written in a manner that will be meaningful and useful to decision makers and to the public.*
> - *Environmental impact reports omit unnecessary descriptions of projects and emphasize feasible mitigation measures and feasible alternatives to projects.*
> - *Information developed in individual environmental impact reports be incorporated into a data base which can be used to reduce delay and duplication in preparation of subsequent environmental impact reports.*
> - *Information developed in environmental impact reports and negative declarations be incorporated into a data base which may be used to make subsequent or supplemental environmental determinations.*
> - *All persons and public agencies involved in the environmental review process be responsible for carrying out the process in the most efficient, expeditious manner in order to conserve the available financial, governmental, physical, and social resources with the objective that those resources may be better applied toward the mitigation of actual significant effects on the environment.*

The legislature recognized both the importance of a robust environmental review system and the time savings/efficiencies that can be realized when these documents are used for subsequent assessments. Indeed, without the direction from the Legislature, we would forever be re-proving foundational concepts. Our entire system relies upon the body of past assessments.

Evenage Management and Impacts to Water Quality

Another significant theme of the letters involve negative impacts to water quality directly attributable to evenage management. Several reports and technical memorandums are provided to support this concern. As Lead Agency, CAL FIRE must evaluate this information within the context of the record for this THP.

Overall, while the presence of impacts to the lower reaches of Battle Creek are well documented, pinning these impacts solely on timber harvesting and specifically evenage management is not supported by the record. The significant post-fire sedimentation impacts from the Ponderosa Fire make attribution to a specific source problematic. This is in addition to the many other potential sources which have been identified other than timber harvesting (e.g. county and other private roads, viticulture, grazing etc.) The contribution that any timber harvesting plan would have on downstream resources is purely speculative under these circumstances. As a result, requiring modifications to the plan, other than what has already been included, cannot be supported by CAL FIRE.

What appears abundantly clear after evaluating all of the available literature provided, including materials supplemented into the review by CAL FIRE, is that while everyone can agree that impacts are evident, no one can agree on the exact source, nor can they agree on the specific causes and the apportionment of cause to assign for each source.

Given this tremendous uncertainty, CAL FIRE also relies upon the results of our own analysis[7], which show that when properly implemented, the Forest Practice Rules do not cause a significant adverse effect on the environment. It is our duty and obligation as a Department to continuously review new information as it becomes available, to refine and test our understanding of how environmental impacts can be reduced or avoided through the prudent application of feasible mitigation measures.

Greenhouse Gas Sequestration

Another disagreement relates to the weight given to the sequestration of release of greenhouse gasses. There is a strong opinion by the comment writer that carbon sequestration is the preeminent consideration upon which plans must be evaluated. Essentially, if an alternative exists that would result in more carbon sequestration, the plan submitter (and CAL FIRE by extension) are obligated to choose that option. While CAL FIRE understands this position, requiring such an action would be an abuse of power and contrary to the laws and regulations governing timber harvesting in California. Carbon sequestration is one of many competing considerations which must be evaluated as part of a proposed project. CAL FIRE recognizes

[7] See, for example, the work of the Board of Forestry Effectiveness Monitoring Committee https://bof.fire.ca.gov/board-committees/effectiveness-monitoring-committee/

that there are many potential ways a plan submitter may choose to pursue Maximum Sustained Production (MSP) on a land ownership, but we are not permitted to require one method over another.

Forest Practice Regulatory Background

The Z'berg-Nejedley Forest Practice Act (Division 4, Chapter 8, PRC) establishes the necessity for Timber Harvesting Plans to conduct commercial timber operations and establishes the Board of Forestry and Fire Protection as the regulatory authority for promulgation of regulations to, among other things:

> *…encourage prudent and responsible forest resource management calculated to serve the public's need for timber and other forest products, while giving consideration to the public's need for watershed protection, fisheries and wildlife, sequestration of carbon dioxide, and recreational opportunities alike in this and future generations.*

The FPA was initially adopted in 1973. Since that time, the BOF has enacted numerous regulations to support the Act's intent related to sustained yield and has adopted conservation standards for post-harvest stocking that meet or exceed the minimum resource conservation standards specified in PRC §4561 of the Act. The Board has established rules related to demonstration of Timberland Productivity, Sustained Forestry Planning (14 CCR §933.10), demonstration of Maximum Sustained Productivity (14 CCR §933.11), and has defined sustained yield and Long Term Sustained Yield (14 CCR §895.1). Under these various rule provisions, landowners with more than 50,000 acres of timberland are required to demonstrate long-term sustained yield under the management regime they have selected for the ownership. Under this provision, the Department has received and approved long term sustained yield documents covering approximately 3.2 million acres of timberland. For smaller industrial and nonindustrial landowners, they must comply with minimum retention standards specified in the Rules as established by the BOF, although they may choose a higher standard.

More recently, amendments were made to the FPA to clarify and refine other mandates related to the assessment of Greenhouse Gas (GHG) impacts:

> *4512.5. Sequestration of carbon dioxide; legislative findings and declarations.*
> *The Legislature finds and declares all of the following:*
> *(a) State forests play a critical and unique role in the state's carbon balance by sequestering carbon dioxide from the atmosphere and storing it long term as carbon.*
> *(b) According to the scoping plan adopted by the State Air Resources Board pursuant to the California Global Warming Solutions Act of 2006 (Division 25.5 (commencing with Section 38500) of the Health and Safety Code), the state's forests currently are an annual net sequesterer of five million metric tons of carbon dioxide (5MMTCO2). In fact, the forest sector is the only sector included in the scoping plan that provides a net sequestration of Greenhouse Gas emissions.*
> *(c) The scoping plan proposes to maintain the current 5MMTCO2 annual sequestration rate through 2020 by implementing "sustainable management practices," which include potential changes to existing forest practices and land use regulations.*
> *(d) There is increasing evidence that climate change has and will continue to stress forest ecosystems, which underscores the importance of proactively managing forests so that they*

can adapt to these stressors and remain a net sequesterer of carbon dioxide.

(e) *The Board, the Department, and the State Air Resources Board should strive to go beyond the status quo sequestration rate and ensure that their policies and regulations reflect the unique role forests play in combating climate change.*

4551. Adoption of district forest practice Rules and regulations; factors considered in Rules and regulations governing harvesting of commercial tree species; funding.

(a) …

(b) (1) The Board shall ensure that its Rules and regulations that govern the harvesting of commercial tree species, where applicable, consider the capacity of forest resources, including above ground and below ground biomass and soil, to sequester carbon dioxide emissions sufficient to meet or exceed the state's Greenhouse Gas reduction requirements .for the forestry sector, consistent with the scoping plan adopted by the State Air Resources Board pursuant to the California Global Warming Solutions Act of 2006 (Division 25.5 (commencing with Section 38500) of the Health and Safety Code).

(2) …

Technical Rule Addendum #2, Item G:

G. GREENHOUSE GAS (GHG) IMPACTS

Forest management activities may affect GHG sequestration and emission rates of forests through changes to forest inventory, growth, yield, and mortality. Timber Operations and subsequent production of wood products, and in some instances energy, can result in the emission, storage, and offset of GHGs. One or more of the following options can be used to assess the potential for significant adverse cumulative GHG Effects:

1. *Incorporation by reference, or tiering from, a programmatic assessment that was certified by the Board, CAL FIRE, or other State Agency, which analyzes the net Effects of GHG associated with forest management activities.*
2. *Application of a model or methodology quantifying an estimate of GHG emissions resulting from the Project. The model or methodology should at a minimum consider the following:*
    a. *Inventory, growth, and harvest over a specified planning horizon*
    b. *Projected forest carbon sequestration over the planning horizon*
    c. *Timber Operation related emissions originating from logging equipment and transportation of logs to manufacturing facility*
    d. *GHG emissions and storage associated with the production and life cycle of manufactured wood products.*
3. *A qualitative assessment describing the extent to which the Project in combination with Past Projects and Reasonably Foreseeable Probable Future Projects may increase or reduce GHG emissions compared to the existing environmental setting. Such assessment should disclose if a known 'threshold of significance' (14 CCR § 15064.7) for the Project type has been identified by the Board, CAL FIRE or other State Agency and if so whether or not the Project's emissions in combination with other forestry Projects are anticipated to exceed this threshold.*

California Legislative and Administrative Background

Over the years, various efforts by the California Legislature and the Governor to quantify greenhouse gas emissions and develop strategies for avoiding potential negative impacts have occurred. A summary relevant to this THP is provided below:

1. Assembly Bill 32 (AB32), the Global Warming Solutions Act of 2006, was signed into law by Governor Schwarzenegger and represents a comprehensive approach to address climate change. AB32 establishes a statewide goal to reduce greenhouse gas emissions to 1990 levels by 2020. The California Resources Air Board (ARB) is the lead agency for implementing AB32.

   The scoping plan adopted by the ARB in December of 2008 (CARB, 2008) establishes a general roadmap that California will take to achieve the 2020 goals. Targets for the Forestry Sector were established under the "Sustainable Forests" section of the Scoping Plan. The "Sustainable Forest" element was recognized as a carbon sink based on the current carbon inventory for the Forest Sector and sequestration benefits attributable to forest. Specific recommendations for the sector included:

   - Maintaining the current 5 $MMTCO_2E$ reduction target through 2020 by ensuring that current carbon stock is not diminished over time.
   - Monitoring of carbon sequestered
   - Improving greenhouse gas inventories.
   - Determining actions needed to meet the 2020 targets.
   - Adaptation
   - Focusing on sustainable land-use activities.

   Wildfire threat and loss to conversions were recognized as potential threats to the Forest Sector in relation to achieving sector goals.

2. AB 1504 (Chapter 534, Statutes of 2010, Skinner): Requires the Board of Forestry and Fire Protection to ensure that its rules and regulations that govern timber harvesting consider the capacity of forest resources to sequester carbon dioxide emissions sufficient to meet or exceed the state's GHG reduction target for the forestry sector, consistent with the AB 32 Climate Change Scoping Plan goal of 5 million metric tons CO2 equivalent sequestered per year. Currently, these reports are principally prepared by Glenn A. Christensen.

3. SB 1122 (Chapter 612, Statutes of 2012, Rubio): This bill requires production of 50 megawatts of biomass energy using byproducts of sustainable forest management from fire threat treatment areas as determined by CAL FIRE.

4. AB 417 (Chapter 182, Statutes of 2015, Dahle): This bill provides the Board of Forestry and Fire Protection with additional flexibility in setting post timber harvest tree stocking standards in order to, in part, contribute to specific forest health and ecological goals as defined by the Board. The 2020 Forest Practice Rules include the Board's revisions to the "Resource Conservation Standards" under 14 CCR §932.7.

5. In 2015, the Governor issued Executive Order B-30-15 establishing a GHG reduction target for California of 40 percent below 1990 levels by 2030 and 80 percent by 2050 to help limit global warming to 2 degrees Celsius or less as identified by the IPCC to avoid potentially catastrophic climate change impacts. In 2016, the California Legislature passed Senate Bill 32 (Chapter 249, Statutes of 2016), which codifies the Governor's Executive Order. CARB updated the AB 32 Scoping Plan in 2017 to reflect the 2030 target.

6. SB 859 (Chapter 368, Statutes of 2016, Committee on Budget and Fiscal Review): Among other things, calls for CARB, in consultation with CNRA and CAL FIRE, to complete a standardized GHG emissions inventory for natural and working lands, including forests by December 31, 2018 (CARB, 2018).

7. SB 1386 (Chapter 545 Statutes of 2016, Wolk): Declares the policy of the state that the protection and management of natural and working lands, including forests, is an important strategy in meeting the state's greenhouse gas reduction goals, and requires all state agencies, departments, boards, and commissions to consider this policy when revising, adopting, or establishing policies, regulations, expenditures, or grant criteria relating to the protection and management of natural and working lands.

8. (2018) Accompanying release of the Forest Carbon Plan, Governor Brown's Executive Order B-52-18 on forest management emphasizes the importance of implementing the Forest Carbon Plan. Executive Order B-55-18 also calls for California to achieve carbon neutrality no later than 2045, with carbon sequestration targets to be set in the Natural and Working Lands to help achieve this goal.

These Laws, Regulations and Executive Orders form the background under which CAL FIRE reviews plans for impacts to GHG emissions and sequestration.

National and State-Level GHG Assessments

A variety of assessments have been conducted to calculate the GHG emissions and rates of sequestration related to management of natural and working lands. Due to the rapidly evolving science, accounting methods and policy directions from the executive and legislative branches, specific accounting that conforms from study to study has yet to be achieved. The overall trends, however, do provide meaningful insight within which to make assumptions about how an individual THP fits into the overall objectives of assessing and mitigating potential negative impacts from GHG emissions.

USEPA Inventory of U.S. Greenhouse Gas Emissions and Sinks 1990-2018 (EPA, 2020)**:**

Summary: Forest management falls under the "Land Use, Land Use Change, and Forestry" (abbreviated LULUCF) for consistent reporting with other international efforts. Sequestrations at the national level offset approximately 12% of total US GHG Emissions annually and this carbon pool remains relatively stable over time.

- *In 2018, total gross U.S. greenhouse gas emissions were 6,676.6 million metric tons of carbon dioxide equivalent (MMT CO2 Eq). Total U.S. emissions have increased by 3.7 percent from*

1990 to 2018, down from a high of 15.2 percent above 1990 levels in 2007. Emissions increased from 2017 to 2018 by 2.9 percent (188.4 MMT CO2 Eq.). Net emissions (including sinks) were 5,903 MMT CO2 Eq. Overall, net emissions increased 3.1 percent from 2017 to 2018 and decreased 10.2 percent from 2005 levels as shown in Table ES-2. The decline reflects many long-term trends, including population, economic growth, energy market trends, technological changes including energy efficiency, and energy fuel choices. Between 2017 and 2018, the increase in total greenhouse gas emissions was largely driven by an increase in CO2 emissions from fossil fuel combustion. The increase in CO2 emissions from fossil fuel combustion was a result of multiple factors, including increased energy use from greater heating and cooling needs due to a colder winter and hotter summer in 2018 compared to 2017.

- *Conversely, U.S. greenhouse gas emissions were partly offset by carbon (C) sequestration in forests, trees in urban areas, agricultural soils, landfilled yard trimmings and food scraps, and coastal wetlands, which, in aggregate, offset 12.0 percent of total emissions in 2018.*

- *Within the United States, fossil fuel combustion accounted for 92.8 percent of CO2 emissions in 2018. There are 25 additional sources of CO2 emissions included in the Inventory (see Figure ES-5). Although not illustrated in the Figure ES-5, changes in land use and forestry practices can also lead to net CO2 emissions (e.g., through conversion of forest land to agricultural or urban use) or to a net sink for CO2 (e.g., through net additions to forest biomass).*

- *Land Use, Land-Use Change, and Forestry (LULUCF)*

    - *Overall, the Inventory results show that managed land is a net sink for CO2 (C sequestration) in the United States. The primary drivers of fluxes on managed lands include forest management practices, tree planting in urban areas, the management of agricultural soils, landfilling of yard trimmings and food scraps, and activities that cause changes in C stocks in coastal wetlands. The main drivers for forest C sequestration include forest growth and increasing forest area, as well as a net accumulation of C stocks in harvested wood pools.*
    - *The LULUCF sector in 2018 resulted in a net increase in C stocks (i.e., net CO2 removals) of 799.6 MMT CO2 Eq. (Table ES-5). This represents an offset of 12.0 percent of total (i.e., gross) greenhouse gas emissions in 2018… Between 1990 and 2018, total C sequestration in the LULUCF sector decreased by 7.1 percent, primarily due to a decrease in the rate of net C accumulation in forests and Cropland Remaining Cropland, as well as an increase in CO2 emissions from Land Converted to Settlements.*
    - *Forest fires were the largest source of CH4 emissions from LULUCF in 2018, totaling 11.3 MMT CO2 Eq. (452 kt of CH4).*
    - *Forest fires were also the largest source of N2O emissions from LULUCF in 2018, totaling 7.5 MMT CO2 Eq. (25 kt of N2O). Nitrous oxide emissions from fertilizer application to settlement soils in 2018 totaled to 2.4 MMT CO2 Eq. (8 kt of N2O).*

CARB AB32 Scoping Plan (CARB, 2017) **:**

Summary: At the state level, all sectors are cumulatively on track to meet the 2020 targets for GHG reductions and sequestration. The Natural and Working Lands in the state represent a key sector for the long-term storage of carbon in vegetation and soils. During the period of

2001-2010, disturbances (primarily in the form of wildfire) caused significant losses to the total stored carbon. Meeting state goals will require multi-owner and jurisdictional cooperation as well as trade-offs between competing interests.

- *California's natural and working landscapes, like forests and farms, are home to the most diverse sources of food, fiber, and renewable energy in the country. They underpin the state's water supply and support clean air, wildlife habitat, and local and regional economies. They are also the frontiers of climate change. They are often the first to experience the impacts of climate change, and they hold the ultimate solution to addressing climate change and its impacts. In order to stabilize the climate, natural and working lands must play a key role.*

- *Work to better quantify the carbon stored in natural and working lands is continuing, but given the long timelines to change landscapes, action must begin now to restore and conserve these lands. We should aim to manage our natural and working lands in California to reduce GHG emissions from business-as-usual by at least 15-20 million metric tons in 2030, to compliment the measures described in this Plan.*

- *California's forests should be healthy carbon sinks that minimize black carbon emissions where appropriate, supply new markets for woody waste and non-merchantable timber, and provide multiple ecosystem benefits.*

- *AB 32 directs CARB to develop and track GHG emissions and progress toward the 2020 statewide GHG target. California is on track to achieve the target while also reducing criteria pollutants and toxic air contaminants and supporting economic growth. As shown in Figure 1, in 2015, total GHG emissions decreased by 1.5 $MMTCO_2e$ compared to 2014, representing an overall decrease of 10 percent since peak levels in 2004. The 2015 GHG Emission Inventory and a description of the methodology updates can be accessed at: www.arb.ca.gov/cc/inventory/inventory .*

FIGURE 1: CALIFORNIA GHG INVENTORY TREND

- *Carbon dioxide is the primary GHG emitted in California, accounting for 84 percent of total GHG emissions in 2015, as shown in Figure 2 below. Figure 3 illustrates that transportation, primarily on-road travel, is the single largest source of CO2 emissions in the State.. When* *these emissions sources are attributed to the transportation sector, the emissions from that sector amount to approximately half of statewide GHG emissions. In addition to transportation, electricity production, and industrial and residential sources also are important contributors to CO2*

- *Increasing Carbon Sequestration in Natural and Working Lands*
  - *California's natural and working lands make the State a global leader in agriculture, a U.S. leader in forest products, and a global biodiversity hotspot. These lands support clean air, wildlife and pollinator habitat, rural economies, and are critical components of California's water infrastructure. Keeping these lands and waters intact and at high levels of ecological function (including resilient carbon sequestration) is necessary for the well-being and security of Californians in 2030, 2050, and beyond. Forests, rangelands, farms, wetlands, riparian areas, deserts, coastal areas, and the ocean store substantial carbon in biomass and soils.*
  - *Natural and working lands are a key sector in the State's climate change strategy. Storing carbon in trees, other vegetation, soils, and aquatic sediment is an effective way to remove carbon dioxide from the atmosphere. …We must consider important trade-offs in developing the State's climate strategy by understanding the near and long-term impacts of various policy scenarios and actions on our State and local communities.*
  - *Recent trends indicate that significant pools of carbon from these landscapes risk reversal: over the period 2001–2010 disturbance caused an estimated 150 MMT C loss, with the majority– approximately 120 MMT C– lost through wildland fire.*
  - *California's climate objective for natural and working lands is to maintain them as a carbon sink (i.e., net zero or negative GHG emissions) and, where appropriate, minimize the net GHG and black carbon emissions associated with management, biomass utilization, and wildfire events.*
  - *Decades of fire exclusion, coupled with an extended drought and the impacts of climate change, have increased the size and intensity of wildfires and bark beetle infestations; exposed millions of urban and rural residents to unhealthy smoke-laden air from wildfires; and threatened progress toward meeting the state's long-term climate goals. Managing forests in California to be healthy, resilient net sinks of carbon is a vital part of California's climate change policy.*
  - *Federally managed lands play an important role in the achievement of the California climate goals established in AB 32 and subsequent related legislation and plans. Over half of the forestland in California is managed by the federal government, primarily by the USDA Forest Service Pacific Southwest Region, and these lands comprise the largest potential forest carbon sink under one ownership in the state... The State of California must continue to work closely and in parallel to the federal government's efforts to resolve these obstacles and achieve forest health and resilience on the lands that federal agencies manage.*

California Forest Carbon Plan (Forest Climate Action Team, 2018)

Summary: Current estimated sequestration for the entire forest sector is 32.8 MMT CO2e/year, which is 6.56 times more than the current target of 5 MMT per year. Regional, landscape or watershed level assessments are appropriate scales for examining rates of GHG emissions and sequestration. Wildfire remains the single largest source of carbon loss and remains the largest source of black carbon emissions. Although there are trade-offs with in-forest carbon stores, sustainably managed working forests can further provide climate mitigation benefits.

- *When all forest pools are considered, California's forests are sequestering 34.4 MMT CO2e/year, and when land-use changes and non-CO2 emissions from wildfires are accounted for, the total net sequestration is 32.8 MMT CO2e/year.*

Table 16. Statewide Average Annual Growth, Removals, Mortality, and Net Change for the Above Ground Live Tree Pool by Disturbance, Owner, and Land Status on Plots Initially Measured between 2001-2005 and Re-Measured between 2011-2015 (thousand metric tons carbon dioxide equivalent per year).

	UNRESERVED FORESTLAND			RESERVED FORESTLAND	ALL FORESTLAND[2]
	Private, Corporate	Private, Non-Corporate	USDA Forest Service	USDA Forest Service	Total
	thousand metric tons CO2 equivalent per year				
Gross tree growth	18,554	13,772	25,983	7,188	**73,253**
Removal - harvest	-10,664	-1,476	-1,467	-22	**-13,645**
Mortality – fire killed	-278	-449	-6,077	-4,689	**-12,566**
Mortality – cut and fire[1]	-466	-49	-326	0	**-842**
Mortality – insects and disease	-488	-435	-3,162	-1,039	**-5,728**
Mortality – natural/other	-2,525	-2,988	-6,743	-2,203	**-16,543**
Net live tree	4,133	8,375	8,208	-765	**23,929**
				95% confidence interval	**4,575**

[1]Mortality – Cut and fire: plots where tree mortality has occurred due to both harvest and fire.

[2]Includes other public forestland.

Source: USDA Forest Service FIA.[267]

- *The key findings of the [Forest Carbon Plan] include:*
  - *California's forested landscapes provide a broad range of public and private benefits, including carbon sequestration.*
  - *The long-term impacts of excluding fire in fire-adapted forest ecosystems are being manifested in rapidly deteriorating forest health, including loss of forest cover in some cases.*
  - *Extreme fires and fire suppression costs are increasing significantly, and these fires are a growing threat to public health and safety, to homes, to water supply and water quality, and to a wide range of other forest benefits, including ecosystem services.*
  - *Reducing carbon losses from forests, particularly the extensive carbon losses that occur during and after extreme wildfires in forests and through uncharacteristic tree mortality, is essential to meeting the state's long-term climate goals.*
  - *Fuel reduction in forests, whether through mechanical thinning, use of ecologically beneficial fire, or sustainable commercial timber harvest to achieve forest health goals,*

involves some immediate loss of forest carbon, but these treatments can increase the stability of the remaining and future stored carbon.
  - *Current rates of fuel reduction, thinning of overly dense forests, and use of prescribed and managed fire are far below levels needed to restore forest health, prevent extreme fires, and meet the state's long-term climate goals.*
  - *Where forest stands are excessively dense, forest managers may have to conduct a heavy thinning to restore resilient, healthy conditions, which, among other benefits, will subsequently facilitate the reintroduction of prescribed fire as an ecological management tool.*
  - *Sustainable timber harvesting on working forests can substantially improve the economic feasibility of these treatments to achieve forest health goals at the scale necessary to make an ecologically meaningful difference.*
  - *Where forestlands have been diminished due to fires, drought, insects, or disease, they should be reforested with ecologically appropriate tree species from appropriate seed sources.*
  - *The scale and combination of needed treatments and their arrangement across the landscape is likely to be highly variable and dependent on the local setting.*
  - *The state must work closely with Federal and private landowners to manage forests for forest health, multiple benefits, and resiliency efficiently at a meaningful scale.*

- *The watershed level has proven to be an appropriate organizing unit for analysis and for the coordination and integrated management of the numerous physical, chemical, and biological processes that make up a watershed ecosystem. Similarly, a watershed can serve as an appropriate reference unit for the policies, actions, and processes that affect the biophysical system, and providing a basis for greater integration and collaboration. Forests and related climate mitigation and adaptation issues operate across these same biophysical, institutional, and social gradients.*

  Because of these factors, the Forest Carbon Plan proposes working regionally at the landscape or watershed scale. The appropriate scale of a landscape or watershed to work at will vary greatly depending upon the specific biophysical conditions, land ownership or management patterns, and other social or institutional conditions.

- *Forests are shaped by disturbance and background levels of tree mortality. However, elevated tree mortality from overly dense stand conditions, fire exclusion, lack of or poor forest management practices, and impacts related to drought and climate change can have a substantial effect on the forest carbon balance. Wildfire is the single largest source of carbon storage loss and GHG emissions from forested lands: of the estimated 150 million metric tons of carbon lost from forests from 2001-2010, approximately 120 million metric tons of carbon was lost through wildland fire. Wildfire also is the single biggest source of black carbon emissions. Reducing the intensity and extent of wildland fires through tools such as fuels reduction, prescribed or managed fire, thinning, and sustainable timber management practices is therefore a top priority.*

- *In addition to fuels reduction and prescribed and managed fire treatments, sustainable commercial timber harvesting on private and public lands, where consistent with the goals of owners or with management designations and done to maximize forest health goals, can play a beneficial role, both in thinning dense forests and financing additional treatments. Although* *there are trade-offs with in-forest carbon stores, sustainably managed working forests can further provide climate mitigation benefits. Commercial timber harvest within a sustainable management regime to maximizing forest health goals also creates revenue opportunities to fund additional forest treatments and should be seen as a tool in the maintenance of our forests as healthy, resilient net sinks of carbon.*

- *In order to support the goals of this Forest Carbon Plan, wood and biomass material generated by timber harvesting, forest health, restoration and hazardous fuels treatments must be either utilized productively or disposed of in a manner that minimizes net GHG and black carbon emissions. Timber and other biomass harvest volumes are expected to increase as a result of the forest management activities outlined above. These volumes will include green and dead trees suitable for timber production, smaller-diameter green and dead trees with little traditional timber value, and tops and limbs.*

- *Specific Rates of Sequestration/Emission by landowner category:*

    - *Private Corporate Forestland: Private corporate forestland includes both timberland and other forestland. On private corporate forestland growth is high and exceeds removal and mortality, reflecting the practice of sustained yield as required by California's Forest Practice Act and Rules. These forests are managed to create relatively little annual mortality and the harvested volume is less than forest growth. Rates of removals from harvest and thinning are highest on these lands, but the rate of fire-related mortality is lowest. These forests experience a net gain in carbon at a rate of 0.75 metric tons of CO2e per acre per year, or 4.1 MMT of CO2e per year. In 2012, these lands contributed 70 percent of the total harvest (Figure 16) and are therefore an important contributor to the carbon stored long-term in harvested wood products and reduced emissions from burning wood instead of fossil fuels for energy.*

    - *Private Non-Corporate Forestland: This category represents private ownerships for which timber production may or may not be a primary management objective. The rate of gross growth is high on these lands, while the rate of natural, non-fire related mortality is low. The rate of fire-related mortality is also quite low, although it is higher than on private corporate forestland. As these lands exhibit high growth rates, lower harvest per acre than corporate forestland, and have relatively low levels of mortality, these forest lands see the highest net sequestration rates on the order of 1.33 metric tons of CO2e per acre per year, or 8.4 million metric tons of CO2e per year.*

      Private non-corporate forestland has the highest rate of sequestration per acre (Figure 17), and despite making up 10 percent less of the forestland base than USDA Forest Service unreserved forestland, these forests sequester the greatest total amount (Table 16). A net 33 percent increase in carbon stock from private non-corporate forestland came from only 24 percent of the California forestland base (Figure 18, Figure 9). A net 13 percent increase in carbon stock from private corporate forestland came from 15 percent of the forestland base. … Private non-corporate forestlands provided slightly less of a net increase in carbon stocks than all USDA FS forestlands, despite being just half the size.

- *Forest carbon is stored in both forest ecosystems and, to a lesser extent, in harvested wood products. The degree to which California forests operate as a sink or source is influenced by land* *management, weather, and a range of forest health issues (e.g., growth, tree mortality from drought, pest and disease outbreaks, wildfire severity). In recent years, prolonged drought conditions have resulted in elevated tree mortality that is widespread across the southern Sierra. The combination of drought impacts and extensive wildfires has made forests lose significant capacity for storing carbon. For all forestlands, improving forest health and managing to reduce losses from mortality can greatly increase the carbon balance on forestlands. On commercial and other actively managed forestlands in California, efficient uses of long lasting wood products and residues for energy can yield GHG benefits. Key inventory findings include:*

- *<u>Based on FIA Program data from 2006-2015, all California forests combined</u> on all ownerships were performing as a net sink and are sequestering carbon at an average rate of 0.79 metric tons of CO2e per acre per year, or 0.22 metric tons of carbon per acre per year.*

- *Based on FIA Program data from 2006 – 2015, California forests have substantial carbon storage; 1,303 MMT above ground and 734 MMT below ground, for a total of 2,037 MMT.*

- *Based on remeasurements taken between 2011 and 2015, carbon sequestration in the live tree pool (in-forest) was estimated at 7.4 MMT of CO2e per year on National Forest System unreserved and reserved forestlands, 4.1 MMT on private corporate forestland, 8.4 MMT on private noncorporate timberlands, and 4.0 MMT on other public lands. The net change in the live tree pool across all forestlands is estimated at 23.9 MMT of CO2e per year.*

- *When other forest pools, soils, non-GHG emissions from wildfire, and changes from land-use are accounted for, the net change is 32.8 MMT CO2e per year, meeting the AB 1504 goal of sequestering 5 MMT CO2e per year, assuming the contribution of flux associated with wood products does not drastically lower rates.*

- *On a per-acre basis, conifer forest types have enormous carbon capture and storage potential.*

- *FIA Program data suggest that on private forestland growth is outpacing losses from harvest and mortality (excluding wood product storage), and exceeds that of National Forest System lands.*

- *FIA Program data show that non-corporate forestland has the greatest net growth (i.e., growth minus mortality and harvest excluding wood product storage).*

- *Based on FIA Program data, tree mortality from forest health-related causes results in substantial declines in forest carbon. These data indicate that tree mortality rates are highest on federal forest lands in reserve (e.g., wilderness), where mortality is slightly outpacing growth.*

CARB California Greenhouse Gas Emissions for 2000 to 2018 (CARB, 2020)

Summary: This inventory is specific to anthropogenic sources so most of the agriculture category relates to commercial agriculture. Emissions related to logging from trucks and equipment would fall under the transportation sector. The Natural and Working Lands Emission Inventory contains more specific emission and sequestration numbers for Forestry.

- *California statewide GHG emissions dropped below the 2020 GHG Limit in 2016 and have remained below the 2020 GHG Limit since then.*
- *Transportation emissions decreased in 2018 compared to the previous year, which is the first year over year decrease since 2013.*
- *Since 2008, California's electricity sector has followed an overall downward trend in emissions. In 2018, solar power generation has continued its rapid growth since 2013.*
- *Emissions from high-GWP gases increased 2.3 percent in 2018 (2000-2018 average year-overyear increase is 6.8 percent), continuing the increasing trend as they replace Ozone Depleting Substances (ODS) being phased out under the 1987 Montreal Protocol.*

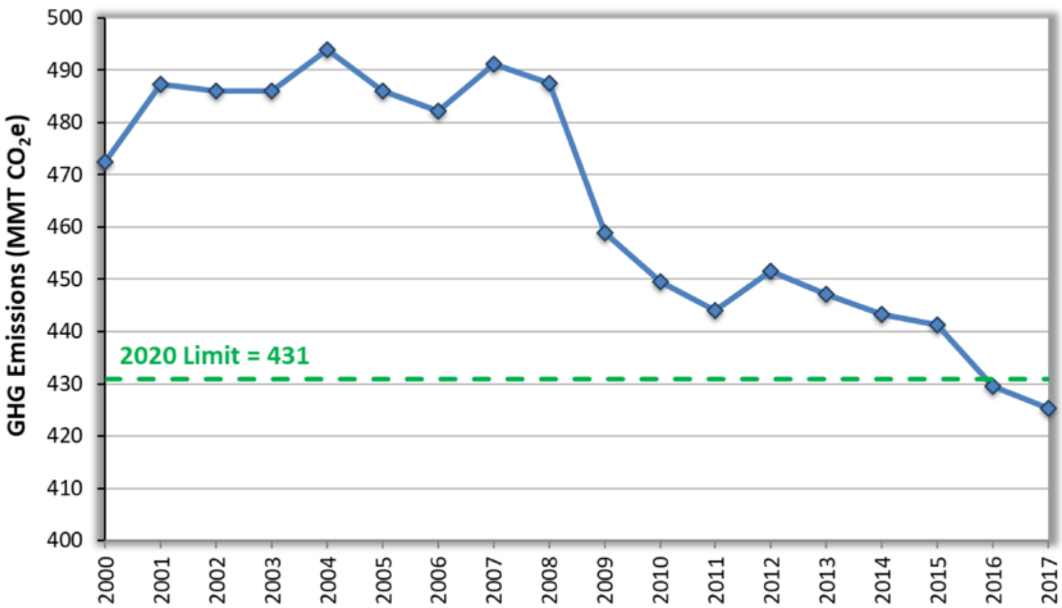

Figure 1. California GHG Emissions Trends. This figure shows the emission trends between 2000 and 2017 as compared to the 2020 statewide GHG limit of 431 $MMTCO_2e$.

- *In 2017, emissions from statewide emitting activities were 424 million metric tons of CO2 equivalent (MMTCO2e), which is 5 MMTCO2e lower than 2016 levels. 2017 emissions have decreased by 14 percent since peak levels in 2004 and are 7 MMTCO2e below the 1990 emissions level and the State's 2020 GHG limit. Per capita GHG emissions in California have dropped from a 2001 peak of 14.1 tonnes per person to 10.7 tonnes per person in 2017, a 24 percent decrease.4,19 Overall trends in the inventory also demonstrate that the carbon intensity of California's economy (the amount of carbon pollution per million dollars of gross domestic product (GDP)) is declining. From 2000 to 2017, the carbon intensity of California's economy has decreased by 41 percent from 2001 peak emissions while simultaneously increasing GDP by 52 percent. In 2017, GDP grew 3.6 percent while the emissions per GDP declined by 4.5 percent compared to 2016.22 Figures 2(a)-(c) on the next page show California's growth alongside GHG reductions.*

- *California's agricultural sector contributed approximately 8 percent of statewide GHG emissions in 2017, mainly from methane (CH4) and nitrous oxide (N2O) sources.*

An Inventory of Ecosystem Carbon in California's Natural & Working Lands (NWL) (CARB, 2020)

This inventory tracks carbon within California ecosystems and how it moves between various "pools". This is a snapshot view that provides for valuable long-term comparisons. These inventories are constantly being improved and some tracking categories have higher levels of certainty than others. Soil is the largest estimated pool of carbon and also has the highest error associated with those estimates. The assessment estimates that a majority of soil carbon loss is associated with the Sacramento-San Joaquin Delta region. Forest and shrublands show a 6% decrease, due to loss from wildfire. During the early iterations of these inventories, it appears prudent to only focus on gross trends.

- *The Earth's carbon cycle involves the exchange of carbon between the atmosphere, biosphere (plants, animals, and other life forms), hydrosphere (water bodies), pedosphere (soils), and lithosphere (Earth's crust and mantles, including rocks and fossil fuels). Carbon moves between land types (e.g., forests and grasslands) and carbon pools1 (e.g., wood, roots, and soils) due to natural processes (growth, decay, and succession) and disturbances (e.g., wildfire) or anthropogenic forces such as land use change. The NWL Inventory tracks how much carbon exists in California's ecosystems, where that carbon is located, and estimates how much carbon is moving in and out of the various land types and carbon pools. It provides stored carbon "snapshots" and gives insight into the location and magnitude of NWL carbon stocks at discrete moments in time.*

- *The NWL inventory includes:*
  - *Forest and other natural lands (woodland, shrubland, grassland, and other lands with sparse vegetation): live and dead plant materials and their roots*
  - *Urban land: trees in urban area*
  - *Cropland: woody biomass in orchards and vineyards*
  - *Soil Carbon: organic carbon in soils for all land types*
  - *Wetlands: CO_2 and CH_4 emissions from wetland ecosystem*

- *Current NWL Inventory*

  - *There are approximately 5,340 million metric tons (MMT)2 of ecosystem carbon in the carbon pools that CARB has quantified.3 (To put it into context, 5,340 MMT of carbon in land is equivalent to 19,600 MMT of atmospheric CO_2 currently existing as carbon in the biosphere and pedosphere as carbon cycles through the Earth's carbon cycle.) Forest and shrubland contain the vast majority of California's carbon stock because they cover the majority of California's landscape and have the highest carbon density of any land cover type. All other land categories combined comprise over 35% of California's total acreage, but only 15% of carbon stocks. Roughly half of the 5,340 MMT of carbon resides in soils and half resides in plant biomass.*

  - *Soil is the largest carbon reservoir. Using the IPCC default assumptions, most of the estimated net change in soil carbon was due to microbial oxidation of organic soil on the Sacramento-San Joaquin Delta. Disturbance caused by tillage and other agricultural management practices, land conversion, and land degradation also contributed to the* *soil carbon loss. Forest and shrubland carbon stocks in 2010 was 6% lower than in 2001 due to a number of large wildfires that occurred during the 2001-2010 period. (Future inventory editions will capture the impacts of large fire events seen in recent years.) Woody crops and urban forest both gained carbon, as these trees are generally well maintained due to their economic and aesthetic values. Part of the carbon gain seen in urban forests came from expansion of the urban footprint over this period of time. Movement of carbon among land types and carbon pools is a dynamic process. Carbon gain in one land type may be a result of carbon loss in another land type, and vice versa.*

  - *Although carbon that leaves the land base is counted as a carbon stock loss in the NWL Inventory, not all carbon stock loss becomes emissions released into the atmosphere. Some of the carbon leaving the land base continue to retain carbon as durable wood products (e.g., furniture and building materials).*

- *Disturbances in Forest and Other Natural Lands*
  Geospatially explicit carbon stock change information can be related to the different types of disturbance on land. During the 2001–2014 period, wildfire accounted for 74% and prescribed fire accounted for 3% of the areas that experienced disturbance. The impact of wildfire can be seen throughout the State, in both rural areas and urbanized areas near shrublands and forest. Harvest and clearcut accounted for 11%, and fuel reduction activities (thinning, mechanical, and mastication) accounted for 14% of the disturbed area.

- *Uncertainty of the Inventory Estimates The science, method, and technique for accounting of ecosystem carbon are relatively new and still rapidly advancing. Although significant progress has been made in the inventory development, more work still needs to be done. The parts of the NWL Inventory that have been in development for more years generally have a reasonably constrained uncertainty (between 15% and 40%), but other parts of the inventory that CARB started to develop more recently contain significant uncertainties.*

AB 1504 California Forest Ecosystem and Harvested Wood Product Carbon Inventory
(Christensen, Gray, Kuegler, Tase, & M, 2021)

Summary: California forests vastly exceed the 5MMT CO2e target, by a factor of over 5 times, even when taking into account losses from fire, drought and timberland conversion. Forests remain a net sink of carbon, even accounting for losses from wildfire and drought.

- *Overall California forests are exceeding the 5 MMT CO2e target rate of annual sequestration established by AB 1504, sequestering 26.8 ± 4.2 MMT CO2e per year (excludes confidence interval for HWP C net change; Table 7.1). This value includes changes in forest ecosystem pools (26.0 MMT CO2e per year), harvested wood product pools (0.8 MMT CO2e per year), non-CO2 emissions from wildfires (-0.6 MMT CO2e per year), and forest land conversions (-1.0 MMT CO2e per year).*
- *Based on plots initially measured between 2001-2009 and re-measured between 2011-2019, the average statewide rate of forest carbon sequestration is 26.0 ± 4.1 MMT CO2e per year, excluding net CO2e contributions from other sources such as, harvested wood products, forest land conversions and non-CO2 GHG emissions from wildfire (Table 4.1,4.3).*
- *Based on the 2019 measurement period, after accounting for these other CO2 and greenhouse gas sources the statewide rate of carbon sequestration on all forest land is 24.5 ± 4.0 MMT*

CO_2e per year (Table 4.2a), down from the 2018 re-calculated reporting period estimate of 26.4 ± 4.3 MMT CO_2e. This value cannot be directly compared to previous report values from the 2015 reporting period (32.8 ± 5.5 MMT CO_2e per year), the 2016 reporting period (30.7 ± 5.3 MMT CO_2e per year), or the 2017 reporting period (27.0 ± 5.5 MMT CO_2e per year) due to improved methods over time and the re- stratification that occurred in 2019. However, data suggest that the net annual sequestration rate is decreasing over time. This value excludes contributions from HWP pools.

<u>THP-Specific Assessment</u>
CEQA requires that individual projects estimate the associated GHG emissions from a proposed project and make a determination of significance. The plan submitter provided a site-specific analysis on pages 186-208. These calculations are provided by silvicultural category and are broken into three categories: Primary, Secondary and Tertiary where:

- <u>Primary Emissions</u> are those direct emissions caused by rotting or oxidation of woody materials during burning or site preparation activities. These are calculated as instant emissions, even though they will occur over time.
- <u>Secondary Emissions</u> are those from equipment that consume diesel fuel involved in harvesting, yarding and hauling logs to the mill.
- <u>Tertiary Emissions</u> are those produced after the logs are delivered to a sawmill.

These calculations estimate that the THP is capable of releasing a total of 18,891 tonnes of CO_2e. As described in the analysis, many of these releases will occur slowly over time, and are provided in the THP as a conservative, worst case emission estimate. These emissions are estimated to be recouped by trees planted in the THP area within 21 years. The THP concluded that these emissions would not be significant, when combined with other past, present and reasonably foreseeable future projects.

The Department has reviewed the estimates of emissions associated with the pools evaluated by SPI as part of the project specific analysis and has determined that the calculations have reasonably accounted for emissions from biologic and production elements of the project and that the sequestration estimates incorporate approaches for estimating carbon sequestration that are consistent with current science.

When this THP is considered within its own context, taking into account the state and national assessments discussed previously, CAL FIRE believes that it meets the requirements of CEQA and is consistent with the broader goals established by AB32 in providing for long-term carbon sequestration while providing for the market needs for forest products.

CEQA Analysis

A CEQA analysis is not required to be perfect, but it must be accurate and adequately describe the proposed project in a manner that allows for informed decision-making. It must include an assessment of impacts based upon information that was “reasonably available before submission of the plan.” (Technical Rule Addendum #2)

CEQA clearly establishes that the Lead Agency has a duty to minimize harm to the environment while balancing Competing Public Objectives (14 CCR §15021)[8]. These duties are further refined in the Z'berg-Nejedly Forest Practice Act (PRC §4512(c)[9]) and PRC §4513(b)[10] for how the mandate to provide "maximum sustained production of high quality timber products" is to be balanced with other environmental considerations. The term "while giving consideration to" is further defined in 14 CCR §895.1 as follows:

> ***While Giving Consideration*** *means the selection of those feasible silvicultural systems, operating methods and procedures which substantially lessen significant adverse Impact on the environment and which best achieve long-term, maximum sustained production of forest products, while protecting soil, air, fish and wildlife, and water resources from unreasonable degradation, and which evaluate and make allowance for values relating to range and forage resources, recreation and aesthetics, and regional economic vitality and employment.*

What is missing from the Act, Rules or CEQA Guidelines is the weight that is to be applied to the evaluation of the other resources specified. Clearly, there are certain legal restrictions on the degradation of specific values (i.e. water quality standards) but many of the elements that must be considered have a qualitative, not quantitative mandate for evaluation. This allows the Plan Submitter and the Lead Agency to exercise "professional judgement[11]" when preparing and evaluating plans.

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[8] Duty to Minimize Environmental Damage and Balance Competing Public Objectives

CEQA establishes a duty for public agencies to avoid or minimize environmental damage where feasible.

(1) In regulating public or private activities, agencies are required to give major consideration to preventing environmental damage.

(2) A public agency should not approve a project as proposed if there are feasible alternatives or mitigation measures available that would substantially lessen any significant effects that the project would have on the environment.

(b) In deciding whether changes in a project are feasible, an agency may consider specific economic, environmental, legal, social, and technological factors.

(c) The duty to prevent or minimize environmental damage is implemented through the findings required by Section 15091.

(d) CEQA recognizes that in determining whether and how a project should be approved, a public agency has an obligation to balance a variety of public objectives, including economic, environmental, and social factors and in particular the goal of providing a decent home and satisfying living environment for every Californian. An agency shall prepare a statement of overriding considerations as described in Section 15093 to reflect the ultimate balancing of competing public objectives when the agency decides to approve a project that will cause one or more significant effects on the environment.

Note: Authority cited: Section 21083, Public Resources Code; Reference: Public Resources Code Sections 21000, 21001, 21002, 21002.1, and 21081; San Francisco Ecology Center v. City and County of San Francisco, (1975) 48 Cal. App. 3d 584; Laurel Hills Homeowners Association v. City Council, (1978) 83 Cal. App. 3d 515.

Discussion: Section 15021 brings together the many separate elements that apply to the duty to minimize environmental damage. These duties appear in the policy sections of CEQA, in the findings requirement in Section 21081, and in a number of court decisions that have built up a body of case law that is not immediately reflected in the statutory language. This section is also necessary to provide one place to explain how the ultimate balancing of the merits of the project relates to the search for feasible alternatives or mitigation measures to avoid or reduce the environmental damage.

The placement of this section early in the article on general responsibilities helps highlight this duty to prevent environmental damage. This section is an effort to provide a careful statement of the duty with its limitations and its relationship to other essential public goals.

[9] (c) The Legislature thus declares that it is the policy of this state to encourage prudent and responsible forest resource management calculated to serve the public's need for timber and other forest products, while giving consideration to the public's need for watershed protection, fisheries and wildlife, sequestration of carbon dioxide, and recreational opportunities alike in this and future generations.

[10] (b) The goal of maximum sustained production of high-quality timber products is achieved while giving consideration to values relating to sequestration of carbon dioxide, recreation, watershed, wildlife, range and forage, fisheries, regional economic vitality, employment, and aesthetic enjoyment.

[11] *14CCR §897(d) Due to the variety of individual circumstances of timber harvesting in California and the subsequent inability to adopt site-specific standards and regulations, these Rules use judgmental terms in describing the standards that will apply in certain situations. By necessity, the RPF shall exercise professional judgment in applying these judgmental terms and in determining which of a range of feasible (see definition 14 CCR 895.1) silvicultural systems, operating methods and procedures contained in the Rules shall be proposed in the plan to substantially lessen significant adverse Impacts in the environment from timber harvesting. The Director also shall exercise professional judgment in applying these judgmental terms in determining whether a particular plan complies with the Rules adopted by the Board and, accordingly, whether he or she should approve or disapprove a plan. The Director shall use these Rules to identify the nature he limits to the professional judgment to be*

What is also evident from an examination of the entire record (i.e. information provided by the Plan Submitter, submitted as public comment and information supplemented to the record by CAL FIRE) is that there is disagreement amongst experts about what the appropriate course of action is or what the feasible alternatives to the project may be. Again, CEQA provides guidance on this topic, with respect to both the adequacy of the record, and on differences of opinion, even between recognized experts:

> ***15151. Standards for Adequacy of an EIR***
> *An EIR should be prepared with a sufficient degree of analysis to provide decision-makers with information which enables them to make a decision which intelligently takes account of environmental consequences. An evaluation of the environmental effects of a proposed project need not be exhaustive, but the sufficiency of an EIR is to be reviewed in the light of what is reasonably feasible. Disagreement among experts does not make an EIR inadequate, but the EIR should summarize the main points of disagreement among the experts. The courts have looked not for perfection but for adequacy, completeness, and a good faith effort at full disclosure.*
>
> ***Note:*** *Authority cited: Section 21083, Public Resources Code; Reference: Sections 21061 and 21100, Public Resources Code; San Francisco Ecology Center v. City and County of San Francisco, (1975) 48 Cal. App. 3d 584.*
>
> ***Discussion:*** *This section is a codification of case law dealing with the standards for adequacy of an EIR. In Concerned Citizens of Costa Mesa, Inc. v. 32nd District Agricultural Assoc. (1986) 42 Cal. 3d 929, the court held that "the EIR must contain facts and analysis, not just the agency's bare conclusions or opinions." In Browning-Ferris Industries of California, Inc. v. San Jose (1986) 181 Cal. App. 3d 852, the court reasserted that an EIR is a disclosure document and as such an agency may choose among differing expert opinions when those arguments are correctly identified in a responsive manner. Further, the state Supreme Court in its 1988 Laurel Heights decision held that the purpose of CEQA is to compel government at all levels to make decisions with environmental consequences in mind. CEQA does not, indeed cannot, guarantee that these decisions will always be those which favor environmental considerations, nor does it require absolute perfection in an EIR.*

The position of the commenter seems to be that if any information is provided that contradicts a conclusion reached by the Plan Submitter or CAL FIRE, that the entire conclusion is invalid. This simply cannot be the case. CAL FIRE has an obligation to explain the rationale for approving a plan. This is often done in the presence of contradicting information. A competent CEQA analysis is not required to make the “best” choice, but the choice made must be supported by information contained within the record. This is where Lead Agency discretion comes into play. CAL FIRE ultimately bears the responsibility for making a decision and, when presented with public comments, is expected to provide an answer to significant questions raised.

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exercised by him or her in administering these Rules.

Another expressed concern is over the extent to which the plan, and by extension CAL FIRE, discusses effects that are not deemed to be significant. CEQA provides guidance on how to address impacts within 14 CCR §15130:

15130. DISCUSSION OF CUMULATIVE IMPACTS

(a) An EIR shall discuss cumulative impacts of a project when the project's incremental effect is cumulatively considerable, as defined in section 15065 (a)(3). Where a lead agency is examining a project with an incremental effect that is not "cumulatively considerable," a lead agency need not consider that effect significant, but shall briefly describe its basis for concluding that the incremental effect is not cumulatively considerable.

(1) As defined in Section 15355, a cumulative impact consists of an impact which is created as a result of the combination of the project evaluated in the EIR together with other projects causing related impacts. An EIR should not discuss impacts which do not result in part from the project evaluated in the EIR.

(2) When the combined cumulative impact associated with the project's incremental effect and the effects of other projects is not significant, the EIR shall briefly indicate why the cumulative impact is not significant and is not discussed in further detail in the EIR. A lead agency shall identify facts and analysis supporting the lead agency's conclusion that the cumulative impact is less than significant.

(3) An EIR may determine that a project's contribution to a significant cumulative impact will be rendered less than cumulatively considerable and thus is not significant. A project's contribution is less than cumulatively considerable if the project is required to implement or fund its fair share of a mitigation measure or measures designed to alleviate the cumulative impact. The lead agency shall identify facts and analysis supporting its conclusion that the contribution will be rendered less than cumulatively considerable.

(b) The discussion of cumulative impacts shall reflect the severity of the impacts and their likelihood of occurrence, but the discussion need not provide as great detail as is provided for the effects attributable to the project alone. The discussion should be guided by the standards of practicality and reasonableness, and should focus on the cumulative impact to which the identified other projects contribute rather than the attributes of other projects which do not contribute to the cumulative impact. The following elements are necessary to an adequate discussion of significant cumulative impacts:

(1) Either:

(A) A list of past, present, and probable future projects producing related or cumulative impacts, including, if necessary, those projects outside the control of the agency, or

(B) A summary of projections contained in an adopted local, regional or statewide plan, or related planning document, that describes or evaluates conditions contributing to the cumulative effect. Such plans may include: a general plan, regional transportation plan, or plans for the reduction of greenhouse gas emissions. A summary of projections may also be contained in an adopted or certified prior environmental document for

such a plan. Such projections may be supplemented with additional information such as a regional modeling program. Any such document shall be referenced and made available to the public at a location specified by the lead agency.

(2) When utilizing a list, as suggested in paragraph (1) of subdivision (b), factors to consider when determining whether to include a related project should include the nature of each environmental resource being examined, the location of the project and its type. Location may be important, for example, when water quality impacts are at issue since projects outside the watershed would probably not contribute to a cumulative effect. Project type may be important, for example, when the impact is specialized, such as a particular air pollutant or mode of traffic.

(3) Lead agencies should define the geographic scope of the area affected by the cumulative effect and provide a reasonable explanation for the geographic limitation used.

(4) A summary of the expected environmental effects to be produced by those projects with specific reference to additional information stating where that information is available; and

(5) A reasonable analysis of the cumulative impacts of the relevant projects. An EIR shall examine reasonable, feasible options for mitigating or avoiding the project's contribution to any significant cumulative effects.

(c) With some projects, the only feasible mitigation for cumulative impacts may involve the adoption of ordinances or regulations rather than the imposition of conditions on a project-by- project basis.

(d) Previously approved land use documents, including, but not limited to, general plans, specific plans, regional transportation plans, plans for the reduction of greenhouse gas emissions, and local coastal plans may be used in cumulative impact analysis. A pertinent discussion of cumulative impacts contained in one or more previously certified EIRs may be incorporated by reference pursuant to the provisions for tiering and program EIRs. No further cumulative impacts analysis is required when a project is consistent with a general, specific, master or comparable programmatic plan where the lead agency determines that the regional or areawide cumulative impacts of the proposed project have already been adequately addressed, as defined in section 15152(f), in a certified EIR for that plan.

(e) If a cumulative impact was adequately addressed in a prior EIR for a community plan, zoning action, or general plan, and the project is consistent with that plan or action, then an EIR for such a project should not further analyze that cumulative impact, as provided in Section 15183(j).

Note: Authority cited: Sections 21083, 21083.05, Public Resources Code. Reference: Sections 21003(d), 21083(b), 21093, 21094 and 21100, Public Resources Code; Whitman v. Board of Supervisors, (1979) 88 Cal. App. 3d 397; San Franciscans for Reasonable Growth v. City and County of San Francisco (1984) 151 Cal.App.3d 61; Kings County Farm Bureau v. City of Hanford (1990) 221 Cal.App.3d 692; Laurel Heights Homeowners Association v. Regents of the University of California (1988) 47 Cal.3d 376; Sierra Club v. Gilroy (1990) 220 Cal.App.3d 30; Citizens to Preserve the Ojai v. County of Ventura (1985) 176

> *Cal.App.3d 421; Concerned Citizens of South Cent. Los Angeles v. Los Angeles Unified Sch. Dist. (1994) 24 Cal.App.4th 826; Las Virgenes Homeowners Fed'n v. County of Los Angeles (1986) 177 Cal.App.3d 300; San Joaquin Raptor/Wildlife Rescue Ctr v. County of Stanislaus (1994) 27 Cal.App.4th 713; Fort Mojave Indian Tribe v. Cal. Dept. Of Health Services (1995) 38 Cal.App.4th 1574; Santa Monica Chamber of Commerce v. City of Santa Monica (2002) 101 Cal.App.4th 786; Communities for a Better Environment v. California Resources Agency (2002) 103 Cal.App.4th 98; and Ass'n of Irritated Residents v. County of Madera (2003) 107 Cal.App.4th 1383.*

When an analysis has determined that the impacts are less than significant, a detailed discussion is not required and an abbreviated explanation is acceptable.

The Value of Cited Literature:

Proponents and opponents of a project often use literature to support their positions. It is CAL FIREs responsibility to evaluate this literature to determine how applicable it may be to the proposed project. In doing so, CAL FIRE must dispassionately and thoroughly review the submitted materials to understand what is, and often is not, being said, supported or hypothesized as part of the work. All too often, individuals assign significance to a study far beyond what is appropriate, in exceedance of prudence and even the author's intentions. It is valuable to consider each study as a reference point in a larger picture, never placing too much weight on any one paper. Doing so places too high a burden on the scientific method, which is designed to be a journey as opposed to a destination.

CAL FIRE is not in the business of directly refuting or dismissing concerns either pro or con. On the contrary, CAL FIRE is responsible for evaluating the proposed plan within the context of the available information (Record) and making a determination of impacts. This decision is made without regard to the popularity of such a decision, nor with prejudice to the information presented by those who disagree with the position. CAL FIRE must weigh the available information and determine whether to approve or deny an individual plan. This decision does not prejudice CAL FIRE against making a different determination on a different plan with similar concerns, nor does it obligate us to continue future actions if it is determined that incomplete or faulty information was relied upon. Each project stands on its own merits, and every decision is unique to that plan.

When the public provides arguments and evidence to impeach the credibility of the plan or its conclusions, it is appropriate that CAL FIRE respond. When necessary, it is further appropriate to explain how the information was unpersuasive or not applicable. In this, the Lead Agency has deference, but must proceed in a manner prescribed by law. 14 CCR §1037.4 provides little clarification on what response is to be given, saying merely that CAL FIRE must "*respond in writing to the issues raised*". Under PRC §15132(d), we are provided the additional direction of "*The responses of the Lead Agency to significant environmental points raised in the review and consultation process."* Ultimately, there is no clear direction on the extent and nature of the response, although it appears prudent to follow the pattern that CAL FIRE has used in this and other responses.

When it comes to literature that is specific to the larger Battle Creek area, it is the opinion of CAL FIRE that this is predominantly “results-focused” research. In other words: the study designers are creating experiments to return conclusions favorable to their preconceived position. While it may sound disparaging, this is not the intent of the statement. Rather, it is a realization that CAL FIRE must accept that both SPI and the Battle Creek Alliance are sponsoring and promoting research that they believe are favorable to their base positions. There is undoubtedly value to be found in the scientific work being conducted, but the conclusions drawn from that data must recognize the context within which it was sponsored.

Although not discussed in this response, issue could be taken with research and literature referenced by the Plan Submitter. In the case of this plan, however, it is unnecessary to highlight these issues since no one or cumulative source of information would change the decision that CAL FIRE has ultimately reached on this plan. It is the weight of the evidence within the entire record, not a few items, that forms the basis for the decision.

In this response, specific comments and notes are provided for literature submitted as public comment where appropriate. This is justifiable since the concerns are presented in an attempt to impeach the credibility of the Plan Submitters position. It is reasonable, therefore, for CAL FIRE to provide a response as to why, or why not, the information is persuasive. While this could be interpreted as dismissive, this is not intended to indicate that the information provided is without merit, false or misleading. Also, this same information could be viewed differently with respect to another proposed harvesting plan.

Requirement to augment the record

In addition to information provided by the Plan Submitter and Public Commenters, CAL FIRE is also responsible for considering additional information and adding it to the plan record. This requirement is specified in 14 CCR §898 ”*The Director shall supplement the information provided by the RPF and the plan submitter when necessary to ensure that all relevant information is considered.*“ Sometimes this information is discovered while reviewing submitted literature and other information is added when the reviewer believes it is relevant to the discussion.

About Agency “Activism” (Agency Prohibited from creating “underground regulations”)

Another theme is that CAL FIRE should take an activist role in steering plan submitters towards, or in this case away from, certain actions that the comment writer deems deleterious to the natural environment. To do so would be contrary to our purpose and entirely outside of our jurisdictional authority. The plan submitter is responsible for proposing plans consistent with their objectives and CAL FIRE is responsible for determining whether or not the operations as proposed would cause a significant adverse effect on the environment. How an individual THP may or may not align with state goals or other non-regulatory targets is not a factor we can consider when making such a determination.

In fact, if CAL FIRE was to impose a standard not required by regulation, we would likely be found to have created an "underground regulation[12]" and would be open to legal challenge.

Presumed Competency

The THP review process is built upon the fundamental presumption that a plan filed by CAL FIRE is "accurate, complete and in proper order" (14 CCR §1033) and that the individuals who prepared the plan are competent to submit the work product to CAL FIRE (see also PRC §752). Without this base assumption, the review of THPs would take as long, or perhaps longer, than the THP took to be developed. Such a process, taking months or years for agency staff to complete, is entirely contrary to the intent of the FPA and FPRs. Instead, the THP and the work completed by the RPF is presumed to be correct, unless information casts doubt on that assessment. Administrative and field review of plans is designed to validate the information provided by the RPF to the extent feasible, within the time constraints provided in the Act and Rules. Field review, in particular, can only visit a portion of the plan area unless problems are discovered that would require more extensive review. In those circumstances, it is more likely that CAL FIRE would recommend a plan for denial, due to the presence of extensive issues requiring detailed assessment.

Evaluation of Literature from the Greater Battle Creek Area

Compared to other areas in California, the larger Battle Creek watershed contains a great deal of literature, investigations, studies and expert analysis. In order to place them all within some form of context, CAL FIRE has decided to place them within a single discussion.

Documents in this Review

Year	Document
2001	Aquatic Condition Report for the Upper Battle Creek Watershed (USDA, 2001) (THP pages 374-389)
2011	California Sportfishing Protection Alliance (CSPA) review of BCA sampling (CSPA, 2011)
2011	A Rapid Assessment of Sediment Delivery from Clearcut Timber Harvest Activities in the Battle Creek Watershed, Shasta and Tehama Counties, California (THP Pages 439-508) (CNRA, 2011)
2012	Cumulative Watershed Effects of Timber Harvest and Other Activities Battle Creek Watershed, Northern California (Myers, 2012)
2012	*Ponderosa Fire*
2015	USFWS Memo - Increase in fine sediment in South Fork Battle Creek (USFWS, 2015)
2016	2015 Battle Creek Watershed Hydrology and Sediment Assessment (Jameson, 2015) (AKA, "Henkle")
2017	Summary of South Fork Battle Creek Fine Sediment Evaluation Survey (USFWS, 2017) (THP Pages 409-418)
2017	Ponderosa Way Road Assessment and Sediment Reduction Plan (Pacific Watershed Associates, 2017)
2017	2017 Pacific Watershed Associates Ponderosa Way Assessment and Sediment Reduction Plan (Pacific Watershed Associates, 2018)

[12] https://oal.ca.gov/underground_regulations/

2018	SPI Bioassessment and Water Quality for the South and North Forks of Digger Creek (James C. , 2018) (THP Pages 426-438)
2018	Road Erosion and Delivery Index (READI): A Model for Evaluating Unpaved Road Erosion and Stream Sediment Delivery (Benda, 2019) (THP Pages 509-534)
2018	Turbidity Responses from Timber Harvesting, Wildfire, and Post-Fire Logging in the Battle Creek Watershed, Northern California (Lewis, 2018)
2019	Monitoring Adult Chinook Salmon, Rainbow Trout, and Steelhead in Battle Creek, California from March through November 2017 (Bottaro R. &., 2019)
2019	Battle Creek Watershed Stream Condition Monitoring 2012-2017 (THP Pages 535-569) (Tussing, 2019)
2019	Battle Creek Watershed Based Plan (Version 2019 May) (Battle Creek Watershed Conservancy, 2019)
2020	Monitoring Adult Chinook Salmon, Rainbow Trout, and Steelhead in Battle Creek, California, from March through November 2018 (Bottaro R. a., 2020)
2020	Digger Creek Tributaries Water Quality and Road Erosion Report (THP Pages 570-587) (James C. , 2020)

Aquatic Condition Report for the Upper Battle Creek Watershed

This US Forest Service study was initiated by the Battle Creek Watershed Conservancy to study the condition of the watercourses in the upper reaches of the Battle Creek HSA under federal ownership. These stream reaches are all upstream of SPI holdings.

Specific to this plan, both the North and South Forks of Digger Creek were evaluated. 19 individual stream reaches for a total of 10,100 meters (33,136 feet) were examined.

Table 3.- List of streams inventoried in the upper Battle Creek watershed.

Stream	Watershed	No. of Reaches	Survey Length (meters)
Martin	South Fork	5	3500
Trib to Martin	South Fork	3	1300
Nanny Creek	South Fork	3	2500
Summit Creek	South Fork	6	3300
Trib # 1 to SF Battle	South Fork	1	900
Trib #2 to SF Battle	South Fork	2	1300
Panther	South Fork	3	1350
Dry Lake Outlet	South Fork	2	800
Dry Lake Trib "A"	South Fork	2	900
SF Digger	North Fork	9	4800
NF Digger	North Fork	10	5300
South Fork Bailey	North Fork	4	2500
North Fork Bailey	North Fork	5	3000
Manzanita	North Fork	5	2700
NF Battle	North Fork	6	3900
Total		66	38050

With the exception of the North and South Forks of Digger and Bailey Creeks, all streams inventoried had more than 50 square meters of sediment sources for every 100 meters of channel (figure 2). Survey notes indicate that the majority of sediment sources recorded are related to natural bank failures and landslides attributed to the January 1997flood.

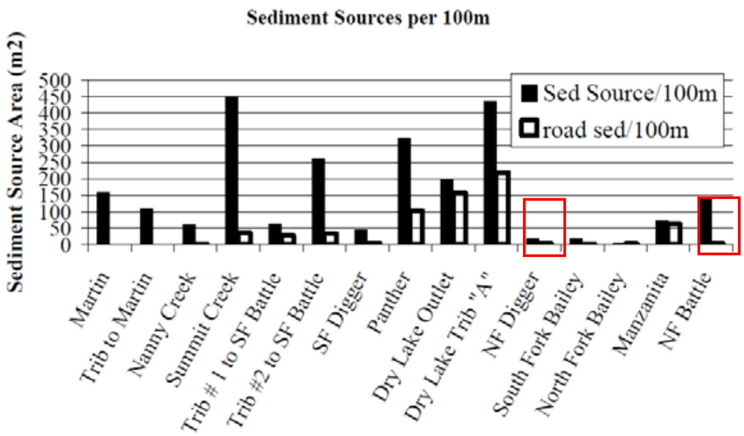

Figure 2.- Sediment source areas for upper Battle Creek tributaries. Total sediment source and road related sediment source areas are shown.

The report notes sedimentation concerns with roads and crossings that are under federal or state control:

> *Near-stream road assessment*
> *<u>Field surveys inventoried near stream roads and evaluated their erosion potential. Many crossings in the watershed are existing sources of sediment.</u> Notable in this regard are the crossing of Summit Creek by Forest road 29N64, the crossing of Nanny Creek by Forest road 29N22, the crossing of South Fork Bailey Creek meadows by road 31N12, and the crossing of upper Panther Creek by Forest road 29N21YA, the crossing of SF and NF Digger, and SF Bailey by the 17 road, and Highway 44 where it parallels Manzanita Creek. Flow was diverted down the roadway and over unprotected fill slopes by the 1997 storm at the Summit and Nanny Creek sites, and potentially at the streams crossing the 17 road. Additionally, the crossing of Summit Creek by Forest road 29N60 has historically acted as a barrier to the passage of bedload*
>
> *Discussion*
> *Generally, all the streams inventoried are in good condition. Aquatic habitat has been negatively affected by site problems at several locations; <u>most of these problems are road related.</u> Although a few streams have high fines, levels in Battle Creek tributaries, as a whole, compare favorably with reference streams throughout California. Streams with average fines exceeding 10% include Trib to SF Battle #2 (22% pool tail fines), SF Digger (15% fines), Dry Lake Outlet (43% fines), Dry Lake Trib "A" (11% fines), SF Bailey (29% fines), Manzanita (58% fines), and NF Battle (17% fines).*
>
> *In-channel large wood and large wood recruitment both rated high across the analysis area. A few reaches were low in large wood and recruitment. Two cases, Manzanita Creek, and Tributary to Martin Creek, were related to a wildfire. At Panther Creek, extensive timber harvest had depleted the amount of near stream wood. At Summit Creek, reach # 6, log landings had been placed near the stream. Along the upper reaches of SF and NF Digger the stream is within a meadow. Large wood in the channel appears to represent a natural range of variability. On a reach scale, stream shade varied from low to high, but was generally high across the analysis area. There do not seem to be any problems with stream shade that would result in any negative affect on water temperature.*
>
> *Most streams had stable banks. Response reaches (upper forks of Digger Creek and Bailey*

> *Creek) are heavily vegetated, with high water tables and undercut banks. Stream with the lowest bank stability are Martin, Tributary # 2 to SF Battle, lower SF Digger, and lower NF Digger. Bank stability at Tributary #2, SF Battle, lower SF and NF Digger was high immediately below road crossings but improved on the upstream side.*
>
> *…*
>
> *Roads affect stream condition by accelerating erosion, increasing sediment delivery to streams, and by altering channel morphology (Furniss et al. 1996). Poorly designed roads can prevent or restrict fish migration of both juvenile and adult salmonids (Furniss et al. 1996). Culverts are the most common migration barriers associated with roads. Several culverted stream crossings in the upper watershed may pose migration barriers to salmonids (Powers and Orsborn, 1985). The most notable are the concrete box culverts where Nanny and Martin Creek cross Highway 36. Potential barriers also exist along Forest road 31N17 at the North and South Fork Digger Creek, and Bailey Creek stream crossings. It is difficult to assess the degree to which culverts in the analysis area restrict fish migration without formal fish passage assessments at each fish-bearing stream crossing.*

California Sportfishing Protection Alliance (CSPA) 2011 Letter:

CSPA reviewed data from the Battle Creek Alliance and provided findings based upon this data. The reviewers claimed that the observed increase in turbidity violated water quality standards and attributed those violations to increased clearcut harvesting:

> *CSPA has reviewed the data from the Battle Creek Alliance monitoring program (Four-Creeks) and find evidence of adverse changes in water quality conditions attributable to clear-cutting activities, and numerous and continuous exceedances of the turbidity Water Quality Standards in the Regional Water Quality Control Plan (Basin Plan). See Attachment 1.*

The authors do not explain how they arrived at the direct link between observed water quality and clearcutting, other than the change in silviculture observed on the landscape. The sheer size of the drainage area involved make singling out any one source problematic, especially considering the sampling sizes. This is further explained below.

> *Data Analysis*
>
> *For this review CSPA looked for comparable data from unaffected streams and we looked for comparable turbidity data from the same watershed. We found no published data for these four creeks at any time. We did find published data and references to miscellaneous data for the period 1955 through 2002 for Battle Creek and some other tributaries. Most of the historical data is collected more than 10 miles downstream of the Four-Creek project. A single, 18 month daily record of turbidity was data collected and published by U.S Fish and Wildlife Service (FWS) at the Coleman fish hatchery on Battle Creek (see Attachment 2). The FWS covers the period from September 1999 to February 2001. While the two data sets represent the same approximate duration (≈ 1.5 years) the FWS data set consists of daily measurements in contrast to the Four-Creek data set that consists a 10% sampling of the time span.*

From outward appearances, these two datasets appear dissimilar.

> *If we use this general characterization, we can infer that given equal conditions, the Four-Creeks*

water quality should have lower turbidity than the downstream data. But, the data shows the opposite, strongly suggesting changed conditions for the upstream environment. This points directly at the likely impacts from the clear-cutting in the Four-Creeks watershed.

Tying observed impacts to a single cause can be problematic, especially in the absence of an environment where single variables can be isolated.

As part of the 2011 Battle Creek Rapid Assessment, the Central Valley WQCB reviewed this information and provided the following:

The Battle Creek watershed is, like many foothill communities in the Sierras and Cascades, subject to multiple uses such as; grazing, farming, vineyard conversion, timber harvesting, recreation, illegal marijuana plantations, county roads, rural residential, etc. This makes tracking impacts to water quality from one single activity a challenge. We are inspecting a wide-variety of activities in the watershed and putting together a plan for immediate and future actions.

Further on in their report they offer the following with respect to the CSPA review:

Staff reviewed the CSPA data analysis of Ms. Woodhouse's data and we wish to advise caution in relying on the data to prove that a single land use is creating water quality impacts in the Battle Creek watershed. However, the data is certainly useful for providing a basis for trend monitoring, and does provide some direction for prioritizing and directing our field inspections, as noted above.

Clearly, the data provided by Ms. Woodhouse is not conclusive. Nor, as your letter states, will the analysis of data collected by SPI on Bailey Creek be conclusive. You rightly acknowledge the limitations of data collected in one sub-watershed being applicable to all the other sub-watersheds within the larger Battle Creek watershed.

Ms. Woodhouses' data indicates that several sampling locations are potentially being subject to increased turbidity. Our field inspections confirm that sediment is being transported from a variety of sources, most of which are related to roads, both private and county-owned.

During timber harvest plan review and field inspections, we specifically analyze roads and watercourse crossings as roads are the most common and dominant sources of sediment related to timber harvest activities. Whenever a road is located too close to a watercourse, or the opportunities for drainage placement to control discharge to a watercourse are limited, management measures are put in place to remove or re-route those roads or otherwise address the sediment transport issue. Over the past ten years our records indicate that over 18 miles of roads on SPI lands, many of which presented a threat to water quality, have been removed from the network. In many cases, new roads with modern design standards were built in more appropriate areas within the landscape to better protect water quality but still provide access for landowner management and fire suppression efforts. Further efforts to improve roads on private timber lands may be needed, once our assessment of the situation is completed.

The road network in the larger Battle Creek watershed is comprised of a combination of legacy and new roads, owned by the federal government, the counties (Tehama and Shasta) and private landowners. The Central Valley Water Board will be communicating with the Lassen National

Forest and both Tehama and Shasta Counties, regarding the need to improve the road networks in the larger Battle Creek watershed.

A Memo was also produced by CVWQCB staff assessing the data itself:

In general, Central Valley Water Board staff found many of the assertions regarding timber harvest-induced turbidity violations made by CSPA are not supported by the available data. Furthermore, staff has extensive field experience within the Battle Creek Watershed, and found that the assumptions of the CSPA analyses did not reflect the types of physical processes operating in the Battle Creek Watershed. General issues related to the analyses are briefly summarized as the following:

- *No consideration given for minimum detectable effects;*
- *No information provided regarding potential measurement errors;*
- *No control for spatial variability in turbidity in the analyses;*
- *No control for temporal variability in turbidity in the analyses;*
- *Analyses assumptions did not reflect the types of watershed processes governing turbidity patterns in Battle Creek drainage;*
- *No linkage of monitoring results to beneficial use impairment.*

…

Upland streams are closely coupled to spatially and temporally variable hillslope sediment sources, and can receive episodic and chronic sediment from both natural and anthropogenic sources of sediment (e.g., mass wasting, raveling, bank erosion, soil creep, etc.) (MacDonald and Coe, 2007). Hence, inputs of sediment can result in increased turbidity and these turbidity plumes readily move in the downstream direction. As the turbidity plume moves downstream it is subject to dilution from potentially clear water tributaries, and the larger sediment size fractions in the turbidity plume are subject to storage in the lee of roughness elements (e.g., large boulders) and in large woody debris dams. As a result, suspended sediment/turbidity plumes are often attenuated in the downstream direction, with a resultant decrease in turbidity (Sullivan, 1995; MacDonald, 1992; MacDonald and Coe, 2007). CSPA's assumptions regarding increases in turbidity in the downstream direction might apply to comparisons between Battle Creek and the lower reaches of the Sacramento River, but their assumptions regarding watershed processes (e.g. downstream fining) does not apply to comparisons between the upper and lower reaches of Battle Creek.

CSPA contends that the turbidity exceedances pose a threat to the ongoing salmonid restoration project in the watershed. As such, it is important to compare the Four Creeks dataset with known turbidity exposure-response relationships for salmonids. A frequently used exposure-response relationship is the one documented by Sigler et al. (1984). This is also frequently cited as one of the lowest thresholds for salmonid response. Their laboratory study showed that as little as 25 NTUs of turbidity over a 14-day duration caused a reduction in steelhead and coho salmon growth. Figure 4 shows how the Four Creeks data relates to this turbidity threshold, and cumulative frequency analysis indicates that 97.6% of the 549 samples fall below the 25 NTU threshold. In fact, 60% percent of the data was below 5 NTU – the level of turbidity imperceptible by the human eye.

The Basin Plan states "that achievement of the [water quality] objectives depends on applying them to controllable water quality factors." The turbidity differences in the CSPA analyses are *likely to be reflections of the spatial, temporal, and measurement-related sources of variability inherent with monitoring turbidity. Staff finds natural variability to be an uncontrollable, rather than controllable, factor.*

It appears that even using the CSPA information prima facie, the values do not rise to a level at which negative impacts to salmonids could be expected. The CVWQCB did provide an assessment of the value of this data set to the overall understanding of Battle Creek:

Uses of the Four Creeks Dataset
The Central Valley Water Board staff sees value in the data collected by the Battle Creek Alliance in that it offers a limited view of the status of turbidity in the Battle Creek watershed. For example, of the 549 samples collected, 97.6% percent of the samples were below the lower turbidity threshold for stressing salmonids commonly used in the literature (i.e., 25 NTUs) (Sigler et al., 1984). Overall, the mean and median turbidity of the Four Creeks dataset was 6.0 and 3.8 NTUs, respectively. These levels are generally imperceptible to the human eye. As such, the dataset indicates a relatively low exposure of salmonids to stressing levels of turbidity, and relatively low turbidity overall (Figure 5).

The Four Creeks dataset does provide some spatially explicit information into potential water quality problems in the watershed. For example, the Four Creeks dataset indicates that the Canyon Creek monitoring stations (i.e., CC, CC2, and CCC) have elevated turbidity levels relative to the other monitoring stations. Field inspection of the Canyon Creek watershed indicates significant sediment delivery from the county maintained Rock Creek Road, which parallels Canyon Creek for much of its length (Figure 6a and b). All the Canyon Creek monitoring stations showed direct evidence of fine-grained sediment delivery from the Rock Creek Road, which likely accounts for the elevated turbidity at all three stations. A private in-holding within the Canyon Creek watershed also allows grazing, with evidence of livestock grazing in the channels (Figure 6c). No sediment plumes or erosion features were observed coming directly off the nearby clearcuts. These observations indicate that sediment sources other than clearcuts might be resulting in the elevated turbidity at the Canyon Creek monitoring stations.

A field examination of the sites showing increased turbidity found the causes to be County roads and grazing on nonindustrial timberlands to be the source of the elevated sediment. This information plays a role in the understanding of Battle Creek and has been included in the decision making process for this plan.

A Rapid Assessment of Sediment Delivery from Clearcut Timber Harvest Activities in the Battle Creek Watershed, Shasta and Tehama Counties, California (2011)

Executive Summary:
The Battle Creek Salmon and Steelhead Restoration Project is a cornerstone for the recovery of listed salmonid species in the Sacramento Valley, northern California. The spring-dominated, relatively cold waters of Battle Creek provide important potential refugia for salmon and steelhead in the event of rising global temperature. As restoration activities focus on the removal of downstream barriers for salmonid migration, much of the headwaters of Battle Creek are being managed for high-yield timber production by the largest private landowner in the watershed – Sierra Pacific Industries (SPI). SPI's use of clearcutting, coupled with the rate of

harvest in the upper watershed, has alerted local environmental stakeholders to the potential for water quality impacts from these harvest practices. These concerns have garnered State-wide attention with the recent publishing of several stories in the Sacramento Bee detailing the potential for clearcut- related impacts to the success of the restoration in Battle Creek. In response to public concern, staff from the Timber Harvesting Plan (THP) Review Team agencies formed the interagency Battle Creek Task Force (Task Force). The Task Force performed a rapid assessment to determine if timber operations associated with SPI clearcut harvesting in Battle Creek had resulted in observable erosion and subsequent delivery of sediment which has resulted in violation of state law or observable negative impact to fisheries.

Over a five-day field period in September 2011, the Task Force assessed the potential for water-quality impacts at 135 sites they determined to have a high risk for sediment delivery to waters of the state. Of these sites, 55 were clearcut harvest units, 39 were road crossings of watercourses, 24 were watercourse-adjacent road segments, 6 were watercourse-adjacent landings, 5 were tractor crossings of watercourses, and 3 were associated with other sources of erosion. Despite assessing approximately 16 miles of riparian buffers directly adjacent to clearcut harvest units (i.e., 47 percent of the total buffer-zone length adjacent to harvested clearcuts), the Task Force only found one instance of low-magnitude sediment delivery (less than 1 cubic yard) directly associated with a clearcut. However, sediment delivery associated with this site resulted from a Forest Practice Rules (FPRs) violation (encroachment of a tractor into an equipment- limitation zone adjacent to a watercourse), rather than from erosion generated within the adjacent clearcut unit.

The Task Force field study found the likelihood of sediment delivery in the assessment area to be highest for tractor crossings, road crossings, watercourse-adjacent road segments, and watercourse-adjacent landings, respectively. All 5 tractor crossings delivered sediment, but were generally delivering only a low-magnitude of sediment to waters of the state. Road crossings and watercourse-adjacent road segments delivered sediment 69 percent and 67 percent of the time, respectively. The magnitude of sediment delivery from road crossings and watercourse-adjacent road segments with implemented Best Management Practices (BMPs) was generally low or unobservable.
The highest magnitudes of sediment delivery from roads were associated with poor BMP implementation (e.g., poor road drainage) and/or poor location (e.g., road segments within 30-50 feet of a watercourse). Poor BMP implementation was commonly associated with county-managed roads or SPI-managed roads with public access. Watercourse-adjacent landings associated with recent Timber Harvesting Plans (THPs) delivered no sediment, and the lack of delivery was attributed to the protective ground cover provided by application of a wood–chip mulch.

Overall, the Task Force saw no significant direct water quality impact related to clearcut harvesting in the assessment area. Most observed timber-harvest-related water-quality impacts were found to be associated with publicly and privately managed roads. These roads are used for all types of timber harvesting in the watershed, whether clearcutting, selection, or some intermediate silvicultural method. Due to the limited time period of the assessment, the Task Force was unable to evaluate the potential for indirect water- quality impacts that may result from clearcut harvesting (such as possible increases in suspended sediment and turbidity associated with logging-induced increases in peak flows). Recommendations developed by the Task force are provided herein to improve the water-quality-related performance of forest roads

> *and to further evaluate the potential for logging-induced water quality impacts in the Battle Creek watershed*

Additional discussion of this report is also included in Jameson 2015, below.

Cumulative Watershed Effects of Timber Harvest and Other Activities Battle Creek Watershed, Northern California

Dr. Tom Myers prepared this report to complete a cumulative watershed effects study for the larger Battle Creek watershed, and develop a conceptual flow model to predict responses to future logging. This study used existing data available within the watershed from multiple sources. No data was collected by Myers during the study and direct observations were limited to a one day visit described by the author as a "windshield study". The author disagreed with the findings made by the Interagency Task Force (CNRA, 2011). It is worth noting that Myers spent one day conducting a "windshield study" while the Task Force spent 5 days in the field collecting data for their rapid assessment.

The purpose of the report was to study the link between increased management and watershed effects:

> *This study completes a cumulative watershed effects (CWEs) study of the watershed, in an attempt to identify areas that are being most affected by logging.*

CAL FIRE finds this approach somewhat presumptive and is consistent with the results-focused nature of some of the research being conducted in Battle Creek (See also the discussion on "The Value of Cited Literature").

The author ultimately concludes that "There is too little data on the watershed to necessarily make informed decisions about future watershed management." This is a common theme even in the more recent studies of the Battle Creek watershed.

The Ponderosa Fire begins on August 8, 2012

July 20, 2015 USFWS Memo

This memo provides documentation of increased fine sediment and reduced spawning habitat in South Fork Battle Creek and attributes it to *the August 2012 Ponderosa Fire, subsequent salvage logging and other forest management practices, and highly precipitous 'Atmospheric River' rain events in December of 2012 and 2014 within the Battle Creek watershed*.

2015 Battle Creek Watershed Hydrology and Sediment Report. Prepared for the Central Valley Regional Water Quality Control Board

This study appears to be the first attempt to examine impacts and trends at the scale of the larger Battle Creek watershed. It works to establish some baseline conditions and outlines informational deficiencies and needs required to establish long term monitoring and trend information.

Excerpts:

Executive Summary:

When available in the proper abundance and composition, sediment is a key component for healthy aquatic habitat affecting ecosystem functions. However, when present in excess, sediment can impair water quality, ruin aquatic habitat, and even cause acute and/or chronic illnesses in aquatic organisms. As a result, catchments subjected to historic and on-going anthropogenic impacts should be outfitted with a nested array of water discharge and sediment flux monitoring stations to track conditions. <u>When collected over sufficient duration, water and sediment data from a nested array may be used to ascertain baseline and impacted conditions relative to standards established for different water quality criteria and ecological functions.</u>

Sediment dynamics in the Battle Creek watershed were investigated through review and re-analysis of historic studies and their data sets, in combination with data obtained through the field operations of the current study. Existing information was reviewed in terms of landscape attributes, anthropogenic changes, natural disturbances, hydrology, sediment, geomorphology, and management actions. In addition, all available water and sediment data were analyzed to yield updated results and new findings about hydrology and sediment flux. <u>Based on this historical analysis and pilot scale monitoring of water and suspended sediment conducted by the authors during 2015, it was determined that there is a near total lack of data to support sediment impact assessment methods. Although a limited amount of information is available to track benthic macroinvertebrate species abundance and diversity as a water quality indicator, overall, this study found that wholly insufficient data exists to perform any existing method of sediment impact assessment. Thus, the status of the watershed is largely unknown.</u>

<u>Suspended sediment was found to be highly suitable for monitoring in Battle Creek using traditional methods to ascertain the central tendency of sediment flux processes.</u> For example, the data show that a small number of very large storm events can dominate the total annual sediment flux. Also, the spatial distribution of precipitation patterns in Battle Creek produces unique responses in streamflow and sediment transport for the South and North Forks of Battle Creek, even though they are adjacent. <u>Comparing data collected in 2015 to historical data yielded some contradictory findings. Suspended sediment concentration was found to be generally similar today as in the past for any given discharge, except perhaps at the highest discharges for which few samples exist among all years of data collection. However, the total sediment load observed in 2015 was notably higher than in the past for similar flow regimes. More data needs to be collected and more consistently through time to arrive at firm conclusions.</u>

In this study 14 different scenarios were evaluated to isolate the individual effects of each contributing factor and see how they work together in combination. <u>The final scenario, Model 14, reveals the best comprehensive analysis of the cumulative effects of all factors during wet season conditions to reveal the complex yet organized spatial pattern of landscape processes. This analysis shows that sheet wash erosion is widely occurring in Battle Creek as a result of the soils that are present. Depending on soil conditions locally, wildfire can substantially increase the area of sheet wash as well as initiate gullying.</u> The results also show that landsliding is an important concern for South Fork Battle Creek especially, but is also something that should be evaluated for sections of North Fork and mainstem Battle Creek, as revealed in the maps provided in this report<u>. In the absence of extensive monitoring data, this analysis may be used to guide management in the near term, but into the future it is best utilized as a hypothesis that</u>

subsequent field observation can evaluate to reveal the opportunities and constraints of such geospatial analysis in reality. Nevertheless, today models are widely used to aid environmental management and this new analysis brings forward novel ideas about landscape processes in Battle Creek for careful consideration.

There is insufficient data at this time to conduct state-of-the-art analyses that go beyond central tendency to explain how climatic, hydrological, and land cover / land use factors control the variation of sediment flux about the expectation – something that has been demonstrated for other watersheds for which longer term suspended sediment data have been collected. A comprehensive monitoring plan is recommended to include a multiscalar approach to suspended sediment monitoring at gages targeting both North Fork Battle Creek (NFBC) and South Fork Battle Creek (SFBC) above, within, and below the perimeter of the Ponderosa wildfire, as well as Mainstem Battle Creek. It is recommended that permanent turbidity monitoring stations be installed at MSBC, NFBC, and SFBC and that suspended sediment grab samples be collected for sediment rating curve development.

3 EXISTING INFORMATION REVIEW

All publicly available information related to water quality in Battle Creek were located, compiled, and summarized. A database of existing information was developed to centralize important documents. A literature review of 59 sources including peer-reviewed journal articles, publications, reports from state and federal agencies, reports from local and private entities, books, and abstracts provides a synopsis of geomorphic processes.

3.5 Sediment and Geomorphology

Multiple studies have addressed fine sediment in Battle Creek with conflicting results. Industry reported turbidity values indicate land-use does not have significant effects on water quality, while environmental and scientific reports interpret land use and cumulative watershed effects as inputs causing erosion and sedimentation. Although there are methodological problems with some of these studies as discussed below, a common conclusion has been that the large event in January 1997 overwhelmed the geomorphology of Battle Creek, with its disturbance sedimentation processes masking the long-term normative effects of upland sources contributing sediment through the system.

3.5.2 Fine Sediment

Sources of fine sediment including roads, timber harvest clearcut units, and logging infrastructure are reported as delivering sediment to streams (Ward and Moberg, 2004; Kier Associates (KA), 2009; Myers, 2012) although these results are in direct conflict with a 2011 rapid assessment performed by Task Force (2011).

The 2001-2002 Battle Creek Watershed Assessment (BCWA) measured fine sediment in scour pool tailouts at 50 sites in the Battle Creek watershed and attempted to relate the differences to watershed-scale factors. Surface fine sediment ≤2 mm was measured at 35 of 50 sites as a result of algae at seven sites and lack of scour pools at eight sites. Ward and Moberg (2004) reported mean percent fine sediment of 31%. Fine sediment conditions at 8 of 35 sites were fully or likely favorable using Ecosystem Management Decision Support (EMDS) models. EMDS models quantify overall biological conditions. EMDS modeling assigns "truth" values returning a measure of certainty that a premise is true or false (Figure 10). Conditions at 22 sites were designated as fully or likely unfavorable using the EMDS criteria. They found no statistically significant relationship linking surface fine sediment to watershed-scale factors, including *elevation, watershed area, roads, precipitation, soils, and land cover. Lack of a positive relationship was interpreted to be due to the overwhelming effect of a large storm in January 1997 that delivered a lot of sediment to the river, purportedly masking the long-term balance of sediment sources and sinks of fine sediment that might be reflected in pool tail outs.*

In 2011, a multiagency special task force was assigned to perform a rapid assessment on sediment delivery from timber harvest activities in the Battle Creek watershed. Over five days, a detailed survey of potential sources and pathways impacting water quality at 135 sites associated with logging operations were evaluated. Sites included 58 clearcut harvest units, 39 road-stream crossings, 6 vehicle and equipment landings, 5 tractor-stream crossings, 24 stream-adjacent road segments, and 3 other sediment sources. Out of 132 sediment source sites associated with streams and swales, they observed:

1) *39% of these sites delivered sediment*
2) *Only one out of 55 clearcut harvest units delivered sediment*
3) *69% of road crossings delivered sediment*
4) *67% of stream adjacent road segments delivered sediment*
5) *100% of tractor crossings delivered sediment*
6) *17% (1/6) of landings delivered sediment*

Results displayed that road crossings and road segments have a higher number of sites contributing sediment than clearcut units, although the volume of sediment was not reported. Lack of sediment production from clearcuts is explained as high surface cover and contour ripping post-harvest. They also credit riparian buffer strips with halting the transport of sediment from harvest units to streams. The impact to downstream fish and aquatic habitat given the relatively low inputs of sediment from clearcut activities was uncertain. Sediment delivery from roads and crossings was found to be a chronic problem that may result in impacts to anadromous fish and their habitats. More extensive monitoring and data collection was recommended to determine the impact of timber harvest activities on fisheries in Battle Creek.

3.5.3 Turbidity
Turbidity has been monitored by SPI and the BCA in recent history. SPI has reported no elevated levels of turbidity due to best management practices, while the BCA has reported extreme effects in turbidity levels. Turbidity is an optical characteristic of water measuring the cloudiness of liquid used as a surrogate for suspended sediment transport. The presentation of results can often be construed to provide evidence for interpretations and should always be viewed with a cautious and inquisitive eye.

3.5.7 Cumulative Watershed Effects
The presence and absence of cumulative watershed effects in Battle Creek have been documented. Of six studies addressing the effects of land use on sediment, three reported a direct relationship while three indicated no directly observed correlations.

Myers (2012) identified CWEs in Battle Creek as primarily arising from timber harvesting, road building, and water regulation resulting in changes in runoff, sediment transport, and turbidity. Removing canopy cover from clearcutting can have effects that alter hydrology, which compound as water moves downstream. Myers posited that Battle Creek may be reaching a threshold at which both runoff and sediment transport could substantially increase. He concluded with the *statement that previous work was inconclusive on the status of the watershed to make informed decisions on future management.*

KA (2003) complimented the 2001-2002 BCWA using spatial data to further analyze potential sediment sources from land-use and management activities. They assessed multiple variables contributing to CWEs, which pose risks for elevated sediment yield. Landsat images were interpreted for upland and riparian areas as a surrogate for timber harvest activities in absence of harvest data. The effect of roads was analyzed using road density, road-stream crossings, and roads near streams on steep slopes. Rain-on-snow events, steep slopes, and wildfire were identified as important sediment sources in this study. KA (2003) posited that timber harvest on private lands where canopy cover was reduced over 25% for a sub-basin were of concern for increased delivery of sediment, particularly in the rain-on-snow elevation band where rhyolitic soils are present. Roads on steep slopes and adjacent to streams were noted as having high erosion potential in Battle Creek. The study suggested that roads and timber harvest might have combined to increase sediment risk, especially given geology and precipitation patterns. Areas covered with rhyolitic soils were the most sensitive to increased erosion where timber harvest occurs and steep slopes are present. Rain-on-snow events were found to have increased erosion potential on timberlands, areas of high road density, and steep slopes. Timber harvest in the region mainly avoided steep slopes and did not seem to combine together as a cumulative effect to exacerbate erosion, although roads on steep slopes can yield cumulative effects.

The condition and factors described above likely do not work independently yet contribute to CWEs. Whereas Ward and Moberg (2004) could not statistically link upland effects with sediment deposited in pool tailouts that are also heavily influenced by local fluvial processes, risk associated with cumulative effects as analyzed by KA (2003) is consistent with compromised aquatic habitat values, given that sediment eroded from uplands move into and through the river system over years to decades. The Task Force (2011) also failed to link timber harvest practices to CWE in the form of sediment delivery to stream channels.

4 EXISTING DATA GAPS

Through a comparison of the range of sediment impact assessment methodologies presented in Section 2.6 and the existing information presented in Section 3 it is evident that very little is known about the physical conditions in Battle Creek and the potential of sediment and geomorphic processes to create impacts on biota and on beneficial human uses. This is especially true in terms of understanding the watershed through time. Although a variety of environmental studies have been done that provide a useful snapshot of conditions, it will be necessary to track conditions over many years in order to get into a position to make firm interpretations and conclusions at some point in the future.

Before describing specific data gaps, one thing that is clear from the existing information review of Battle Creek is that the situation that exists now is not just one of a lack of data, but far more importantly, a lack of a consensus-based conceptualization of the linked physical-biotic system as a whole as well as a framework for monitoring and assessing that system. This is true not just for sediment impacts, but for the broader issues of environmental management within which the topic of sediment comes into play. Further, there has been a lot of anecdotal reporting and ad hoc sampling that can be highly influential to individual stakeholders, but without a transparent and objective framework for analysis, there is no way to know whether concerns are founded or not. Therefore, the most glaring and immediate problem is to develop the conceptualization of the system and a framework for monitoring and assessment.

With regard to sediment specifically, none of the approaches described in Section 2.6 have been implemented yet, nor have any other comprehensive approaches been done.
Apart from the short-term efforts from the existing literature and presented later in this report, there is no systematic sediment monitoring in the watershed. Various stakeholders are performing ad hoc grab sampling and turbidity measurement, which has little to no value when done this way.

Overall, the situation for Battle Creek is not so much one of data gaps, but of a near complete absence of sediment data and sediment analyses, especially within the context of one or more assessment frameworks.

6 SEDIMENT AND WATER QUALITY ANALYSIS
Sediment is a critical component in river systems supporting physical and ecological functions such as providing aquatic habitat (Ryan, 1991), transporting nutrients (Walling et al., 2001), and degrading benthic health when in excess (Henley et al., 2000). … Despite our efforts to get as much out of these data and analyses, they primarily serve to stimulate future monitoring of the watershed, because in and of themselves they could not be sufficient to sufficiently inform the sediment impact methodologies described in Section 2.6.

9.2 Sediment Budgeting Assessment Approach
The scientific situation for Battle Creek is far worse than that for Colusa Basin in that no sediment budget study has even been done. Without a sediment budget framework, the various individual studies of sediment that have been done cannot be placed into a process-based context. Further, the data quantity is too poor to enable comparison with data from other Central Valley Rivers. Whereas California maintains the GrandTab database centralizing the escapement estimates of the late-fall, winter, spring, and fall-run Chinook salmon in the California Central Valley, there is no equivalent centralized database for sediment data in the Central Valley. Systematically insufficient monitoring of sediment precludes comparative evaluation. Therefore, it is not possible to perform a sediment impact assessment on the basis of sediment budgeting for Battle Creek either in terms of figuring out its internal relative sediment sources or by comparing high-quality observations between major watersheds of comparable size and condition.

9.4 Suspended Sediment Flux Findings
SFBC is the main contributor of suspended sediment to the main channel delivering 88% of the total volume delivered from both SFBC and NFBC. No historical sediment data exists for NFBC and SFBC to make comparisons as for MSBC. The South Fork Battle Creek ridge was subject to the 2012 wildfire and has experienced significant gullying on the north wall. Ponderosa way has been documented as contributing fine sediment from road-stream crossing failures. An aerial flyover recorded the extent of surface erosion in 2014 and the videos are in supplemental material.

Although SSC was similar in 2015 as in historical records, the watershed sediment flux at MSBC for WY 2015 was observed to have increased significantly over historical data for similar flow regimes. The increase in suspended sediment could be attributable to the two main disturbances discussed previous of land use and wildfire, but insufficient historical and on-going monitoring has been done to say for certain.

Note this THP flows into the North Fork Battle Creek (NFBC) which contributed 12% of the sediment to the main stem.

Summary of South Fork Battle Creek Fine Sediment Evaluation Survey

This report included in the THP is not specific to the North Fork Battle Creek which is downstream of the project and hydrologically disconnected from it but is part of the South Fork that affects conditions in the Main Stem Battle Creek.

> *A survey of Battle Creek Reach 3, spanning the wetted area from Coleman Diversion Dam to the confluence of South Fork and North Fork Battle Creek, was conducted to visually assess the current conditions of spawning and holding habitat for spring-run Chinook Salmon Oncorhyncus tshawytscha (Chinook) and to document the abundance, location, and impact of fine sediments within this reach. Photographs were taken at photographic reference points for comparison against ones taken from surveys from previous years (Figures 1-7). Similar reconnaissance surveys have been conducted annually since 2015, the first year that increased presence of fine sediments in the South Fork had been detected. The presumed origin of these fine sediments is terrestrial sediments mobilized subsequent to the lightning- caused Ponderosa Fire (August 18-31, 2012; 27,676 acres within the Battle Creek watershed) by large rain and runoff event, especially following intense storms in December 2014 and February 2015.*
>
> *Surveys in 2015 and 2016 described the instream conditions as inundated with fine sediments filling previously observed holding pools and interstitial areas between cobble substrates such that they were described by USFWS biologists as being unfit for use by Chinook for holding or spawning, respectively. This resulted in a management decision to block the entry of Chinook into South Fork Battle Creek by constructing a passage barrier weir during the holding and spawning periods of 2015 and 2016. In contrast, this survey revealed that the majority of fine sediments observed in previous surveys were significantly reduced, although still present in some places both wetted and in the near-shore bankfull area. This reduction was likely caused by extreme high-flow events in this area during the winter and early spring of 2017, with a maximum discharge of5,177 cfs recorded December 10, 2016 (Figure 8).*
> *Pools that were previously filled with fine sediments now had the majority of sediment removed from the thalweg although some fine sediment persisted near the streambanks and pool tails. This was true for the majority of the pools, which ranged from three to nine feet maximum depth. The two most upstream pools, although improved in condition and maximum pool depth compared to previous surveys, still had a significant amount of fine sediments present in both the thalweg and depositional areas. This could speculatively be due to the influence that Coleman Diversion Dam had on these pools during the high flow events potentially reducing the force of water immediately downstream of the dam below the threshold necessary to transport sediments at these locations. Additionally in faster areas such as glides and runs, fine sediments had been reduced such that the underlying cobble was exposed to aquatic environment. It was also noted that in spawning areas there was more of a variety of size classes of sediment ranging from pea to quarter size. These size classes were not as abundant in years prior to the Ponderosa fire.*
>
> *Despite these observed reductions in fine sediments, it is important to note that some deposits of fine sediments remained in this reach. In the near-shore bankfull area large deposits of sandy sediments persisted in various locations throughout the reach where they had not been observed during surveys prior to the influence of the Ponderosa Fire. Fine*

sediments were likely transported to these areas during high flows and deposited as water levels receded. Sediment deposits also lingered in the wetted area typically behind large, boulder substrates or in areas where back eddies would be present during higher flows, i.e. on the inside of curves in the stream channel. These depositional areas preclude them from having much influence on the holding or spawning habitats during the 2017 season at the current and expected summer flow regime; however, these sediments could be remobilized during higher flows anticipated during the wetter winter months and renter the aquatic system.

Biological diversity in this reach has increased for this survey in comparison to previous surveys. In 2015 and 2016 it was noted that there was a low diversity and abundance of species, both vertebrate and invertebrate, within this reach, with the predominate species being Sacramento Sucker Catostomus occidentalis Hardhead Mylopharodon conocephalus juveniles present in low numbers. Snorkelers also noted that benthic macroinvertebrates were nearly absent from the reach likely due to fine sediments inundating their preferred habitat of small/ large cobbles. Most notably during these surveys, very few Rainbow Trout 0. mykiss and only a single adult Chinook were observed. The Chinook was observed in a shallow, sandy holding pool downstream of Manton Road Bridge on June 5, 2015. In addition to the live fish observation, one unspawned female carcass was observed during routine weir maintenance July 27, 2015. During the 2016 survey, no Chinook adults, carcasses, or redds were observed.

In contrast, during this survey many Rainbow Trout of varying size classes were observed in addition to Hardhead and Sacramento Sucker juveniles, and benthic macroinvertebrates (primarily caddis fly larvae) were abundant on the surfaces of exposed cobble substrates. No adult Chinook were observed during this year's survey, potentially due to the low numbers of individuals returning to Battle Creek in 2017. From the period beginning April 1, 2017 until the survey date, 25 Chinook entered Battle Creek based on video surveillance of passage through the Coleman National Fish Hatchery (CNFH) barrier weir fish ladder. Surveys are scheduled beginning in mid-September 2017 through late-October to locate adult spring-run Chinook, carcasses, and redds throughout Battle Creek downstream of fish passage barriers (Eagle Canyon Dam on the north fork and Coleman Diversion Dam on the south fork) to the CNFH barrier-weir.

To summarize, large amounts of fine sediments that were previously observed in the South Fork Battle Creek during surveys in 2015 and 2016 have been significantly reduced in this region as a result of being mobilized downstream into the mainstem of Battle Creek by high flows during the winter of 2016-17. Holding and spawning areas that were previously described as unsuitable for spring-run Chinook would no longer be described as such in the opinion of USFWS biologists. Fine sediments still persist in this area, but mostly contained to the near-shore bankfull area and slow-moving backwaters, which area areas not typically utilized by Chinook for holding or spawning. Invertebrate and vertebrate species which were noticeably absent during previous surveys have begun to return presumably in response to improved habitat conditions in this reach. Although this region has not fully recovered from the effects of sedimentation subsequent to the Ponderosa Fire, the amount of fine sediments has been reduced to the point such that management actions to prevent the unsuccessful spawning of Chinook, such as the blocking of entry to South Fork Battle Creek, are no longer recommended.

Ponderosa Way Road Assessment and Sediment Reduction Plan

This report was an assessment of Ponderosa Way, which is a historic road that traverses portions of the larger battle creek watershed. The majority of the road assessed in the report (14 miles) was constructed by the CCC in the early 1930's with other portions (8.1 miles) constructed in the 1960's and 1980's to facilitate PG&E water diversion activities in the watershed. This road was not constructed to modern road building standards and predates the modern Forest Practices Act.

Although the report mentions potential for increased sedimentation from timber harvesting and fire salvage operations, there are no specific references to determine where these conclusions were reached. It is possible that the report writers were referencing erosion potential in general, but this is unclear. In any event, it is abundantly clear that the report focused on current and potential sediment problems from a historic road that is unlikely to fall under the authority of CAL FIRE to regulate. The largest forest landowner in the study area, SPI, indicated that they do not even use this road for their management activities. The report also indicates that the largest existing and potential sediment problems for this road are along abandoned and now unmaintained sections.

> *Described limitations (page 4):*
> *The interpretations and conclusions presented in this report are based on a study of inherently limited scope. Observations are qualitative, semi-quantitative and quantitative, and are confined to surface expressions of limited extent and artificial exposures of subsurface materials. Interpretations of problematic geologic and geomorphic features (such as unstable hillslopes) and erosion processes are based on the information available at the time of the study and on the nature and distribution of existing features we observed.*
>
> *The conclusions and recommendations contained in this report are professional opinions derived in accordance with current standards of professional practice, and are valid as of the submittal date. No other warranty, expressed or implied, is made.*
>
> *Introduction:*
> *"Erosion originating from forest road systems is a common and significant accelerated anthropogenic sediment source input to streams in managed watersheds affected by wildfire and forest management throughout Northern California. Road related sediment production includes storm-triggered episodic erosion (fluvial and mass wasting) and chronic surface erosion of fine sediment from the road alignment, both of which impact aquatic and salmonid habitat. Coupled with intense wildfire damage and high intensity rain events in the project area, we found that the project roads are nonfunctional and unable to adequately pass the accelerated post-fire runoff regime, thereby exasperating the magnitude of erosion and increasing downstream sedimentation rates that caused significant impacts in the South Fork Battle Creek watershed (Map 1). Stormproofing roads that access private residences and salvage logging areas, or decommissioning unwanted roads in burned areas, provides an opportunity to protect and improve aquatic habitat and long term water quality through the reduction of ongoing and future sediment delivery to affected streams."*
> *"Two of the most important elements of long-term restoration and maintenance of beneficial uses (water quality and fish habitat) from forested and wildland watersheds is the reduction of ongoing and future impacts from upland anthropogenic (human caused) erosion and sediment*

> *delivery associated with roads, clear-cuts, and other land management activities and disturbed areas. Sediment delivery to stream channels from roads and road networks has been extensively documented in managed steepland watersheds and is recognized as a significant impediment to water quality and the health of salmonid and aquatic habitat (Furniss et al., 1991; Higgins et al., 1992; Harr and Nichols, 1993; Flosi et al., 2010; NMFS, 2000, 2001). Roads modify natural drainage networks and accelerate erosion processes. These changes can alter physical processes in streams, leading to impaired streamflow regimes, sediment transport and storage, channel bank and bed configurations, substrate composition, and stability on slopes adjacent to streams. These changes can have important biological consequences, and they can negatively affect the aquatic ecosystem (Furniss et al., 1991)."*

This last paragraph reiterates many of the concerns that have led to the creation of Rules governing road construction and maintenance. These concepts and more are incorporated into the Rules, including recent additions like the 2014 "road rules" package and Technical Rule Addendum #5. Clearly, when roads are not built and maintained to modern standards, impacts on the landscape are more likely. Road construction and maintenance conducted in conformance with the Rules, however, is not expected to result in negative impacts like those observed along Ponderosa Way.

Further on (page 8) the report documents the significant impacts of the Ponderosa Fire and the subsequent extreme rainfall events and the resulting impacts that these had on the road studied and on downstream salmonid habitat.

It appears from several references in the documents that the generalized road impacts discussion comes from the Furniss citation. This work (Furniss, 1991) documents the potential deleterious impacts of roads to watershed health. It is in response to works like these, and many others, that the FPRs have been revised over the years to address and mitigate these impacts (in fact one of the authors, Dr. Carl Yee, was a member of the Board of Forestry when this was published). It is difficult to make a direct comparison to the roads constructed today and to today's standards under a THP and those described in the Furniss work.

In fact, there have been a total of 3 major rule revisions since this work was written, all designed to reduce impacts from roads on the beneficial uses of water and salmonids. These are:

- Protection measures for "Watersheds with threatened or impaired values" – 2001
- Protection measures for "Watersheds with Listed Anadromous Salmonids – 2010
- "Road Rules" revisions for road and watercourse construction – 2013
- Technical Rule Addendum #5 "Guidance on Hydrologic Disconnection, Road Drainage, Minimization Of Diversion Potential, And High Risk Crossings" - 2014

Pacific Watershed Associates Ponderosa Way Assessment and Sediment Reduction Plan (2017/2018)

While the initial study was limited to only Ponderosa Way, which falls outside of jurisdiction of CAL FIRE, the study area was expanded to include additional roads which could fall under our jurisdiction.

To identify current and future erosional impacts associated with Ponderosa Way, the CVRWQCB and the California Department of Fish and Wildlife (CDFW), contracted with PWA to inventory all current and potential sources and causes of road related sediment delivery along the Ponderosa Way road alignment, and to develop prioritized erosion and sediment control prescriptions to address these sediment sources. Reconnaissance field investigations and air photo analysis made it clear that significant impacts had also originated from upslope erosion and flood flows. Thus, as a part of the project, PWA also inventoried sediment sources along 15.6 miles of selected roads and hillslope areas upslope of Ponderosa Way to evaluate recent erosion processes and the potential for future sediment delivery and impacts to downslope areas, including Ponderosa Way.

(4) A field based erosion site inventory and assessment on 15.6 miles of selected haul roads and spur roads on SPI property in the burned and unburned project area upslope of Ponderosa Way.

Air photo analysis shows that watershed and hillslope processes upslope of Ponderosa Way have varied through time, and they have had a variable impacts on the road, including its own susceptibility and response to erosion and failure. That impact has become significantly more apparent since the 2012 Ponderosa wildfire and subsequent storms and flood events. In preparing the Ponderosa Way Road Assessment and Sediment Reduction Plan, it was important to understand those on-site and upslope processes, even if there was limited time and resources to quantify the ongoing and potential impacts they may have had on the Ponderosa Way road alignment. Only by understanding past and future upslope processes, and their likely downstream impacts, can effective treatments for Ponderosa Way be prescribed and successfully implemented.

Sections of Ponderosa Way suffered significant erosional impacts following the 2012 Ponderosa Fire and subsequent winter storm events. Some of those impacts are a result of failure of the road itself, perhaps caused by under-designed drainage structures, poor road surface drainage, or lack of adequate maintenance. Other impacts to the alignment have been caused by sediment laden flood flows, including debris flows originating from upslope and upstream areas.

We found that burned areas and road systems showed varying but significantly elevated levels of erosion and sediment delivery to stream channels, and that stream channels showed varying levels of impacts and sediment transport of the erosional products down to and across Ponderosa Way.

The areas burned on SPI properties in 2012 were subsequently salvage logged; cumulatively, SPI had 17,500 acres of forestland impacted by the high intensity wildfire (James, 2014) and in the project area the 2012 wildfire burned 8,105 acres of forestland (Table 1). Immediately following post- fire salvage logging and the construction of 158 acres of fire line, high intensity storm events in WY2013 and WY2015 generated extreme rainfall, runoff and high energy stream flows. The storms triggered significant, widespread surface erosion, gullying, debris flows, and morphological channel changes. High rates of erosion, sediment transport, and sediment delivery also severely impacted streams, water quality, and salmonid habitat in downstream areas (CVRWQCB, 2015; James, 2014; PWA, 2017).

<u>The mainline roads on SPI lands upslope of Ponderosa Way (C-Line, D-Line, and E-Line) were upgraded in 2011, presumably following specifications listed in the California Forest Practice Rules.</u> The selected roads were upgraded by employing armored fills, properly sized culverts for their respective drainage areas (Photo 7), road surfacing, and road shaping, including road outsloping and rolling dip construction treatments (Table 4). In our analysis, main line haul routes on SPI lands that are rocked, well drained, and maintained have less of an impact on water quality compared to the inventoried spur roads that did not receive these treatments.

<u>Some mainline roads we observed had been upgraded shortly before the 2012 wildfire, and they appear to be functioning well in the post-fire period.</u>

Recently upgraded stream crossing culverts on the haul routes (e.g. C-Line, D-Line, and E-Line) were improved in 2011 (Jeff Caster, SPI RPF, 2017 personal communication), prior to the 2012 wildfire. Many of the stream crossing culverts on these haul routes were replaced with larger diameter culverts designed for the 100-year peak flow event, according to the Forest Practice Rules, some with mitered inlets (Photos 7 and 12).

The 2012 Ponderosa Fire, subsequent salvage logging, road re-opening, and fire line construction significantly altered the dominate forest canopy cover, exposed underlying bare mineral soils, altered hillslope drainage patterns, and impacted erosion rates and sediment delivery to streams. Forest hydrology was altered through decreased rainfall interception, increased runoff, and heightened hydrologic connectivity between hillslopes and stream channels. <u>Harvesting and salvage logging can indirectly influence sediment transfer by altering the hydrology of harvested hillslopes. However, wildfires and subsequent land management practices may have more direct effects by making much more sediment available for transfer as the result of soil exposure and disturbance, altered slope stability, increased surface runoff, damage to streambanks, and the emplacement of forest debris in gullies and stream channels.</u> The consequences of harvesting, salvage logging operations, and road opening effects on streamflow, combined with the loss of understory and ground cover vegetation, are almost always accompanied by changes in sediment mobilization due to surface disturbance, increased surface runoff, and altered stability of stored sediment.

<u>Most mainline haul roads we observed in watershed areas upslope from Ponderosa Way (e.g., C-Line) had recently (2011) been improved by upgrading stream crossings and improving road surface drainage to reduce the chance of post-fire stream crossing failure and hydrologic connectivity, respectively. With local exceptions, the permanent, mainline roads we observed largely appear to be effectively treated to address post-fire hydrologic conditions and erosion rates.</u>

However, in our field assessment PWA observed many unimproved and deteriorating secondary roads and road segments with deteriorating or failing stream crossings and excessively long lengths of undrained (bermed or throughcut) road surfaces and inboard ditches that are hydrologically connected to stream channels. Most of these were found in the heavily burned areas. <u>Years of intermittent forest management, log hauling, maintenance grading, and subsequent road surface erosion along these native surface secondary haul roads has created long, moderately throughcut road reaches, or confined, undrained road reaches through the unintentional construction of continuous berms along the outside edge the seasonal roads.</u>

Mainline roads that were treated (upgraded) just prior to the 2012 Ponderosa Fire only require spot treatments to fully stormproof the alignments. In contrast, untreated (unimproved) roads in the downslope burned portions of project area now intercept, generate, collect, and discharge far more runoff and eroded sediment than they did prior to the 2012 wildfire. Hydrologically connected road lengths are now far longer, more active, and carry more eroded sediment to streams. Connectivity of the road system now typically extends far up into the adjacent burned hillslope areas and the discharge includes more runoff, higher rates of erosion, and significantly more sediment delivery than these connected road reaches likely carried before the fire.

As a result, interception of accelerated hillslope runoff and fine sediment derived from erosion in the burned areas and from the scarified fire line areas are now being delivered directly to the stream system. These types of sedimentation issues were greatly accelerated by the 2012 wildfire and locally by subsequent additional surface disturbances during road reopening and salvage logging. Many of the most impacted, secondary, native surface roads and road reaches (including those we inspected but did not quantitatively inventory) have been noted as a high priority for treatment and remediation. The most effective roadbed treatments would include flow dispersal and road drainage treatments such as frequent waterbarring, rolling dips, outsloping, lead-out ditching, berm removal, road realignment or relocation to remove throughcut road reaches, seasonal closure, and selected road decommissioning.

It appears that areas that were more frequently managed and therefore subject to modern Forest Practice Rules fared better post fire than other legacy roads. As noted in other reports, there are many different landowners within the larger Battle Creek watershed and individual landowners cannot be forced to initiate projects that are subject to CAL FIRE jurisdiction. Additionally, as is pointed out in the report and discussed in this THP, SPI has taken control of various roads in the Battle Creek assessment area from county control and conducted extensive road upgrades, ultimately reducing potential impacts from these identified sources.

SPI Bioassessment and Water Quality for the South and North Forks of Digger Creek

The SPI Research and Monitoring program conducted a specific study of the THP area in preparation for the submitted plan 2-17-070-TEH “Artemis”. This was eventually withdrawn from consideration, but covers the same footprint as this plan.

Background
The Sierra Pacific Industries (SPI) Research and Monitoring Program has been collecting benthic macroinvertebrate (BMI) and water quality data from the greater Battle Creek watershed since 2002. In 2012, two additional permanent water quality stations on the South and North Forks of Digger Creek (i.e., 560, 561) were installed to collect continuous measurements for a variety of parameters, including water temperature, turbidity, and flow. Associated sampling design, logistics, and quality assurance are detailed in the report Greater Battle Creek Turbidity Monitoring: Update and Additions (James and MacDonald 2012). Turbidity and water temperature data collected over seven water years on the South and North Forks of Digger Creek has not approached thresholds established to protect Salmonid health. BMI and associated physical habitat data is collected from areas adjacent to water quality stations. The coordinates and codes associated with all involved sampling sites are defined in Element A6: Project/Task Description of SP l's Research and Monitoring

Program Quality Assurance Project Plan. By the end of the four water years studied, statewide metrics categorized Digger Creek's health as "Good".

Road Erosion and Delivery Index (READI): A Model for Evaluating Unpaved Road Erosion and Stream Sediment Delivery

This model was developed by SPI and three of the seven basins studied for this model are included in the Battle Creek HSA (“Bailey”, “Digger” and “Rock”). Details from the READI model specific to this plan will be discussed later.

Abstract
The Road Erosion and Delivery Index (READI) is a new geographic information system–based model to assess erosion and delivery of water and sediment from unpaved road networks to streams. READI quantifies the effectiveness of existing road surfacing and drain placements in reducing road sediment delivery and guides upgrades to optimize future reductions. Roads are draped on a digital elevation model and parsed into hydrologically distinct segments. Segments are further divided by engineered drainage structures. For each segment, a kinematic wave approximation generates runoff hydrographs for specified storms, with discharge directly to streams at road–stream crossings and onto overland-flow plumes at other discharge points. Plumes are attenuated by soil infiltration, which limits their length, with delivery occurring if plumes intersect streams. Sediment production and sediment delivery can be calculated as a relative dimensionless index. READI predicts only a small proportion of new drains and new surfacing results in the majority of sediment delivery reductions. The model illustrates how the spatial relationships between road and stream networks, controlled by topography and network geometries, influence patterns of road–stream connectivity. READI was applied in seven northern California basins. The model was also applied in a recent burn area to examine how reduced hillslope infiltration can result in increased hydrologic connectivity and sediment delivery.

Turbidity Responses from Timber Harvesting, Wildfire, and Post-Fire Logging in the Battle Creek Watershed, Northern California. (2018)

Abstract
The Battle Creek watershed in northern California was historically important for its Chinook salmon populations, now at remnant levels due to land and water uses. Privately owned portions of the watershed are managed primarily for timber production, which has intensified since 1998, when clearcutting became widespread. Turbidity has been monitored by citizen volunteers at 13 locations in the watershed. Approximately 2000 grab samples were collected in the 5-year analysis period as harvesting progressed, a severe wildfire burned 11,200 ha, and most of the burned area was salvage logged. The data reveal strong associations of turbidity with the proportion of area harvested in watersheds draining to the measurement sites. Turbidity increased significantly over the measurement period in 10 watersheds and decreased at one. Some of these increases may be due to the influence of wildfire, logging roads and haul roads. However, turbidity continued trending upwards in six burned watersheds that were logged after the fire, while decreasing or remaining the same in two that escaped the fire and post-fire logging. Unusually high turbidity measurements (more than seven times the average value for a given flow condition) were very rare (0.0% of

measurements) before the fire but began to appear in the first year after the fire (5.0% of measurements) and were most frequent (11.6% of measurements) in the first 9 months after salvage logging. Results suggest that harvesting contributes to road erosion and that current management practices do not fully protect water quality.

Discussion

Turbidity and Logging Levels

Post-fire erosion is typically greatest during the first year after wildfire (Agee 1990; Debano et al. 1998; Robichaud and *Brown 1999). Our observations of greater residuals in the second year strongly suggest that post-fire logging operations had an effect beyond that of fire alone on turbidity levels. Our statistical findings are based on estimated logging rates. Because it is not known precisely when salvage logging occurred at each site, the strength of these results could be limited by the accuracy of the estimates of the rates and areas logged. However, post-fire logging effects are almost certainly underestimated because the post-salvage period was compared with the first post-fire year, which already reflects a progression of post-fire logging (i.e., a lower but non-negligible influence).*

In both the pre-fire period and the entire monitoring period, harvesting was positively associated with the median and 90th percentiles of sample turbidities. Regression analysis showed the same effects: after stream discharge, the proportion of watershed harvested explained most of the variation in turbidity. Associations with harvesting are partly confounded with road density, particularly near watercourses, as well as wildfire. All these factors appear to have affected turbidity levels.

The analysis of regression residuals showed significantly increasing turbidity during the monitoring period at 10 of 11 sites affected by fire and post-fire logging. The two sites that have not been burned or logged since 2010 (DC and BCT) showed signs of decreasing turbidity levels starting in 2013. There was also a slight indication of recovery in turbidity levels at site CCC, starting in 2013. Although this trend is not statistically significant, it is consistent with the small fraction of the drainage area affected by fire. Post-fire logging was largely relegated to upslope areas, while a larger portion of the CCC watershed was in recovery mode from earlier harvesting.

Changes in runoff from fire and logging may have con- tributed to monitored turbidity effects by the cascading effects of reduced transpiration and interception on streamflows (Wondzell and King 2003), which can trigger gully erosion (Reid et al. 2010), and increase bank and bed erosion. Accelerated bank erosion was observed in Battle Creek (CALFIRE et al. 2011) prior to the Ponderosa Fire. Site-specific studies of sediment sources might help elucidate causes of elevated turbidity in the Battle Creek watershed; however, our results are consistent with previous hillslope-scale studies showing that post-fire logging impedes post-fire revegetation, compacts soils, reduces ground cover, and elevates and extends the duration of runoff and soil erosion after fire (Donato et al. 2006, Wagenbrenner et al. 2015, 2016).

Our results are consistent with those of Klein et al. (2012) which found that turbidity in the northern California Coast Range was most strongly related to the logging levels in the previous 0–15 years. Our analysis of Battle Creek considered the total amount harvested over an approximately 17 year period starting in 1998, prior to which there had been no *clearcutting in the watershed. In our study, turbidity declined in three subwatersheds with little or no logging in at least five years. Thus, although the turbidity levels were well correlated with logging in this study, a shorter window such as 0–5 years might be an even better explanatory variable for future analyses.*

Our data set cannot separate the impacts of herbicide application, which was used on much of the salvage-logged area outside of riparian zones and some private inholdings within the burned area. While the major loss of cover and vegetation is initially due to fire and salvage logging, herbicides thwart vegetative recovery after disturbance, likely prolonging sediment delivery from logged areas.

While site-specific assessment of logging impacts on erosion was not possible in this study due to lack of access to privately owned timberlands, some sources of increased erosion from logging operations were observable from county roads. Post-fire-logged areas had copious amounts of bare ground with damaged soils that were easily mobilized by runoff and prone to rilling by overland flow (Supple- mental Material: Fig. S9). Roadcuts can unravel when exposed to accelerated runoff, especially in burned areas that have not revegetated (Fig. 8, Supplemental Material: Fig. S10). Roadside ditches in many places lacked armoring and showed signs of incision from increased surface runoff from compacted and burned soils, as well as intercepted subsurface flows that are augmented after fire and logging due to reduced evapotranspiration. Some of the elevated turbidity in Canyon Creek is associated with the watercourse-adjacent county road, which serves as a main haul road for logging operations in that watershed. Thus, the effects of roads and harvesting are not only statistically confounded, but interact in ways that are not physically separable: much of the road erosion is induced by har- vesting activities.

The magnified vulnerability of hillslopes to surface erosion after logging may be transiently mitigated by contour ripping, but gains are likely offset over the long term by the associated ground cover loss and delayed regrowth, which is prolonged in Battle Creek by widespread pre-emergent herbicide application designed to prevent seed germination.

Potentially Confounding Factors

Numerous studies have shown that roads are major sediment sources in many environments (Gucinski et al. 2001). The associations of turbidity with logging levels, especially post-fire salvage logging, in our study appear robust, but findings also suggest that turbidity was influenced by erosion and runoff from roads. Roads are an integral part of the logging operations applied since 1998 in Battle Creek. Over 550 clearcut patches typically 8–10 ha in size have been created and all are accessed by roads. Road density is highly correlated with harvesting levels in this study and is likely one reason for the robust relationship between logging and turbidity.

Road activities, including construction, reconstruction, and increased traffic, occur in conjunction with logging, making it difficult to separate their effects. Increased road traffic for log haul increases road erosion and subsequent delivery of fine sediment to streams (Reid et al. 1981; Reid 1998), particularly during winter operations on wet roads. Runoff from compacted hillslopes can increase erosion on road cutbanks (e.g., Fig. 8, Supplemental Material: Fig. S10). Hence reducing the area under THPs would likely also reduce the impact of roads. However, the partial correlation analysis shows that rate of harvest is well- related to higher percentiles of

turbidity even after accounting for the variation explained by road density, regardless of the type of road considered or its proximity to a stream (Fig. 7).
Elevation can indirectly affect erosion and turbidity. Snow is the dominant form of precipitation at higher elevations in the watershed. Such areas may have lower levels of surface erosion, because they are not subject to rainsplash and snowmelt runoff tends to be less intense than that from rainfall. Most privately owned timberland in the study area is at 900–1500 m in elevation. In the past decade, there has been very little timber harvest at the higher elevations on federal lands (James and MacDonald 2012). Thus, all of the elevation-related variables are inversely correlated with mean percent cut (Fig. 6, top). However, the partial correlation analysis showed that harvesting explains substantial variability in turbidity even after accounting for annual precipitation, elevation, and relief ratio (Fig. 7, top).

Analyses assessing potential logging impacts on turbidity among sites (Fig. 5; Table 4) are inherently vulnerable to confounding by site-specific factors including elevation, precipitation form, topography, geology, and the location and density of roads. However, analyses of variation at individual sites (Fig. 4) are not confounded by fixed factors related to geology, soils, and topography.

Associations of turbidity with time or harvest rate at an individual site could be influenced by water diversions and local variations in precipitation that are not accounted for by discharge measurements at the Coleman station. However, such variations are not expected to systematically induce multiyear trends. The statistical findings could also be influenced by other human activities not examined in this study. However, ranching and agricultural uses affect only a small part of the land base (Supplemental Material: Fig. S1), and recreational activity in the uplands is low-impact.

The Canyon Creek spring (CCSP) differs from the other sites in having no surface watershed, although its turbidity was apparently affected by logging-related disturbances. Omitting it from the analyses would have strengthened some of the tests of association, since it plots higher than expected for a watershed with zero harvest (Fig. 5a, b).

Water Quality and Ecological Impacts
Coefficients in the fitted model (3) indicate that logging of 50% of a drainage is likely to cause a five-fold increase in turbidity, while completely logging a drainage is likely to increase turbidity by a factor of 23. This is a significant water quality concern as peak turbidity levels in streams affected by wildfire and post-fire salvage logging now commonly exceed 100 NTU and occasionally exceed 1000 NTU (Fig. 3). At these levels, turbidity can have adverse effects on salmonids (Rhodes et al. 1994) and a host of downstream beneficial uses of water including irrigation and drinking water.

Due to the lack of continuous monitoring of turbidity in this study, the duration and magnitude of elevated turbidity at monitoring sites is uncertain. However, independent monitoring in the Battle Creek watershed (USFWS 2015) documented major increases in fine sediment levels in salmonid spawning habitats and major losses of pool volume and quality in 2014 and 2015 after post-fire logging. It is likely that pool loss negatively affected salmonids because the quality, volume, and frequency of pools are important for salmonids at multiple lifestages (McIntosh et al. 2000). Increased levels of fine sediment reduce salmon and steel- head survival (Suttle et al. 2004; Cover et al. 2008). Our analysis indicates that logging, particularly after the severe wildfire, *likely contributed to the recent degradation of spawning and pool habitats in the Battle Creek watershed.*

Cumulative Impacts
Emergency rules in California do not require a consideration of cumulative impacts when permitting post-fire salvage logging. However, cumulative impacts are probable when an area is logged, roaded, burned, salvage-logged, and subjected to herbicide, because BMPs cannot completely prevent accelerated sediment delivery (Ziemer and Lisle 1993; Lewis et al. 2001; GLEC 2008; Klein et al. 2012; Wagenbrenner et al. 2015, 2016). Thus, a high temporal concentration of projects in space within a watershed is likely to degrade water quality and aquatic ecosystems via sedimentation. Such negative impacts might be reduced or avoided by limiting the rate of logging in watersheds. This approach has been taken by California state agencies in Elk River and Freshwater Creek (NCRWQCB 2006) where downstream residents have been impacted by aggradation and flooding.

Conclusions
Battle Creek contains important cold-water habitat for threatened and endangered runs of Chinook Salmon in the Sacramento River system. About 48% of privately owned timberlands in the North Fork (NFB drainage) have been logged since clearcutting began in 1998. In the Ponderosa fire area >11,000 ha have been affected by a combination of clearcutting, roads, wildfire, post-fire logging, and herbicide. Each of these factors appears to have been important in elevating turbidity levels. Our analysis of turbidity data from 2009 to 2015 at 13 watershed locations indicates that the sites with the most harvesting and highest road densities had the highest turbidity before the fire and throughout the entire monitoring period. Turbidity remains strongly associated with harvesting after statistically accounting for road effects. Importantly, roads are an inseparable part of logging operations. Turbidity increased over the measurement period at ten sites, during the pre-fire period at four sites, and during the post-fire period (reflecting the influence of post- fire logging) at six sites. Extreme turbidity measurements (>7 times the average value for a given flow condition) were rare before the fire, but became more frequent (5% of measurements) in the year after the fire, and subsequently more than doubled in frequency in the first season after salvage logging was completed. Turbidity decreased in watersheds that were unaffected by the fire and had not been harvested since 2010.

Our results are consistent with previous assessments of the effects of post-fire logging on water quality (Kattelmann 1996; Beschta et al. 2004; Smith et al. 2012; Wagenbrenner et al. 2016). Despite site-specific application of BMPs, ground-based logging with high road densities was strongly associated with the magnitude of turbidity and sediment- related aquatic impacts, apparently forestalling the post-fire recovery of water quality. These findings suggest that adverse cumulative impacts on water quality may not be completely avoidable using current BMPs without also limiting the rate and total area affected by logging operations.

This study was examined by CAL FIRE during peer review and feedback was provided prior to publishing. CAL FIRE does not dispute the integrity or the rigor of the scientific process used in the study, but finds that the conclusions about direct causality between impacts and clearcutting to be problematic. Even so, this study has been considered as part of the record for our conclusion that the plan as proposed will not result in a significant adverse effect on the environment.

USFWS Battle Creek Adult Monitoring Report 2017 (Published 2019)
The USFWS continues to monitor spawning salmon returns along with the quality of the lower reaches of Battle Creek for spawning suitability:

> *Based on our stream survey redd counts (n= 5) we estimated a spawning population of 10 spring-run Chinook Salmon, which means only 33% of the total number of salmon that returned made it to spawn. Higher than normal water temperatures were observed in 2017 during the holding and spawning period which may have led to this reduced number of spawning individuals. However, 60% of the total redds were above the old Wildcat Dam site and based on temperature criteria were in good to excellent temperatures for incubating Chinook Salmon eggs. Sediment studies in and around these redds showed a reduction in the amount of fine sediments in these reaches. As noted in 2015 and 2016 massive amounts of fine sediments had moved into the South Fork inundating all holding pools and spawning areas in that reach. This season we did see a reduction of fine sediments in the South Fork with most of these fine materials noticeably moving out of that reach. Still, we are documenting the movement of this large plume of fine sediments as it has now been filling in pools and covering spawning habitat in the lower river.*
>
> *Holding Temperatures — Using the modified Ward and Keir's suitability categories we summarized the temperatures for the spring Chinook holding period at select monitoring sites on Battle Creek (Table 14). On the North Fork we found that the percentage of MDTs categorized as good ranged from 92% at the upstream-most site to 45% at the downstream-most site.*
>
> *Overall, water temperatures in the South Fork were high for holding and spawning Chinook with only 25% of all habitat falling within the good category. Compared to the average of all other years combined, temperatures were lower on the North Fork but higher on South Fork (Figures 15 and 16). On the main stem, the percentage of MDTs categorized as good ranged from 26% at the upstream-most site to 20% at the downstream-most site. The maximum daily temperatures at CNFH reached nearly 69°F in the last week of June (Figure 17).*
>
> *Mean daily temperatures were evaluated for the spawning period at four locations on the North Fork, three locations on the South Fork, and five locations on the main stem (Table 15). The percentage of MDTs categorized as good or excellent in the North Fork was 98% at the upstream-most sites and above 77% at the downstream sites. Mean daily temperatures for sites categorized as good or excellent on the South Fork ranged from 85% at the upper-most site to 77% at the downstream site. On the main stem, the percentage categorized as good or excellent ranged from 72% at the upstream-most site (RM 16.1) to 62% at the downstream-most site (RM 6.2).*
>
> *The percentage of days that incubating spring Chinook eggs fell within each of the water temperature suitability categories was estimated for Battle Creek in 2017 (Table 16). Our surveys this season showed that all redds solely stayed in the good to excellent ranges for incubating Chinook eggs. The three redds found in Reach 1 and the two redds found in Reach 4 were not exposed to temperatures in the fair, poor or very poor categories.*

USFWS noted the presence of elevated temperatures, especially within the South Fork, which lies downstream of this plan, although site temperatures were in the good or excellent a majority of the time sampling occurred. The sediment within these systems continues to be a concern and the USFWS recommended that measures be implemented to influence fish to migrate higher into the drainage. This would occur by modifying dam barriers, opening fish ladders and modifying altered drainage patters from past hydropower projects.

Battle Creek Watershed Stream Condition Monitoring 2012-2017

Fish-bearing streams throughout the Battle Creek watershed were assessed in 2001 and 2002. Sediment was identified as a concern relative to the condition of fish habitat compared to reference watersheds (Terraqua 2004). Elevated sediment levels were hypothesized to be attributable to the rain on snow precipitation and flooding events of the winter of 1996-97 as there were weak correlations between stream condition and land use attributes (e.g., road density). This storm event resulted in stream flows throughout the Sierra Nevada to exceed 100 year recurrence (USGS 1999) and generated peak flows of 17,963 cfs at the lower Battle Creek stream gauge (BAT station, CDEC online query).

Repeat sampling of a subset of long-term stream monitoring sites in 2006 suggested channels were improving in condition (Terraqua 2008a). In August 2012, the Ponderosa Fire burned 27,600 acres of mid-elevation private timberlands in the Battle Creek watershed. Salvage logging took place on private timberlands where feasible. As a response to the Ponderosa Fire in the fall of 2012, the Battle Creek Watershed Conservancy (BCWC) implemented a rapid stream channel condition monitoring effort to capture the potential impact to channels. This effort captured the pre-fire baseline for channel condition in 2012 and for two years post-fire as it was anticipated that the most significant fire related impacts would be observed in this time period.

Within the first two winters post-fire, increased rates of debris flows were initiated primarily in Digger Creek and Lower South Fork Battle Creek (Terraqua 2018). However, the most severe sediment inputs to perennial stream channels are observed in the third winter post-fire (2015 water year) which brought high intensity rainfall and flooding to the Battle Creek watershed.
Stream flows from this storm event peaked at 15,300 cfs at the lower Battle Creek stream gauge (USGS station #11376550, online query). South Fork Battle Creek peaked at 7,700 cfs, while North Fork Battle Creek peaked at 3,258 cfs (DWR, BAS and BNF gauges respectively). Note that the South Fork gauge captures approximate half the drainage area as the North Fork gauge (Appendix 1, Figure 1). Observations during and after the flood events in the 2015 water year indicate that fish habitat and water quality are being affected by high sediment loads. There is evidence that anadromous habitats have experienced an increase in sediment deposition and the loss of important pool habitat (USFWS 2015a), public road segments have experienced failures (CVRWQCB 2015), and the Coleman National Fish Hatchery is being affected by high suspended sediment concentrations (USFWS 2015b).

Average annual stream flows for the Battle Creek watershed are variable and driven largely by the precipitation of the water year. Prior to the Ponderosa fire (2001-2012) highest peak stream flows for a given water year generally track average annual stream flows in a linear manner (Figure 1). In post-fire water years (2013-2018) the highest peak stream flows are more erratic with the drought years of 2013 and 2015 generating the highest peak flows for this 18 year period of record.

This report is part of a collaborative effort between the BCWC and the California State Water

Resources Control Board to develop a Watershed Based Plan (WBP) for the Battle Creek watershed. Project funding is provided by a 2016 grant from the State Water Board through the Timber Regulation and Forest Restoration Program. With a focus on sediment related concerns, this report addresses the uncertainty about current conditions in the biological and physical condition of Battle Creek fish bearing streams at the watershed and sub-watershed scales. This report also summarizes the results of Ponderosa Fire stream monitoring (2012-2014) and provides historic trends in ecological conditions dating back to 2001-2002 by applying the California Stream Condition Index (CSCI) to historic benthic macroinvertebrate data. Lastly, this report provides some considerations for future long-term stream condition monitoring within the context of the watershed based plan.

Results

CSCI
Current Conditions SWAMP 2017
The watershed average CSCI score from 2017 SWAMP sampling (24 sites) is 1.05 indicating that overall the watershed is in reference condition having similar or greater taxonomic richness and complex ecological function than predicted for reference sites (>/= 1.0). The distribution of CSCI scores illustrates that 20 sites are classified as "likely intact", two are "possibly altered" and two are "likely altered" (Figure 4). While four of 24 sites have scores below those of reference conditions, it is not expected that all sites within a watershed would be in reference condition. The two possibly altered sites occur in the upper watershed upstream of the fire perimeter. The likely altered sites, which are both downstream of the fire perimeter, occur on the mainstem (Site #004, CSCI 0.74) approximately 4.1 miles downstream of the confluence of North and South Forks of Battle Creek, and on the South Fork of Battle Creek downstream of Inskip Dam (Site #019, CSCI 0.79). A map identifying the location of sites with possible or likely altered CSCI scores is provided in Appendix II.

With the exception of the mainstem, average CSCI scores in 2017 for all major sub-watersheds exceed 0.92 "likely intact", though inferences at this scale suffer from low samples sizes (Table 4). The mainstem below the confluence of North and South Forks of Battle Creeks is in "likely altered" condition in 2017, represented by a single sample.

Table 4. Average CSCI scores for major Battle Creek sub-watersheds in 2017.

Watershed / Sub-watershed	Mean CSCI	CI (+/-)	Sample Size	Status
Battle Creek Watershed	1.05	0.06	24	Likely Intact
North Fork	1.15	0.09	6	Likely Intact
South Fork	1.02	0.11	7	Likely Intact
Mainstem	0.74	N/A	1	Likely Altered
Digger Creek	1.08	0.19	4	Likely Intact
Rock Creek	0.93	0.21	2	Likely Intact
Bailey Creek	1.05	0.26	4	Likely Intact

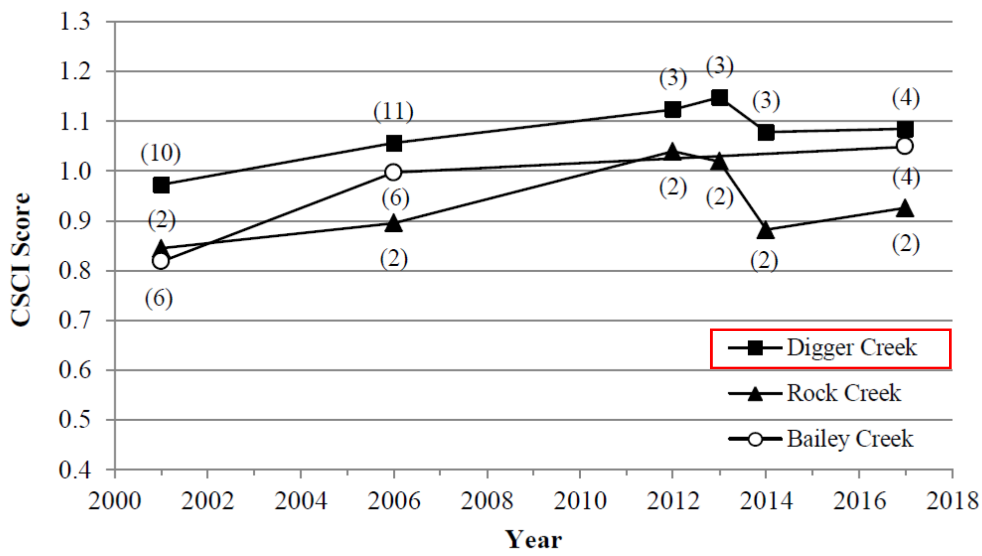

Figure 8. Trends in CSCI averages by year for Digger, Rock and Bailey Creeks in the Battle Creek watershed. Number of sites sampled in each year are in parentheses.

Before and After Ponderosa Fire
<u>Results of the before-after, control-impact analysis of CSCI values for years 2012 (before), and 2013/2014 (after) are not statistically significant relative to detecting a post-fire impact on stream condition</u> (Table 3; Paired T-test for before-after differences, p = 0.29). Control and impact site CSCI averages for years 2012 through 2014 all exceed 0.92 (Figure 9). Trends in average CSCI stream conditions in North Fork, South Fork, Digger and Rock Creeks upstream (control, n=4) and downstream (impact, n=4) of the Ponderosa Fire footprint are illustrated in Figure 9.

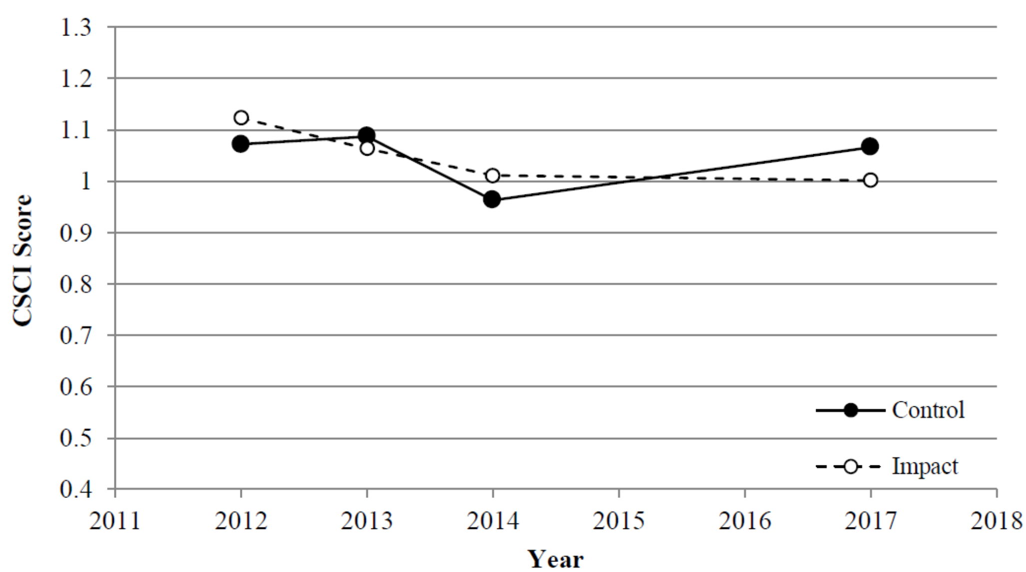

Figure 9. Average CSCI scores for four control and four impacts sites in years 2012 through 2014, and 2017.

Discussion

Based upon the benthic macroinvertebrate CSCI results from 2017, both the watershed as a whole and major tributaries are "likely intact", having similar taxonomic richness and complex ecological function as predicted for reference sites, and similar to conditions observed in 2006 (Figures 6, 7, 8). Results of the BACI analysis for post fire effects are inconclusive, likely for several reasons. First, the sample size of this study is small with only four of both control and impact sites. Secondly, inter annual variability due to larger scale processes appear to be affecting both control and impact sites. For example, decreases in CSCI observed across all control and impact sites between 2013 and 2014 (Figures 10, 11), with 2014 being the 3rd year of a drought cycle and having the lowest average annual discharge of the last 18 years (Figure 1). Lastly, the most significant post-fire impacts to stream reaches downstream of the wildfire likely occurred during the 2015 water year (WY) as documented by USFWS (2015a). The effects of the atmospheric river precipitation events, flooding, and sediment inputs in the 2015 WY across all potentially affected tributaries went undocumented by BCWC stream monitoring due to a lack of funding.

The limited data available suggests that the South Fork may be in a state of recovery from flooding and sediment deposition that occurred in the 2015 WY. In 2017, sediment deposition and shallow pool depths in the South Fork are no longer seen as a threat to over-summer holding survival for spring run Chinook salmon adults (USFWS 2017). South Fork Battle Creek CSCI values in 2017 downstream of the fire footprint average 0.92 (n=3) on the threshold between "likely intact" and "possibly altered". At the one South Fork site (#053) downstream of the fire perimeter monitored in both 2014 and 2017, CSCI values were 0.83 and 0.99 for those years respectively. All other tributary impact sites downstream of the fire perimeter are in "likely intact" in 2017 based upon CSCI scoring (Figure 11).

The mainstem of Battle Creek had the poorest CSCI condition at the sub-watershed scale in both 2001 (CSCI 0.74) and 2006 (CSCI 0.79) when compared to all other tributaries (Figure 7, 8). For the one mainstem site (#004) that was sampled in 2017, CSCI condition has remained "likely altered" across all sampling years 2001, 2006 and 2017 (Figure 5). As the mainstem of Battle Creek has greater sediment storage capacity through lower gradients and a broader floodplain than the tributaries (Terraqua 2018) it is reasonable to assume that it may take longer to recover from sediment related impacts. Sediment transport and deposition within the mainstem may be having a negative effect on the biologic integrity of the channel however, there may be other stressors involved and monitoring data is limited. In 2017, the IPI value of mainstem site #004 is 1.06 indicating that the physical habitat is in reference condition. However, sediment related metrics in 2017 support the low CSCI value (0.74) being related to sediment effects as percent fines and embeddedness were at or exceeded threshold values (Table 6). In 2006 other factors may have been affecting this site as the CSCI value was 0.69, fines (< 2mm) and embeddedness were well below thresholds (15% and 20% respectively), and median particle size (d50) had coarsened to 195mm from a value of 57mm in 2001 (Table 8).

Relative to the SWAMP Index of Physical Integrity (IPI) results from 2017, the watershed as a whole, all major tributaries, and all sites are in reference condition ("likely intact"). The two sites with the lowest IPI scores (0.94) are upstream of the Ponderosa Fire perimeter. With the exception of the mainstem, as noted above, all major tributaries in 2017 have percent fines and embeddedness values below threshold levels that have been demonstrated to impact the *benthic macroinvertebrate community. Watershed scale trends in percent sands and fines (< 2mm) indicate values in 2017 are similar to those observed in 2006, however embeddedness values are increasing over this same time period.*

Battle Creek Watershed Based Plan (May 2019 Version)

This plan provides for a systematic, multi-owner approach to assessing and addressing impacts from controllable sources of pollution. It is hoped that this plan forms the foundation for the development of long-term solutions and allows for greater stakeholder collaboration.

USFWS Battle Creek Adult Monitoring Report 2018 (Published 2020)

Based on our stream survey redd counts (n = 29) we estimated a spawning population of 58 spring-run Chinook Salmon, which means 71% of the total number of salmon that returned made it to spawn. Overall, water temperatures in 2018 were acceptable for spring Chinook to successfully produce juveniles. Ninety-three percent of the redds were located in the North Fork, and based on temperature criteria all of the redds were in good to excellent temperatures for incubating Chinook Salmon eggs.

Holding temperatures — Using the modified Ward and Keir's suitability categories we summarized the temperatures for the spring Chinook holding period at select monitoring sites on Battle Creek (Table 12). High water, equipment failure, and a reduced staff contributed to the lack of maintenance and repair of loggers which led to data loss at multiple sites. On the North Fork we found that the percentage of MDTs categorized as good ranged from 73% at the furthest upstream site with data (Wildcat Dam site) to 47% at the downstream-most site. Overall, water temperatures in the South Fork were high for holding and spawning Chinook with only 19% of all habitat falling within the good category. Compared to the average of all other years combined, temperatures were higher on the North Fork and South Fork (Figure 14; Figure 15). On the main stem no data could be collected at the upstream-most site, but only 19% of the holding temperatures at the downstream-most sites were in the good category. The maximum daily temperatures at CNFH reached nearly 71°F in the middle of July (Figure 16).

Mean daily temperatures were evaluated for the spawning period at four locations on the North Fork, three locations on the South Fork, and five locations on the main stem (Table 13). Twenty percent of all the MDTs could not be calculated due to lost data. At sites on the North Fork which had all their data, 100% of the temperatures stayed within the excellent to good categories. These sites were located at the old Wildcat Dam site and above the confluence in the North Fork. Mean daily temperatures for sites categorized as good or excellent on the South Fork ranged from 100% at the upper-most site to 99% at the downstream site, but no fish spawned in this section. For sites on the main stem that we had all of the water temperature data, the percentage categorized as good or excellent ranged from 77% in Reach 4 (RM 12.9) to 55% at the downstream-most site (RM 6.2).

The percentage of days that incubating spring Chinook eggs fell within each of the water temperature suitability categories was estimated for Battle Creek in 2018 (Figure 14). Our surveys this season showed that all redds stayed in the good to excellent ranges for incubating

Chinook eggs. The 27 redds found in Reach 1 and 2 and the two redds found in Reach 4 were not exposed to temperatures in either the fair, poor, or very poor categories.

Discussion
Battle Creek salmonid monitoring
California experienced a severe drought from 2012-2016. In addition to the drought, there was a large fire (Ponderosa Fire) within the Battle Creek watershed in 2012. These combined environmental events have had lasting effects in the Battle Creek watershed which have been observed over the past several years and documented in previous Battle Creek reports. The Battle Creek adult monitoring program has observed many troubling trends related to these events which have included: (1) lower than average spring Chinook adult fish and redd counts; (2) high water temperatures potentially stressing fish during holding and spawning periods; (3) increased fine sediment inundating holding pools and covering up spawning habitats; and (4) the continued hatchery influence from Feather River Fish Hatchery (FRFH) spring Chinook passing upstream of the CNFH barrier weir. Throughout all of these challenges our monitoring program has continued to successfully collect data to further understand how these long-term issues are influencing the drainage

Reduced spring Chinook and redd counts — Although we observed an increase in spring Chinook and redd counts in 2018 compared to the last several years, the spring Chinook count was less than half of the 24-year average ($\bar{x}$ = 196). During the 2015 season we believe the severe drought and higher than average water temperatures during the holding and spawning period, with documented temperatures reaching upwards of 70 °F in the upper watershed, led to a decrease in successful spawning and emergence (Bottaro and Brown 2018). We anticipated that there would be a lower than average return of age-3 fish in 2018, which appeared to be true. This year's redd count was low (n = 29) compared to the average count from 1995–2017 ($\bar{x}$ = 89), and the number of fish estimated to successfully spawn (n = 58) was at the highest percentage (71%) in the last five years. Since 2013 redd numbers indicate that 31–57% of the total estimated population survived to spawn with 2015 being the lowest since 1995 (31%). This season all of the temperature stations with complete datasets ranged in the good to excellent categories for holding and spawning spring Chinook. The available data was at the top and bottom of our reaches so one could assume the areas in between also contained good to excellent water temperatures because this was a noticeable trend seen in previous years. Overall we believe that a high percentage of the fish successfully spawned and there would be a high percentage of eggs that survived to emergence. Therefore, even though a low number of redds was observed, production was likely higher than the previous years, especially the drought years.

Increased fine sediment — Following the 2012 Ponderosa fire, there has been observations of increased fine sediment in the watershed. Since 2014, several intense storms led to catastrophic road failures in the upper watershed leading to even more fine sediment being observed inundating holding pools and covering up spawning habitat in the South Fork. Each year since, we have observed these fine sediments decreasing in the South Fork; however, they have moved in to the main stem and have now moved their way to the mouth of Battle Creek. This season we also noted the continued improvement in spawning habitats in the South Fork as well as the majority of holding pools in that reach returning to normal depths. Fine sediments are still being documented throughout the creek, with the majority being observed in spawning areas and holding pools in Reaches 4–6. These sediments have filled in pools, including Baldwin Pool, which is a historic holding pool below a large spring-fed tributary, and has led to less fish holding in this section of the creek. Spawning has also reduced in and around this area because *the reduction in holding habitat. We believe that this may be an issue into the future with sub-optimal holding and spawning habitat in the main stem. Similar to the observations in the South Fork, we may see these sediments move out of the drainage over time, but with deeper pools and more dynamic habitats in the main stem where fines can settle, we may see lasting effects from these sediments for years to come.*

The USFWS continues to report and monitor the impacts associated with the Ponderosa Fire and the high precipitation events, but it appears that at least some of the initial impacts are trending towards recovery within the upper reaches of the larger Battle Creek watershed.

Digger Creek Tributaries Water Quality and Road Erosion Report

Summary

The Sierra Pacific Industries (SPI) Research and Monitoring Program has been collecting benthic macroinvertebrate (BMI) and water quality data from the greater Battle Creek watershed since 2002. Following recommendations from the Interagency Task Force Report (2011), in 2012, two additional permanent water quality stations on the South and North Forks of Digger Creek (i.e., 560, 561) were installed to collect continuous measurements for a variety of parameters, including water temperature, turbidity, and flow. Associated sampling design, logistics, and quality assurance (QA) are detailed in the report Greater Battle Creek Turbidity Monitoring: Update and Additions (James and MacDonald 2012[1]) . BMI and associated physical habitat data are collected from areas adjacent to water quality stations. The coordinates and codes associated with all involved sampling sites are defined in Element A6: Project/Task Description of SPl's Research and Monitoring Program Quality Assurance Project Plan.

Resulting Digger Creek data were applied to the following standardized indices:

- *The California Stream Condition Index (CSCI)*
- *The Physical Habitat Index of Physical Integrity (IPI)*
- *Severity of Ill Effects Scale (SEV)*

In each index, both forks of Digger Creek equaled or approached scores of pre-defined reference sites. Details associated with each index appear below.

California Stream Condition Index (CSCI)

The CSCI is a statewide biological scoring tool that translates complex data about individual BMIs into an overall measure of stream health. In the four years studied (see Figure 1), the North Fork of Digger Creek CSCI scores indicated "Good" stream condition, and in two sampling years had scores above 1.0. The South Fork's CSCI scores increased from the upper boundary of " Fair" to "Good" for sampling years 2015 and 2017.

Physical Habitat Index of Physical Integrity

The method used to collect BMI also characterizes the physical habitat (PHAB) of the sampled stream. The physical habitat measurements describe the natural variability in stream types, explain variability in BMI, identify stress indicators, and provide an integrated assessment of overall stream condition. The North Fork of Digger Creek was sampled in four consecutive water years (i.e., 2014 -2017), while the South Fork of Digger Creek was sampled twice (i.e., water years 2015 and 2017). As shown in Figure 2, IPI values exceed 1.0 (i.e., "Good")4 conditions for both forks for all years sampled. These PHAB scores indicated "Good" 4 stream conditions for *the water years sampled at both locations. Because the PHAB scores are greater than 1, it is highly likely that the habitat conditions are similar to reference conditions, at least with respect to the five habitat measures included in the Index.*

Turbidity

Turbidity that is greater than or equal to 25 NTU has been associated with impaired feeding by salmonids (Sigler et al., 1984; ITF, 2011). Figure 3 shows that, between water years 2012 and 2019, average daily maximum turbidity on Digger Creek remained well below this threshold. The highest turbidity values occurred in water year 2017, which had 10-20 more inches of precipitation than the other seven water years (Figure 6).

Because of the episodic nature of stream sediment transport, thresholds should not only be a function of sediment concentration, but also of duration and dose frequency (Schwartz et al., 2008). In addition to being infrequent, turbidity exceedances of 25 NTU were also short-lived in Digger Creek. Results show that, between 2012 and 2019, the North Fork had eight events in which a single day met or exceeded 25 NTU, and three events in which two consecutive days met or exceeded 25 NTU. During this same time period, the South Fork had one event in which two consecutive days met or exceeded 25 NTU, and three events in which a single day met or exceeded 25 NTU.

Using Newcombe's 2003 categories for water clarity (NTU), 2012-2019 results show that in both forks of Digger Creek, NTU was less than seven over 97% of the time. Turbidity was never measured to be greater than 150 NTU for any single event in either fork. Additionally, the SEV model matrix results show that great er than 98% of all events had measured low turbidity levels and that the duration of exposure to those low sediment conditions create an Ideal condition for fresh water fisheries in both forks of Digger Creek.

Water Temperature

Generally, water temperatures above 26 °C are lethal to salmonids depending on the duration of exposure and species tolerance. 22-26 °C temperatures are stressful and may result in loss of appetite and failure to gain weight, competitive pressure, and displacement by other species better adapted to prevailing temperatures, or disease. The temperature zone of preference where growth response depends entirely on food availability and where optimal growth occurs is roughly 13-20 °C. Temperatures below 12 °C are known to have reduced growth for salmonids (Sullivan et. al. 2000 cited extensively in BOF 2008. Chapter 3. Figure 5, page 21).

For the eight water years depicted in Figure 4, the maximum water temperature never exceeded the 26-°C threshold. The highest single recorded temperature was 10.4 °C on 6/7/2016 for the South Fork of Digger Creek and 18.81°C on 7/5/2015 for the North Fork of Digger Creek. None of the summertime average maximum daily temperatures for any water year fall outside the preference temperature zone for salmonids in Digger Creek when compared to the Scientific Literature Review of Forest Management Effects on Riparian Functions for Anadromous Salmonids performed in 2008 by State of California Resources Agency Technical Advisory Committee for the State Board of Forestry and Fire Protection (BOF2008).

The maximum water temperatures seen in Figure 4 contributed to the following daily averages (Figure 5), which are further below the 26-°C threshold. During the summer months, these average daily water temperatures fall within the preference temperature zone for salmonids in

Digger Creek when compared to the Scientific Literature Review of Forest Management Effects on Riparian Functions for Anadromous Salmonids performed in 2008 by State of California Resources Agency Technical Advisory Committee for the State Board of Forestry and Fire Protection (B0F2008). The seasonal fluctuations seen in Figures 4 and 5 range from 3 °C to 18 °C depending on the water year.

Following the publication of Benda et.al. (2019), three roads within the Digger Creek Basin were transferred from public to private SPI ownership: the A, F, and G Line roads. To account for the most current road network conditions within the Powerhouse THP, the READI model was run again including information on those three roads. Large sections of the A, F, and G Line roads were rocked by SPI after transfer of ownership. SPI followed the recommendations of the interagency Task Force Report (2011) to rock road surfaces on individual road segments, crossing approaches, and roads within 50 feet of a watercourse. The total road length is 158.36 km for the Powerhouse THP, including the recent additions to the road network. ·

The updated READI model results for the Powerhouse THP are found in Tables 5-7 below.

Table 5.

Study Basin	Area in km^2 Total (SPI)[a]	Elevation Range (m)	Average Slope (rise/run) [b]	Drainage Density (km/km^2)	Road Density (km/km^2) [c]	Annual Precipitation cm, SPI (PRISM)	Rock Type
Powerhouse	82 (47)	1057-2789	18%	1.29 ★	1.93 ★	138	Quaternary Volcanic

[a] Sierra Pacific Industries ownership
[b] Basin average slope estimated from 1/3-arc-second digital elevation model
[c] Sierra Pacific Industries roads and ownership area only

★SPI informed CAL FIRE that there is a typo in the above table for Drainage Density and Road Density. The values should be 2.8 and 4.0 respectively. The correct values were used to derive the values presented in other tables and in the report. See also Response #24

Table 6.

Study Basin	Number of Topographic Drains[a] (per km)	Number of Engineered Drains[b] (per km)	Number of Road Segments, Topographic Drains Only	Number of Road Segments with Added Engineered Drains	Average Road Segment Length, Topographic Drains (m)	Average Road Segment Length, with Added Drains (m)
Powerhouse	635 (4.0)	2011 (12)	958	2,873	169	56

[a] Topographic drains refer to elevation low points along roads due to topography, road-stream intersections, and road segment junctions.
[b] Engineered drains refer to relief culverts, water-bars, and rolling dips that are not associated with topographic drains.

Table 7.

Study Basin	Percent Road Length Rocked	Length-Averaged Road Slope (rise/run)	Length-Averaged K Factor	Production, All Native (Index Units per km)	Production, Existing Rocked (Index Units per km)	Percent Reduction
Powerhouse	22.0%	5%	0.255	48.1	38.4	20.1%

Public Comment

Public comment for this plan came in the form of several letters and emails. These have been included in Appendix A along with a reference to where they are specifically responded to in the document. The discussion preceding this section provides responses to broader questions received through public comment, and information below provides specific responses to individual questions responded to separately. The brackets around the snapshot below show that this is considered specific Concern #1, of which a corresponding Response #1 is provided.

#1 THP 02-17-070 SHA (hereafter referred to as "the" THP) is located in the Digger Creek watershed not far above the portion that burned severely in the September 2012 Ponderosa Fire. The proposed THP drains to and is in close proximity to BCA's site DC, which is located roughly 0.6 mi upstream of the fire boundary. Their site DCH is located 4.8 mi downstream of DC and roughly 0.7 mi downstream of the fire boundary. Approximately 16% of the DC watershed and 28% of the DCH watershed have been logged since 1998. The difference is due to pre-fire clearcutting and post-fire salvage logging that affected about 4000 acres of watershed between the two sites. Comparison of measurements at the DC and DCH sites permits an

Response #1:

A majority of this concern rests on the definition of "assessment area". As described in detail in the General Discussion, the Plan Submitter has chosen a different assessment area than the one preferred by public comment writers. It is within the context of the defined assessment areas that the disclosure of past, present and reasonably foreseeable future projects is based. Likewise, the potential impacts of the plan are also evaluated within the defined assessment areas. The results of the BCA water quality analysis are also discussed elsewhere and will not be repeated here, aside from noting that CAL FIRE disagrees with the conclusion as to the direct impacts that silviculture had on instream observations. As can be seen from the research evaluated in the General Discussion, stream conditions in the larger Battle Creek area are subject to much speculation and disagreement. Site specific, quantitative measurements taken within the plan and assessment area (e.g pages 227-228, 426-438 and 570-587) show the streams to be in good condition.

Additionally, the plan contains discussion about significant improvements and investments made to upgrade roads previously under the control of the county, and roads within their private network. These improvements are expected to result in lower sediment inputs than their historic contribution.

Wildfire effects are not ignored when evaluating both the Environmental Setting and the potential impacts from a proposed project. The Ponderosa Fire its impacts and planned actions to be taken as a result are discussed on pages 58, 59, 215-217, 221, 242, 250, 261, 264, 390-404, 408, 409-418, 517-518, 525, 540-569 and 584-587

Response #2:

As it relates to water temperature, CAL FIRE has reviewed the submitted materials and studies on this topic and conducted some of our own research. Instream temperatures vary can vary greatly year to year and while the comment writers pin this solely on fire and logging effects, there is no way to separate myriad sources or the apportionment that is to be assigned to each source.

For example, an evaluation of instream temperature at monitoring station "BAS", located on the South Fork of Battle Creek, shows a trend of instream temperature decline from water years 2001 to 2011, then an increase and interyear variation during water years 2014-2020. The complete analysis is included as Appendix B to this response.

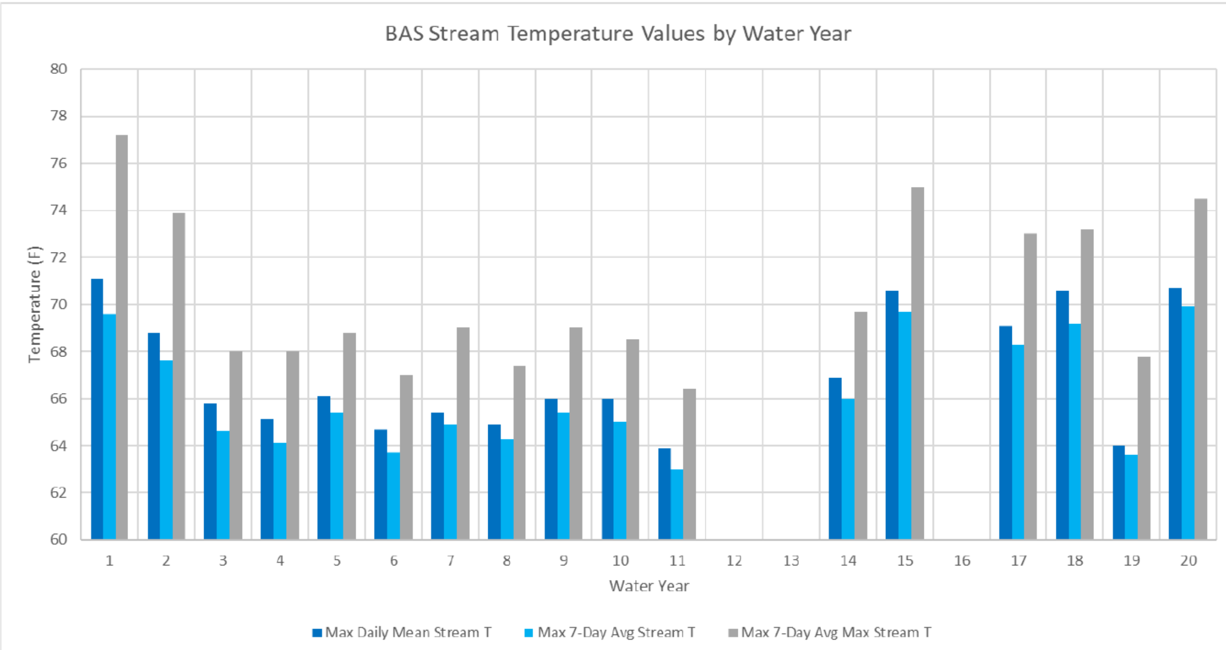

Figure 5: By water year, where 1 = WY2001, 2 = WY2002, and so on, the maximum daily mean stream temperature (dark blue), the maximum mean 7-Day average daily stream temperature (T_{Avg7}) (light blue), and the maximum mean 7-Day average daily maximum stream temperature (T_{Max7}) (gray).

Instream temperatures are showing as elevated in recent years, but these are not inconsistent with the past 20 water years as displayed in the graph above. Documents such as those provided by the USFWS (e.g. (Bottaro R. &., 2019) (Bottaro R. a., 2020)) and (Tussing, 2019) note the presence of several drought years that likely resulted in increased stream temperatures. This is consistent with the results of the CAL FIRE analysis that is included in Appendix B. Below is an excerpt:

> *Assessing the entirety of individual stream temperature data points, the percent exceedance of 65F ranged from 1% (WY2011) to 15.6% (WY2001) (Figure 4). Percent exceedances have seemingly increased when stream discharge has decreased, air temperatures increase, or when discharge decreases and air temperature increase concurrently. Stream temperature at the BAS station is therefore, acknowledging the large drainage area upstream and multiple land uses, influenced strongly by air temperature trends, and runoff and stream discharge volume trends.*

It is also important to note the difference between temperature readings reported by instream equipment and temperature thresholds related to impacts to salmonids. The report by Katharine Carter for the Central Valley Water Quality Control Board titled "The Effects of Temperature on Steelhead Trout, Coho Salmon, and Chinook Salmon Biology and Function by Life Stage" (Carter, 2005) provides a good discussion on the different ways that thresholds are reported and calculated:

In considering the effect of temperature on salmonids, it is useful to have a measure of chronic (i.e. sub-lethal) and acute (i.e. lethal) temperature exposures. A common measure of chronic exposure is the maximum weekly average temperature (MWAT). The MWAT is the maximum seasonal or yearly value of the mathematical mean of multiple, equally spaced, daily temperatures over a running seven-day consecutive period (Brungs and Jones 1977, p.10). In other words, it is the highest single value of the seven-day moving average temperature. A common measure of acute effects is the instantaneous maximum. A third metric, the maximum weekly maximum temperature (MWMT), can be used as a measure of both chronic and acute effects. The MWMT (also known as the seven-day average of the daily maximum temperatures (7-DADM)) is the maximum seasonal or yearly value of the daily maximum temperatures over a running seven-day consecutive period. The MWMT is useful because it describes the maximum temperatures in a stream, but is not overly influenced by the maximum temperature of a single day.

Based upon her review, the author chose the following as benchmarks for impacts to salmonids:

Table 13: Temperature Thresholds-from USEPA 2003

Life Stage	MWMT (°C)
Adult Migration	20
Adult Migration plus Non-Core[1] Juvenile Rearing	18
Core[2] Juvenile Rearing	16
Spawning, Egg Incubation, and Fry Emergence	13

[1] Non-Core is defined as moderate to low density salmon and trout rearing usually occurring in the mid or lower part of the basin (moderate and low not defined).
[2] Core is defines as areas of high density rearing (high is not specifically defined).

Table 14: Lethal Temperature Thresholds

Lethal Threshold (°C)			
Life Stage	Steelhead	Chinook	Coho
Adult Migration and Holding	24	25	25
Juvenile Growth and Rearing	24	25	25
Spawning, Egg Incubation, and Fry Emergence	20	20	20

It is important to note that these thresholds are calculated as the Maximum Weekly Average Temperature (MWAT), also known as the Seven Day Average of the Daily Maximum Temperatures (7-DADM). This is not to be confused with the MWMT, which often calculates higher. It is important to know which measurement is being used and the calculations necessary to reach those numbers. This is especially important when looking at CDEC tables, which show the Instantaneous Maximum, which is not the same as the MWAT and cannot be substituted in discussions. When the MWMT or MWAT is calculated, the numbers are less than the instantaneous maximum. This confusion can lead one to conclude that lethal temperatures are present in the streams when this condition is not occurring. As noted in the USFWS reports, conditions at spawning locations are observed as more favorable than what may appear to be the case when looking at the instantaneous maximum data.

The THP discusses the results of site-specific temperature measurements on pages 212-214, 426-438 and 570-587 and these have already been discussed in the General Discussion above. The THP proposes harvesting trees within the WLPZ and EEZs adjacent to Class I, II and III watercourses. All trees to be harvested within these zones shall be marked prior to harvest. Operations as proposed and evaluated are not anticipated to result in a negative cumulative effect to stream temperatures.

CAL FIRE examined the Moore paper (Moore, 2005) and strongly disagrees with the simple characterization provided by the comment writer *"The expected result is higher summertime air, soil, and stream temperatures (Moore et al., 2005)."* The characterization of the paper provided in the comment is highly presumptive and not consistent with the report itself. Below is a more balanced and thorough characterization of the Moore article [emphasis added]:

> *ABSTRACT: Forest harvesting <u>can increase</u> solar radiation in the riparian zone as well as wind speed and exposure to air advected from clearings, typically causing increases in summertime air, soil, and stream temperatures and decreases in relative humidity. Stream temperature increases following forest harvesting are primarily controlled by changes in insolation <u>but also depend on stream hydrology and channel morphology</u>. Stream temperatures recovered to pre-harvest levels within 10 years in many studies but took longer in others. Leaving riparian buffers <u>can decrease</u> the magnitude of stream temperature increases and changes to riparian microclimate, but substantial warming has been observed for streams within both unthinned and partial retention buffers. <u>A range of studies has demonstrated that streams may or may not cool after flowing from clearings into shaded environments, and further research is required in relation to the factors controlling downstream cooling. Further research is also required on riparian microclimate and its responses to harvesting, the influences of surface/subsurface water exchange on stream and bed temperature regimes, biological implications of temperature changes in headwater streams (both on site and downstream), and methods for quantifying shade and its influence on radiation inputs to streams and riparian zones.</u>*
>
> *<u>Despite decades of research on stream temperature response to forest harvesting, there are still vigorous debates in the Pacific Northwest about the thermal impacts of forestry and how to manage them</u> (e.g., Larson and Larson, 1996; Beschta, 1997; Ice et al., 2004; Johnson, 2004). <u>The conventional approach to minimizing the effects of forest harvesting on streams and their riparian zones is to retain a forested buffer strip along the stream.</u> Most jurisdictions in the Pacific Northwest require buffer strips to be left along larger (usually fish bearing) streams (Young, 2000). However, less protection is afforded to smaller, non- fish-bearing streams.*
>
> *Edge Effects and the Microclimate of Riparian Buffers*
>
> *<u>The magnitude of harvesting related changes in riparian microclimate will depend on the width of riparian buffers and how far edge effects extend into the buffer.</u> Studies by Chen et al. (1993a,b, 1995) in an old-growth Douglas fir forest in Washington state (tree heights 50 to 65 m) are commonly cited in relation to edge effects and required buffer widths. Their results are consistent with those of Ledwith (1996), Brosofske et al. (1997), and Hagan and Whitman (2000), as well as with a range of other studies including Raynor (1971) (10.5 m tall red and white pine, closed canopy, New York state), Öerlander and Langvall (1993) (22 to 25 m tall Norway spruce and Scots pine stands of varying density, Sweden), Young and Mitchell (1994)*

(mixed podocarp-broadleaf forest in New Zealand), Cadenasso et al. (1997) (60+-year-old oak, birch, beech, and maple forest in New York state), Davies-Colley et al. (2000) (mature, 20 m tall native broadleaved rainforest in New Zealand), and Spittlehouse et al. (2004) (25 to 30 m tall Engelmann spruce-subalpine fir forest with a 40 percent canopy cover in British Columbia). All of these studies show that much of the change in microclimate takes place within about one tree height (15 to 60 m) of the edge. Solar radiation, wind speed, and soil temperature adjust to interior forest conditions more rapidly than do air temperature and relative humidity. Nighttime edge temperatures are similar to interior forest conditions. Daytime relative humidity decreases from interior to edge in response to the increased air temperature.

Few studies appear to have examined microclimatic conditions within riparian buffers. In a study in northern California, above stream air temperatures measured in the early afternoon decreased with increasing buffer width, at decreases of about 1.6˚C per 10 m for buffer widths up to 30 m and 0.2˚C per 10 m for buffer widths from 30 m to 150 m (Ledwith, 1996). Above stream temperatures in the 150 m wide buffer treatments were about 6˚C lower than at the no-buffer sites. In the same study, relative humidity was 10 to 15 percent higher than at a clear-cut site for 30 m wide buffers and increased another 5 to 10 per- cent as buffer widths increased to 150 m. At a study conducted at a first-order stream in Maine (Hagan and Whitman, 2000) where a 23 m wide buffer had been left on each side, air temperature 10 m from the stream in the buffer exhibited local differences from the reference sites of up to about 2˚C. Differences up to about 4˚C were observed within about 10 m from the buffer edge.

Only one study, covering 15 small streams in west- ern Washington, appears to have examined changes in riparian microclimate using both pre-harvest and post-harvest data (Brosofske et al., 1997). Prior to harvest, gradients from the stream into upland areas existed for all variables except solar radiation and wind speed. After harvest, conditions at the edges of riparian buffers tended to approximate those in the interior of the clear-cut. Solar radiation increased substantially within the buffers relative to preharvest conditions. Soil surface temperatures were high- er after harvest. For buffers less than about 45 m wide (about one tree height), the pre-harvest gradient from riparian zone to upland was interrupted, which could influence habitat conditions for riparian fauna.

Ground Water Inflow

Ground water is typically cooler than stream water in summer during daytime and warmer during winter and thus acts to moderate seasonal and diurnal stream temperature variations (Webb and Zhang, 1999; Bogan et al., 2003). Forest harvesting can increase soil moisture and ground water levels due to decreased interception losses and transpiration (Hetherington, 1987; Adams et al., 1991). Increases in ground water levels following forest harvesting could act to promote cooling or at least ameliorate warming. Alternatively, several authors have speculated that warming of shallow ground water in clear-cuts could result in heat advection to a stream, exacerbating the effects of increased solar radiation or decreasing the effectiveness of riparian buffers (e.g., Hewlett and Fortson, 1982; Hartman and Scrivener, 1990; Brosofske et al., 1997; Bourque and Pomeroy, 2001), and this process has been incorporated into a catchment scale model of hydrology and water quality (St.-Hilaire et al., 2000). Although there is ongoing research on the thermal response of ground water to forest harvesting (Alexander et al., 2003), no published research appears to have examined ground water discharge and temperature both before and after harvest as a direct test of the ground water warming *hypothesis.*

Influences of Forest Harvesting Without Riparian Buffers

Almost all study streams in rain-dominated catchments experienced post-harvest increases in summer temperatures, with increases in summer maximum temperatures ranging up to 13˚C (Table 1). The strong response at Needle Branch may reflect the harsh treatment: clear-cutting to the streambank, slash burning, and removal of wood from the stream. The difference in response between Needle Branch and H.J. Andrews (HJA) Watershed 1, which was subjected to similar treatment, may reflect the differences in aspects (i.e., south for Needle Branch versus north- west for HJA Watershed 1), but other factors also could have influenced the responses. At HJA Water- shed 3, where streamside harvesting influenced only part of the stream length, a debris torrent removed riparian vegetation and scoured the channel to bedrock, ultimately leading to similar temperature increases as observed in HJA Watershed 1. At HJA Watersheds 1 and 3, the timing of summer maximum temperatures shifted from August for predisturbance conditions into late June and early July after disturbance, probably because inputs of solar radiation came to dominate other factors such as seasonal variations in discharge (Johnson and Jones, 2000).

In contrast to the results summarized in Table 1, Jackson et al. (2001) found that daily maximum temperature for four of seven study streams within clear- cuts in the Washington Coast Range either did not change significantly or decreased following harvesting, likely due to the large volumes of slash that covered the streams and provided shade. However, the post-harvest summer was substantially cooler than the pre-harvest summer, possibly confounding the results.

Influences of Harvesting With Riparian Buffers

Studies in rain dominated catchments suggest that buffers may reduce but not entirely protect against increases in summer stream temperature. In the Oregon Coast Range, the mean of the summer monthly maximum temperatures increased by only 2˚C at buffered Deer Creek, compared to the 5.5˚C increase observed at unbuffered Needle Branch (Harris, 1977; Table 1). However, this comparison is confounded by the fact that the Deer Creek watershed was 25 per-cent patch-cut, with only a portion of the stream network adjacent to cut blocks, compared to the 100 percent cutting at Needle Branch. Post-logging increases in maximum summer stream temperature of up to 3˚C were observed at the two Fox Creek streams in the Oregon Cascades, where sparse or partial-retention buffers were left (Harr and Fredriksen, 1988). In the Washington Coast Range, post-harvest changes in daily maximum temperature ranged from -0.5˚C to 2.6˚C for three streams with unthinned buffers (15 to 21 m wide), while streams with buffers of nonmerchantable species warmed by 2.8 to 4.9˚C (Jackson et al., 2001).

Two studies in snowmelt dominated subboreal catchments examined stream temperature response to harvesting with partial retention buffers, both con- ducted as part of the Stuart-Takla Fish-Forestry Interaction Project in the central interior of BC (Mellina et al., 2002; Macdonald et al., 2003b). Macdonald et al. (2003b) reported maximum changes in mean weekly temperatures that ranged from less than 1˚C to more than 5˚C for a set of streams subject to a range of forestry treatments (Table 1). Greater warming was observed for the low retention buffers and a patch retention treatment than for the high retention buffers. The protective effect of *the buffers was com- promised by significant blowdown, which reduced riparian canopy density from about 35 percent to 10 percent at one high retention buffer and from about 15 percent to less than 5 percent at one low retention buffer. Mellina et al. (2002) documented temperature responses to clear-cut logging with riparian buffers for two lake headed streams. Both streams cooled in the downstream direction both before and after logging. Mean August temperatures at the downstream ends of the cut blocks were slightly warmer (less than 1˚C) after logging, although the maximum daily temperature in August increased by more than 5˚C at one stream. The dominant downstream cooling observed both before and after harvest was attributed to the combination of warm source temperatures associated with the lakes and the strong cooling effect of ground water inflow through the clear-cut, as well as the residual shade provided by the partially logged riparian buffer.*

Downstream and Cumulative Effects

The potential for cumulative effects associated with warming of headwater streams is a significant management concern. Beschta and Taylor (1988) demonstrated that forest harvesting between 1955 and 1984 in the 325 km^2 Salmon Creek watershed produced substantial increases in summer water temperature at the mouth of the watershed. Given that current forest practices in the Pacific Northwest require or recommend buffers around all but the smallest streams and require more careful treatment of unstable terrain, cumulative effects resulting from current practices may be of lower magnitude than those found by Beschta and Taylor (1988). At smaller scales, down- stream transmission of clearing heated water would increase the spatial extent of thermal impacts and possibly reduce the habitat value of localized cool water areas that form where headwater streams flow into larger, warmer streams, which tend to be cooler and have higher dissolved oxygen concentrations than other types of cool water areas (Bilby, 1984).

Some authors have argued that downstream cooling is unlikely to occur except in association with cooler ground water or tributary inflow (e.g., Beschta et al., 1987), while others have contended that streams can recover their natural thermal regimes within relatively short distances downstream of forest openings (e.g., Zwieniecki and Newton, 1999). Streams can cool in the downstream direction by dissipation of heat out of the water column or via dilution by cool inflows. Dissipation to the atmosphere (and thus out of the stream-riparian system) can occur via sensible and latent heat exchange and longwave radiation from the water surface. Heat loss via evaporation (latent heat) can be a particularly effective dissipation mechanism at higher water temperatures for larger streams (Benner and Beschta, 2000; Mohseni et al., 2002). However, the effectiveness of evaporation may be reduced in small forest streams by negative feedback caused by accumulation of water vapor above the stream due to poor ventilation. Dissipation of heat from the water column into the bed can occur via conduction and hyporheic exchange (assuming the bed and hyporheic zone are cooler than stream water), but reciprocally, these mechanisms would add that heat to the bed and hyporheic zone (Poole et al., 2001). Therefore, cooling of the water column may occur at the expense of warming the streambed and riparian zone, which can influence rates of growth and development of benthic invertebrates and influence salmonid incubation (Vannote and Sweeney, 1980; Crisp, 1990; Malcolm et al., 2002).

Reported downstream temperature changes below forest clearings are highly variable, with some streams cooling but others continuing to warm (e.g., McGurk, 1989; Caldwell et al., 1991; Zwieniecki and Newton, 1999; Story et al., 2003). The maximum cooling reported in the *literature was almost 7˚C over a distance of about 120 m (Greene, 1950). The magnitude of downstream cooling may be positively related in some cases to the maximum upstream temperature. Keith et al. (1998) found that greater cooling occurred on sunny days, when maximum stream temperatures were greater than 20˚C, than on cloudy days, when maximum stream temperatures were only approximately 13˚C. Storey and Cowley (1997) observed downstream cooling of 1 to 2˚C for two streams in New Zealand where upstream temperatures were 20˚C or greater. In a third stream, which had a narrow margin of forest in the riparian zone upstream of the study reach, upstream temperatures were lower, approximately 17˚C, and no downstream cooling was observed. However, a high upstream temperature does not ensure that downstream cooling will occur, as illustrated by Brown et al. (1971), who observed no significant cooling despite an upstream temperature of 29˚C. These studies all employed only post-treatment data, so that even where cooling was observed, there is no basis to assess whether the stream temperature had recovered to pre-logging levels.*

Of the studies reviewed, only three attempted to quantify the processes governing downstream temperature changes under shade (Brown et al., 1971; Story et al., 2003; Johnson, 2004). For one clear July day, Brown et al. (1971) found that the latent and conductive heat fluxes were the only cooling (negative) terms because ground water inflow was negligible, and these were offset by the warming influences of net radiation and sensible heat, even though the forest canopy substantially reduced inputs of solar radiation. This estimated net input of heat is consistent with the observed lack of significant downstream cooling. Story et al. (2003) found that radiative and turbulent energy exchanges at heavily shaded sites on two streams represented a net input of heat during most afternoons and therefore could not explain the observed cooling of up to more than 4˚C over distances of less than 150 m. Instead, downstream decreases in daily maximum temperatures were caused by energy exchanges between the streams and their subsurface environments via ground water inflow, hyporheic exchange, and heat conduction. In contrast, Johnson (2004) demonstrated that downstream cooling could occur in an artificially shaded stream with no ground water inflow or hyporheic exchange. Clearly, more research is required to clarify the mechanisms responsible for downstream cooling and how they respond to local conditions.

Three factors may mitigate against cumulative effects of stream warming. First, although cooling by dilution of streamwater with colder inflow water cannot reduce downstream temperatures to pre-harvest levels, dilution may be great enough, especially at larger spatial scales, to render the changes ecologically insignificant, as long as the total discharge of clearing-heated streams is not a substantial fraction of the total discharge (Equation 2). Second, the effects of energy inputs will not be linearly additive throughout a stream network. This is a consequence of the relation between energy exchange (particularly energy losses via evaporation and longwave radiation) and stream temperature: increased temperatures in one reach due to reduction of riparian shade may reduce the propensity for the stream to warm in downstream reaches, even in the absence of dilution by ground water or tributary inflow. Finally, where streams flow into lakes, ponds, or wetlands, the resetting of stream temperatures may minimize the possibility for cumulative effects below the lentic environment (Ward and Stanford, 1983).

An important aspect of cumulative effects is the indirect impacts of forest harvesting. For example, removing riparian vegetation not only reduces shade but can result in a stream becoming wider and shallower due to bank erosion, which can produce a greater temperature response to the additional heat inputs. Aggradation caused by logging related mass movements and subsequent sediment loading can similarly cause stream widening and promote warming

(Beschta and Taylor, 1988). In addition, debris flows that remove vegetation and scour channel beds to bedrock can lead to marked warming in headwater tributaries (Johnson and Jones, 2000).

Predicting the Influences of Forest Harvesting on Stream Temperature

Empirical models for predicting stream temperature response to forest harvesting in the PNW include Mitchell's (1999) regression model for predicting the mean monthly stream temperature following complete removal of the riparian canopy, a "temperature screen" for predicting stream temperature as a function of elevation and percent stream shade in Washington (Sullivan et al., 1990) and a multiple regression model that predicts downstream temperature changes as a function of upstream temperature and canopy cover in the central interior of B.C. (Mellina et al., 2002). Although empirical models have the virtues of simplicity and low requirements for input data, they usually involve significant uncertainties, especially when applied to situations different from those represented in the calibration data (e.g., different locations, weather conditions).

DISCUSSION AND CONCLUSIONS

Summary of Forest Harvesting Effects on Microclimate and Stream Temperature

Forest harvesting can increase solar radiation in the riparian zone as well as wind speed and exposure to air advected from clearings, typically causing increases in summertime air, soil, and stream temperatures and decreases in relative humidity. Riparian buffers can help minimize these changes. Edge effects penetrating into a buffer generally decline rapidly within about one tree height into the forest under most circumstances. Solar radiation, soil temperature, and wind speed appear to adjust to forest conditions more rapidly than air temperature and relative humidity.

Clear-cut harvesting can produce significant daytime increases in stream temperature during summer, driven primarily by the increased solar radiation associated with decreased canopy cover but also influenced by channel morphology and stream hydrology. Winter temperature changes have not been as well documented but appear to be smaller in magnitude and sometimes opposite in direction in rain-dominated catchments. Although retention of riparian vegetation can help protect against temperature changes, substantial warming has been observed in streams with both unthinned and partial retention buffers. Road rights-of-way can also produce significant warming. Changes to bed temperature regimes have not been well studied but can be similar to changes in surface water in areas with downwelling flow.

Although the experimental results are qualitatively consistent, it is difficult to make quantitative comparisons of experimental results because the studies have expressed temperature changes using incommensurable temperature metrics. For the studies where similar metrics were available (e.g., maximum summer temperature), treatment effects exhibited substantial variability, even where the treatments appeared to be comparable (e.g., HJA Watershed 1 and Needle Branch). Thus, on their own, experimental results cannot easily be extrapolated to other situations. Application of heat budget models may help to diagnose the reasons for variations in response in experimental studies and provide a tool for confident extrapolation to new *situations.*

<u>Increased stream temperatures associated with forest harvesting appear to decline to pre-logging levels within five to ten years in many cases, though thermal recovery can take longer in others.</u> There is mixed evidence for the efficacy of low, shrubby vegetation in promoting recovery. Temperature increases in headwater streams are unlikely to produce substantial changes in the temperatures of larger streams into which they flow, unless the total inflow of clear-cut heated tributaries constitutes a significant proportion of the total flow in the receiving stream. Clearing heated streams may or may not cool when they flow into shaded areas. Where downstream cooling does not occur rapidly, the spatial extent of thermal impacts is effectively extended to lower reaches, which may be fish bearing. In addition, warming of headwater streams could reduce the local cooling effect where they flow into larger streams, thus diminishing the value of those cool water areas as thermal refugia.

<u>Based on the available studies, a one-tree-height buffer on each side of a stream should be reasonably effective in reducing harvesting impacts on both riparian microclimate and stream temperature.</u> Nar- rower buffers would provide at least partial protection, but their effectiveness may be compromised by wind throw, and they could still incur costs by complicating access and yarding operations. Alternative approaches to protecting riparian values may be possible that avoid at least some of the problems associated with buffers. For example, in B.C., many companies retain green tree patches within a cut block to provide future wildlife habitat. If these were positioned where they could shade the stream, they could provide at least some of the function of a riparian buffer but perhaps with lower wind throw risk and with less impact on ease of access and yarding.

Issues for Future Research

<u>Riparian microclimates appear to have been relatively little studied, both in general and specifically in relation to the effects of different forest practices. Further research needs to address these knowledge gaps.</u>

<u>Shade is the dominant control on forestry related stream warming, and although algorithms exist for estimating it based on riparian vegetation height and channel geometry, there is a need to refine methods for measuring it in the field and for modeling it.</u>

<u>The physical basis for temperature changes down- stream of clearings needs to be clarified. In particular, it may be useful to determine whether diagnostic site factors exist that can predict reaches where cooling will occur.</u> Such information could assist in the identification of "thermal recovery reaches" to limit the downstream propagation of stream warming. It could also help to identify areas within a cut block where shade from a retention patch would have the greatest influence.

Far from being definitive and claiming a direct cause and effect relationship, the Moore paper evaluates and discusses the differing views on the results of management on stream temperature and the different considerations taken in the prediction of potential results from differing management. Obviously, local factors have a great deal of influence over the results that one could expect from harvesting. Not only can the physical characteristics influence potential outcomes (e.g. Climate, topography, elevation, soils etc.) but the political constraints also undoubtedly have an effect (i.e. local forest practice laws and regulations). These differences cannot be ignored.

Not surprisingly, clearcut harvesting adjacent to stream zones with no buffer did show an increase in temperature, although not in every situation. Also, the dominant source of streamflow also appears to have a great deal of impact on results. The larger Battle Creek HSA receives inflow from rain, snow and also includes a significant number of spring sources, further lowering and moderating stream temperatures.

The breakdown of study results in Table 1 of the study provides a wide range of results for the studies examined, and it is worth noting that none of the study areas are in California so the impacts of the Forest Practice Rules cannot be seen in relation to the other works. It must also be considered that half of the studies used no buffers at all and that the allowable harvesting size for the study areas are significantly larger than what is allowed in California:

- British Columbia: 111 acres until 1989 when it was reduced to 70 acres. (B.C. Ministry of Forests, Mines and Lands, 2010)
- Oregon: 120 acres (Oregon Forest Resources Institute, 2018)
- Washington: 240 acres (Washington Administrative Code Title 222 Chapter 30 Section 025)
- California: 20 acres for tractor yarding & 30 acres for cable with allowances for oversized units (14 CCR933.1(a)(2))

As noted in the table above, there are allowances for increasing evenage harvest units over the limits described above. 14 CCR §933.1(a)(2) describes the conditions under which evenage units can be enlarged and the criteria that CAL FIRE is to use for evaluating the suitability of oversized harvest units. Response #4 discusses the oversized units included in this THP.

Response #3:
CAL FIRE does not dispute that timber operations result in the generation of some sediment. Even absent any management actions, sediment is produced by forested landscapes as natural processes play out. The Rules are designed to provide the most effective means of harvesting wood products, while protecting the many benefits that we derive from forested landscapes. When application of the Rules alone would not reduce the potential for sediment to be produced below the level of significance, additional measures are required to be included in the plan.

CAL FIRE reviewed the Lewis works with respect to rates of harvest and the link between harvesting and erosion. CAL FIRE was invited to participate in the peer review for the Lewis 2019 study and did not ultimately agree with the strength of the correlation between observed impacts and clearcutting. CAL FIRE continues to believe that there are myriad factors influencing impacts in Battle Creek that precludes a single variant causation.

Response #4:
The concern over contradictions in reported slope appear to be based upon a misunderstanding of the THP form. The comment states that Section II of the plan lists the slope gradient for each timber harvesting unit. This information cannot be located in Section II

of the plan. What is provided is an explanation of oversized units on page 10, discussing the 14 units that need to be disclosed to meet the requirements of 14 CCR 933.1(a)(2). There are a total of 47 units in this plan, not including Fuelbreak units.

Section III of the plan, beginning on page 129 contains the following with respect to slopes for the THP area:

> *Topographically, the harvest area consists of slopes varying from approximately 0%- 45%, with slopes averaging 0% - 30% being found on the majority of the ground.*

The CGS PHI report (Appendix C) makes the following observation on page 4:

> *Slopes within the THP area range from horizontal to about 75 percent in gradient, with the majority of slopes between 25 and 35 percent, and are vegetated with a mixed stand of conifer trees ranging in size from 12 to 36 inches in diameter at breast height (DBH).*

The CAL FIRE inspector notes on page 2 of his report that the slopes described in the plan are accurate:

5. Has the Plan accurately described the physical conditions at the plan site (soils & topography information, vegetation &stand conditions, watershed & stream conditions?)[14 CCR §1034(gg)] Yes

Response #5:
This concern letter was written for a prior plan, so the concerns mentioned in this paragraph do not appear relevant. Where they have been repeated for this THP, they will be addressed in those responses.

Response #6:
CAL FIRE understands the comment writer's position, and their refutation is in the record for consideration.

Response #7:
The comment writer has presented a standard for review that is not required by statute or regulation:

> *During the comment period for that plan we requested that Cal Fire provide us with documentation (map, written description) of where their Review Team went during the pre-harvest inspection, how many acres were reviewed, and how they looked for cumulative impacts, as required by law.*

While CAL FIRE can understand why this information would be desired, it is not required to be collected. There was nothing about how the preharvest inspection was conducted that is in violation of any law. Indeed, although it was claimed that laws were violated, no specific law was cited.

Although the Act and Rules provide no specific guidance on the contents of the preharvest inspection report, CAL FIRE Policy provides instruction on the preparation of the Preharvest Inspection Report. This Policy was complied with in the preparation of the report.

It appears that the heart of the issue centers around how much information should be provided in a THP to meet the intent of CEQA and comply with the Forest Practice Act and Rules. Comment writers appear to be asking for all the information relied upon by the RPF and agencies to be included in the plan so that they can conduct an independent investigation. Such a standard is far beyond what is required in any CEQA document, let alone a THP.

The THP is an informational document designed to provide responsible agencies with information necessary to permit "adequate and effective review" while providing sufficient information for the public to be informed and provide comment.

Relevant Citations from the Rules:

> *14 CCR 897(b)(3) While the responsibility for implementation of the Act and Rules belongs to the Director and the Department, <u>RPFs who prepare plans have the responsibility to provide the Director with information about the plan and resource areas and the nature and purpose of the operations proposed which is sufficiently clear and detailed to permit the Director to exercise the discretion and make the determinations required by the Act and Rules. The information in proposed plans shall also be sufficiently clear and detailed to permit adequate and effective review by responsible agencies and input by the public to assure that significant adverse individual and cumulative Impacts are avoided or reduced to insignificance.</u>*
> *(c) <u>The Director shall use the standards provided in these Rules when reviewing plans to determine if they conform to the Rules and regulations of the Board and the provisions of the Act.</u> In specific circumstances provided in these Rules, the Director shall disapprove plans because they conflict with the intent of the Act as interpreted by the Board.*
> *(d) Due to the variety of individual circumstances of timber harvesting in California and the subsequent inability to adopt site-specific standards and regulations, these Rules use judgmental terms in describing the standards that will apply in certain situations. <u>By necessity, the RPF shall exercise professional judgment in applying these judgmental terms and in determining which of a range of feasible (see definition 14 CCR 895.1) silvicultural systems, operating methods and procedures contained in the Rules shall be proposed in the plan to substantially lessen significant adverse Impacts in the environment from timber harvesting. The Director also shall exercise professional judgment in applying these judgmental terms in determining whether a particular plan complies with the Rules adopted by the Board and, accordingly, whether he or she should approve or disapprove a plan. The Director shall use these Rules to identify the nature of and the limits to the professional judgment to be exercised by him or her in administering these Rules.</u>*
>
> *15151. Standards for Adequacy of an EIR*
> *An EIR should be prepared with a sufficient degree of analysis to provide decision-makers with information which enables them to make a decision which intelligently takes account of environmental consequences. An evaluation of the environmental effects of a proposed project need not be exhaustive, but the sufficiency of an EIR is to be reviewed in the light of what is reasonably feasible. Disagreement among experts does not make an EIR inadequate, but the EIR should summarize the main points of disagreement among the experts. The courts have looked not for perfection but for adequacy, completeness, and a good faith effort at full disclosure.*

Relevant Citations from the CEQA Guidelines:

> *14 CCR § 21061. ENVIRONMENTAL IMPACT REPORT*
> *…An environmental impact report is an informational document which, when its preparation is required by this division, shall be considered by every public agency prior to its approval or disapproval of a project. The purpose of an environmental impact report is to provide public agencies and the public in general with detailed information about the effect which a proposed project is likely to have on the environment; to list ways in which the significant effects of such a project might be minimized; and to indicate alternatives to such a project.*
>
> *14 CCR § 15003(i) CEQA does not require technical perfection in an EIR, but rather adequacy, completeness, and a good-faith effort at full disclosure. A court does not pass upon the correctness of an EIR's environmental conclusions, but only determines if the EIR is sufficient as an informational document. (Kings County Farm Bureau v. City of Hanford (1990) 221 Cal.App.3d 692)*
>
> *14 CCR § 15121. INFORMATIONAL DOCUMENT*
> *(a) An EIR is an informational document which will inform public agency decision makers and the public generally of the significant environmental effect of a project, identify possible ways to minimize the significant effects, and describe reasonable alternatives to the project. The public agency shall consider the information in the EIR along with other information which may be presented to the agency.*
> *(b) While the information in the EIR does not control the agency's ultimate discretion on the project, the agency must respond to each significant effect identified in the EIR by making findings under Section 15091 and if necessary by making a statement of overriding consideration under Section 15093.*
> *(c) The information in an EIR may constitute substantial evidence in the record to support the agency's action on the project if its decision is later challenged in court.*
> *Note: Authority cited: Section 21083, Public Resources Code; Reference: Section 21061, Public Resources Code; Carmel Valley View, Ltd. v. Board of Supervisors, (1976) 58 Cal. App. 3d 817.*

It is CAL FIRE's responsibility to determine whether or not sufficient information is contained within the record to make a determination on the plan. CAL FIRE has done so in this case, and notes that this THP is full of site-specific data upon which to reach the conclusions that operations as proposed will not have a significant adverse effect on the environment. That the comment writer disagrees with this decision is not evidence that the conclusions are invalid. Additional discussion is also included in the General Discussion under "Requirements for the THP to contain all information necessary to demonstrate efficacy of Rules".

Response #8:
It is important to note that all CAL FIRE staff in the Redding review team have been under perennial PRA for years, and this is well known and understood. There is nothing in the included emails that appears to be improper. On the contrary, they demonstrate CAL FIRE's commitment to provide for consistent, effective environmental review using the most efficient means possible.

It is helpful to use past Official Responses in the decision-making process because they inform the preparer as to how issues have been considered in the past. They also save time by not requiring continual review of documents and informational sources previously used. They also allow CAL FIRE to save time and money by not duplicating efforts. The Department's obligation to the taxpayers to provide expert, efficient and timely review is an important consideration.

Response #9:
What this email shows is a normal and required interaction conducted as part of plan review.

The Plan Submitter, in this case SPI, is the owner of the plan and they are entitled to know everything that occurs during plan review.

> *14 CCR §1037.5 (i) Communications with Plan Submitter: The plan submitter, and the RPF who prepared the plan, and review team members, shall be provided by the Department with copies of preharvest inspection reports, nonconcurrences and review team recommendations so they are kept informed and are better able to respond promptly to the Department relative to changes that may be needed in a plan before it is acted upon by the Director.*

The Plan Submitter is entitled to know the status of plan review at all times, and they are entitled to a timely decision by CAL FIRE:

> *PRC §4592.5. Timber harvesting plans; guidance and assistance*
> *(a) The department shall provide guidance and assistance to ensure the uniform and efficient implementation of processes and procedures regulating the filing, review, approval, required modification, completion, and appeal of decisions relating to timber harvesting plans. The guidance and assistance shall comply with all of the following requirements:*
> *(1) A plan submitter has the expectation of a timely determination under Section 4582.7 and any relevant administrative regulations.*

Response #10:
CAL FIRE conducted an analysis of GIS and Forest Practice System (FPS) records to characterize the harvesting that has occurred for the period 1997-2020. In summary:

- 77 plans, covering approximately 46,881 acres, or 21% of the Battle Creek HSA, were placed under THP (Including the Rio Gatito plan, currently under litigation).

- 62 Emergency Notices for 16,862 acres within the Ponderosa Fire perimeter (approximately 61% of total area burned).

CAL FIRE cannot replicate the numbers provided by the comment writer without making assumptions about how the data was collated. It is important to remember, as discussed in the General Discussion, that the cumulative effects analysis is limited to the area chosen by the Plan Submitter and agreed to by CAL FIRE.

Response #11:
CAL FIRE watershed protection staff provided a robust and appropriate response to the "Dunn" report in 2003. It is evident from reading both the Dunn report and the CDF response that the authors did not make a good faith attempt to understand the fundamentals of the issue. The report concluded that CDF had no staff with adequate training in CWEs, yet never interviewed

any of the employees who actually did this work. The response is so substantive and germane that it has been included in its entirety as Appendix D.

As for the criticism of the review processes and concerns over adequacy of the Rules, the General Discussion contains a discussion of how the Board of Forestry has revised the Rules since this report was written to address some of the concerns expressed.

Response #12:
This typo was discovered during plan review and revised by the RPF.

Response #13:
The information contained within the pages mentioned in the concern demonstrably contain a mixture of older and newer discussion and references with information as new as 2020. Contrary to the assertion, the plan contains significant site-specific information that is germane to the THP area as discussed in other responses and the General Discussion.

Response #14:
As discussed in the General Discussion, the comment writers disagree with the chosen assessment area. This disagreement does not mean that the analysis was faulty. The General Discussion contains an exhaustive discussion of the appropriateness of using planning watersheds for evaluating cumulative effects. Further, both the THP and the Official Response contain discussions of information outside of the designated assessment areas.

Response #15:
The multiple issues raised in this concern are addressed as follows:

- The General Discussion deals with the issue of assessment areas used within the plan, and the one preferred by the comment writers. The Battle Creek Watershed Based Plan is addressed in the General Discussion in the context of the other Battle Creek studies and assessments.

- Rhyolitic soils do have increased concerns with respect to erosion and, contrary to the comment letter, the plan contains adequate disclosure and consideration:

    - Erosion Hazard Rating (EHR) is calculated based upon the methodology described in Technical Rule Addendum #1 (Attached as Appendix E).
    - Pages 130 & 225 of the THP identifies several soil types present within the plan area, including 2 which are rhyolitic. These two types are characterized as having a “moderate” to “high” erosion potential:

Symbol	Series Name and Slope Range	Parent Material	Surface Texture	Permeability	Drainage	Erosion Potential
CgD, CfE CmE CmD CmDsh	Cohasset Stony Loam 0% to 50%	Basalt	Gritty Loam	Moderate	Good	Slight
WeD WfD WfE WfEsc	Windy/McCarthy Stony sandy loam 0% to 50%	Basalt or Andesite	Stony Sandy Loam	Moderate	Good to Excessive	Slight
AaD	Aiken Loam 10% to 30%	Basalt	Stony Sandy Loam	Rapid	Good	Slight
LhE LvD LgE	Lyonsville/ Jiggs gravelly Sandy loam 10% to 50%	Basalt/Andesite	Stony/Gravelly Sandy Loam	Rapid	Good	Slight
WsD	Windy stony Sandy loam 10% to 30%	Andesite	Stony Sandy Loam	Moderate	Good	Slight
JgD JgE JgE2	Jiggs stony sandy Loan 10% to 50%	Rhyolite	Stony Sandy Loam	Moderate	Good to Excessive	High
FaE	Forward Sandy Loam 30% -50%	Rhyolite	Sandy Loam	Rapid	Good	Moderate
97	Skalan-Holland Fam. Assn. 0% - 35%	Andesite	Very Cobbly, Gravelly Sandy/Sandy Clay Loam	Rapid	Good	Moderate
40	Inville-Yallani Fam. Cobbly complex 15% - 50%	Andesite/Basalt	Very Gravelly Sandy Loam	Rapid	Good	Moderate

- Pages 264-267 contain the required calculations used to determine EHR based upon the methodology described in Technical Rule Addendum #1 and are based upon field observations.
- The CAL FIRE inspector verified that EHR was correctly calculated during the Preharvest Inspection.
- The CGS PHI report noted that non-rhyolitic soils were the dominant type for the THP area:

Table No. 1, Prominent Soil Types in the THP Area	
Soil Name	**Soil Type**
Cohasset stony loam, 0 to 30 percent slopes	Stony clay loam
Cohasset stony loam, 10 to 50 percent slopes	Stony clay loam

- The following observations were made by CGS based upon site-specific observations:

  Based on our field review, the THP generally appears to adequately describe the existing slope stability and soil erosion conditions in the THP area and, unless specifically addressed below, the proposed silvicultural activities appear suitable for the site conditions. The proposed timber harvest operations are not anticipated to adversely impact regional slope stability.

- The Digger Creek THP did not require disclosure in the past projects table because it was submitted more than 10 years before this THP. 14 CCR §898 specifies “Cumulative Impacts shall be assessed based upon the methodology described in Board Technical Rule Addendum Number 2, Forest Practice Cumulative Impacts Assessment Process and shall be guided by standards of practicality and reasonableness.” Technical Rule Addendum #2 specifies:

  D. Past Projects and Reasonably Foreseeable Probable Future Projects
  Past Projects and Reasonably Foreseeable Probable Future Projects included in the Cumulative Impacts assessment shall be described as follows:

  1. *Identify and briefly describe the location of Past Projects and Reasonably Foreseeable Probable Future Projects within assessment*

> *areas. Include a map or maps and associated legend(s) clearly depicting the following information:*
>
> > ***a.*** *Township and Range numbers and Section lines.*
> > ***b.*** *Boundary of the planning watershed(s) which the Plan area is located along with the CALWATER 2.2 Planning Watershed number(s).*
> > ***c.*** *Location and boundaries of Past Projects and Reasonably Foreseeable Probable Future Projects on land owned or controlled by the Timberland Owner (of the proposed timber harvest) within the planning watershed(s) depicted in provision (b) above. For purposes of this provision, Past Projects shall be limited to those Projects <u>submitted within ten years prior</u> to submission of the Plan.*

- CAL FIRE acknowledges that pages 10 and 11 show changes in land cover between 1985 and 2017, but does not agree with the characterization that these are a “significant effect”. It may seem like semantics, but there are differences between the terms “significant”, “significant effect” and “significant adverse effect”

  The Rules as written are designed to avoid significant adverse site-specific or cumulative impacts (see for example §896(a),(b)(3), §897(d), §898, 898.1(c)(1), §936). Technical Rule Addendum #2 provides examples of Cumulative Watershed Effects (CWEs) that can be used to determine impacts within most of the evaluation categories. Beyond the implementation of the standard Rules, the RPF must propose any additional mitigation measures that are required to reduce the impacts from the Plan to below the level of significance. Reviewing agencies also provide recommendations for revisions that are required to allow CAL FIRE to reach a conclusion that significant impacts will not occur.

  The Forest Practice Rules provide the following definitions related to impacts from 14 CCR §895.1:

  > *Long Term Significant Adverse Effect on fish, wildlife, or listed species known to be primarily associated with late succession forest stands means an effect that creates an identifiable trend or set of conditions which provide a substantial level of scientific evidence that a population of one or more species of fish, wildlife, or listed species primarily associated with late succession forest stands will become extirpated from a significant portion of its current range in the Forest District within the planning horizon.*
  >
  > *Significant Adverse Impact on the Environment means a substantial, or potentially substantial, adverse change in any of the physical conditions within the area affected by the project including land, air, water, minerals, flora, fauna, ambient noise, and objects of historic or aesthetic significance. An economic or social change by itself shall not be considered a significant effect on the environment. A social or economic change related to a physical change may be considered in determining whether the physical change is significant.*
  >
  > *While Giving Consideration means the selection of those feasible silvicultural systems, operating methods and procedures which substantially lessen significant adverse Impact on the environment and which best achieve long-term, maximum sustained production of*

forest products, while protecting soil, air, fish and wildlife, and water resources from unreasonable degradation, and which evaluate and make allowance for values relating to range and forage resources, recreation and aesthetics, and regional economic vitality and employment.

- The CEQA Guidelines also provide clarification:

  § 21068. SIGNIFICANT EFFECT ON THE ENVIRONMENT
  "Significant effect on the environment" means a substantial, or potentially substantial, adverse change in the environment.

  15002(g) Significant Effect on the Environment. A significant effect on the environment is defined as a substantial adverse change in the physical conditions which exist in the area affected by the proposed project. (See: Section 15382.) Further, when an EIR identifies a significant effect, the government agency approving the project must make findings on whether the adverse environmental effects have been substantially reduced or if not, why not. (See: Section 15091.)

  15382. SIGNIFICANT EFFECT ON THE ENVIRONMENT
  "Significant effect on the environment" means a substantial, or potentially substantial, adverse change in any of the physical conditions within the area affected by the project, including land, air, water, minerals, flora, fauna, ambient noise, and objects of historic or aesthetic significance. An economic or social change by itself shall not be considered a significant effect on the environment. A social or economic change related to a physical change may be considered in determining whether the physical change is significant.

  CAL FIRE has used these as the basis upon which a determination has been made on this plan. Changes over time from one vegetation type to another and from one seral stage of forest to another does not, in and of itself, constitute a significant adverse effect on the environment.

- As it relates to water quality impacts based upon BCA studies, the General Discussion contained a discussion on these reports and CAL FIREs conclusions based upon a review of all available information.

Response #16:
CAL FIRE understands that the comment writers are dissatisfied with the information that the Plan Submitter has relied upon during the preparation of the THP. This objection does not mean that the information relied upon was not sufficient to determine impacts of the proposed project. As required, CAL FIRE has also supplemented the record as discussed in the General Discussion to include additional information requiring consideration.

Response #17:
CAL FIRE believes that the record is sufficient to document that potential downstream impacts were evaluated, both as part of establishing a baseline condition, and with respect to potential impacts from the proposed project. See General Discussion and other responses.

Response #18:
Timber harvesting plans are not required to evaluate the water cycle as part of the cumulative effects analysis, and it is difficult to understand how a THP could alter patterns of the water cycle on a regional or global scale.

The concern makes a series of generalized and generic conclusions about timber harvesting that can be generally responded to:

- The concern equates timber harvesting with "land degradation" which cannot be supported based upon the Record. One of the definitions used by the International Panel on Climate Change (IPCC) is "*a negative trend in land condition, caused by direct or indirect human-induced processes including anthropogenic climate change, expressed as long-term reduction or loss of at least one of the following: biological productivity, ecological integrity or value to humans."* (IPCC, 2019)*.* The report "Definitions and Methodological Options to Inventory Emissions from Direct Human-induced Degradation of Forests and Devegatation of Other Vegetation Types" (IPCC-NGGIP, 2003) notes that there were over 50 definitions of "degradation" in the literature they reviewed.
- The concern equates timber harvesting with increased fire danger, ignoring the requirements found within the Rules for hazard reduction, the requirement to evaluate fire hazard and risk in the Cumulative Impacts Discussion and the implementation of silvicultural prescriptions designed to protect stands from catastrophic wildfire (Fuelbreak)
- The concern assumes increased erosion, despite mitigation measures included in the Rules and the plan to assess erosion potential (e.g. EHR) and reduce erosion to below the level of significance
- The concern assumes that harvesting will result in loss of soil fertility without providing evidence to support the concern.

The concern states that nothing has been done at the local, regional or state level to address the effects on the water cycle, yet it is unclear what could be done at the THP level to address this. Further, requiring mitigation on an individual THP when the ability for forest management to affect the local water cycle is entirely speculative cannot be supported by the Record.

While impacts on the water cycle are not addressed specifically, the impact that the plan could have on the release and sequestration of Greenhouse Gasses (GHG) has been evaluated on pages 186-207 and is also extensively discussed in the General Discussion. Additionally, the long-term trends in expected changes in temperature and rainfall have also been discussed in the General Discussion and taken into consideration when making a determination on this plan.

CAL FIRE reviewed the Lukovic study (Sekulić, 2021) which reviewed rainfall data for the last 60 years and identified a statistically significant decrease in precipitation in the autumn, extending the dry period in California. This research was conducted in order to inform future modeling of precipitation trends.

CAL FIRE reviewed the Porkony study (Pokorný, 2018) compared temperatures collected and released on different surfaces such as forest, meadows and concrete. Not surprisingly, forested landscapes moderated temperatures much more effectively than areas not covered with vegetation such as concrete. Concerns are noted over conversion of forests into non-forested or urban landscapes. This is not proposed under this plan and a new forest will be planted after harvesting within the evenage units.

CAL FIRE reviewed the Ellison work (Ellison, 2017) and found it to be primarily an opinion piece intended to influence public policy to achieve social justice goals. A variety of topics are discussed in this piece, and it is worth noting, however, that the authors conclusions on the value of biodiversity and native species in plantations meshes very well with current practices in California.

> *Forest-driven water and energy cycles are poorly integrated into regional, national, continental and global decision-making on climate change adaptation, mitigation, land use and water management. This constrains humanity's ability to protect our planet's climate and life-sustaining functions. The substantial body of research we review reveals that forest, water and energy interactions provide the foundations for carbon storage, for cooling terrestrial surfaces and for distributing water resources. Forests and trees must be recognized as prime regulators within the water, energy and carbon cycles. If these functions are ignored, planners will be unable to assess, adapt to or mitigate the impacts of changing land cover and climate. Our call to action targets a reversal of paradigms, from a carbon-centric model to one that treats the hydrologic and climate-cooling effects of trees and forests as the first order of priority. For reasons of sustainability, carbon storage must remain a secondary, though valuable, by-product. The effects of tree cover on climate at local, regional and continental scales offer benefits that demand wider recognition. The forest- and tree-centered research insights we review and analyze provide a knowledge-base for improving plans, policies and actions. Our understanding of how trees and forests influence water, energy and carbon cycles has important implications, both for the structure of planning, management and governance institutions, as well as for how trees and forests might be used to improve sustainability, adaptation and mitigation efforts.*
>
> *Billions of people suffer the effects of inadequate access to water (Mekonnen and Hoekstra, 2016) and extreme heat events (Fischer and Knutti, 2015; Herring et al., 2015). Climate change can exacerbate water shortages and threaten food security, triggering mass migrations and increasing social and political conflict (Kelley et al., 2015). Strategies for mitigating and adapting to such outcomes are urgently needed. For large populations to remain where they are located without experiencing the extreme disruptions that can cause migrations, reliable access to water and tolerable atmospheric temperatures must be recognized as stable ingredients of life. As we explain, the maintenance of healthy forests is a necessary pre-condition of this globally-preferential state.*
>
> *The published work we review suggests forests play important roles in producing and regulating the world's temperatures and fresh water flows. Well recognized as stores of carbon, forests also provide a broad range of less recognized benefits that are equally, if not more, important. Indeed, carbon sequestration can, and perhaps should, be viewed as one co-benefit of reforestation strategies designed to protect and intensify the hydrologic cycle and associated cooling. Organized and conceived in this way, reduced deforestation, forest landscape restoration and forest preservation strategies offer*

> *essential ingredients for adaptation, mitigation and sustainable development.*
>
> *Deforestation and anthropogenic land-use transformations have important implications for climate, ecosystems, the sustain- ability of livelihoods and the survival of species, raising concerns about long-term damage to natural Earth system functions (Steffen et al., 2015). Mean warming due to land cover change may explain as much as 18% of current global warming trends (Alkama and Cescatti, 2016). Deforestation exerts an influence on warming at the local scale and alters rainfall and water availability, not to mention the emission of greenhouse gases.*
>
> *Biodiversity enhances many ecosystem functions like water uptake, tree growth and pest resistance (Sullivan and O'Keeffe, 2011; Vaughn, 2010). The perverse effects of current land management strategies require closer scrutiny. For example, the practice of plantation forestry can negatively impact species richness and related ecosystem services (Ordonez et al., 2014; Verheyen et al., 2015).*
> *Mixed species forests may lead to healthier, more productive forests, more resilient ecosystems and more reliable water related services, and often appear to perform better than monocultures regarding drought resistance and tree growth (Ordonez et al., 2014; Paquette and Messier, 2011; Pretzsch et al., 2014 Pretzsch et al., 2014). Through variation in rooting depth, strength and pattern, different species may aid each other through water uptake, water infiltration and erosion control (Reubens et al., 2007). Species richness – particularly native species – may be an essential driver in land management policies. Forest rehabilitation offers opportunities to restore water-related ecosystem services (Muys et al., 2014). Future research should identify the required species richness for optimal water ecosystem services. The effects of biodiversity on aerosols, volatile organic compounds, ice nucleation and other rainfall related processes require further research.*

The long-term maintenance and perpetuation of forested ecosystems is of primary importance in achieving both regulatory and strategic objectives for mitigating the anticipated negative effects of climate change. This is discussed in great detail in the General Discussion along with the role that forests and forestry play in achieving these goals.

When studies are referring to deforestation, there does not seem to be a unified definition. Some refer to the conversion of forests to non-forest uses to be deforestation while others would consider a native forest replaced by an exotic tree species to meet the definition. The United Nations Food and Agriculture Organization has the following definition for "deforestation": (UNFAO, 2021)

> *Deforestation is:*
>
> *Decision 11/CP.7 (UNFCCC, 2001): the direct human-induced conversion of forested land to non-forested land.*
>
> *FAO 2001: The conversion of forest to another land use or the long-term reduction of the tree canopy cover below the minimum 10 percent threshold.*
>
> > *Explanatory note:*

> *1. Deforestation implies the long-term or permanent loss of forest cover and implies transformation into another land use. Such a loss can only be caused and maintained by a continued human-induced or natural perturbation.*
> *2. It includes areas of forest converted to agriculture, pasture, water reservoirs and urban areas.*
> *3. The term specifically excludes areas where the trees have been removed as a result of harvesting or logging, and where the forest is expected to regenerate naturally or with the aid of silvicultural measures. Unless logging is followed by the clearing of the remaining logged-over forest for the introduction of alternative land uses, or the maintenance of the clearings through continued disturbance, forests commonly regenerate, although often to a different, secondary condition. In areas of shifting agriculture, forest, forest fallow and agricultural lands appear in a dynamic pattern where deforestation and the return of forest occur frequently in small patches. To simplify reporting of such areas, the net change over a larger area is typically used.*
> *4. Deforestation also includes areas where, for example, the impact of disturbance, over-utilization or changing environmental conditions affects the forest to an extent that it cannot sustain a tree cover above the 10 percent threshold.*

Using the definitions established by the UN, nothing short of timberland conversion would meet this definition, and no conversion is proposed in this THP. Restrictions on the size of evenage harvest units and age limits on adjacent harvesting provide more variety in stand ages and composition across the landscape. When it comes to plantation establishment in California, native species specific to the seed zone where the THP occurs are required to be planted. SPI provides leave trees individually and in groups to achieve a variety of objectives that also add to post-harvest species and genetic diversity. Additionally, a diversity of species is commonly planted in these areas which combine with leave trees and adjacent seedfall to perpetuate a diversified landscape.

Response #19:
The Rules do not specify the information source that the RPF must use for describing the physical conditions of the plan area:

> 14 CCR §1034(gg)
> *A general description of physical conditions at the plan site, including general soils and topography information, vegetation and stand conditions, and watershed and Stream conditions.*

Without specifics, the RPF must rely upon their professional judgement to determine appropriate information sources. Review of information provided is based upon information that was available before submission of the plan and what was reasonable and practical to provide. For example, one potential source of regional rainfall data would be the CDEC Database hosted by the Department of Water Resources. The most current report for the “Northern Sierra Precipitation: 8 Station Index” shows that for the average precipitation for the period 1966-2015 was 51.8 inches[13]. The isohyetal maps provided with Technical Rule Addendum #1 (Appendix E) show an average precipitation of 50 inches for the THP area. The Prism Climate

[13] http://cdec4gov.water.ca.gov/reportapp/javareports?name=PLOT_ESI.pdf

Group at Oregon State University[14] shows a "30 year normal" (1991-2020) precipitation value for the THP area to be 48.1 inches. For the period of 1901-2017, Prism shows an average precipitation value of 42 inches, although the accuracy of the historic data is not as robust as more recent measurements.

It is not appropriate to use short term precipitation figures, especially when values generated are used to estimate the proper sizing of culverts and for the estimation of Erosion Hazard Rating. As a result of the higher precipitation number used by the RPF, Erosion Control standards are more stringent and new culverts and bridge projects must be able to pass more water than would be required if the RPF used the lower figure suggested by public comment.

Response #20:
CAL FIRE believes this concern is adequately responded to in both the General Discussion and in Response #2.

Response #21:
The THP maps are not required to show past logging. The only requirement to map past projects is found within Technical Rule Addendum #2, Item "D". This map is found on page 270.

Response #22:
The works of Lewis and Carter are discussed in the General Discussion. As discussed, CAL FIRE does not agree about the conclusions of direct impacts from logging on stream temperature and sediment. Also as described in the General Discussion, the reported temperatures are not being correctly correlated with the literature.

Response #23:
CAL FIRE acknowledges that the methodology used by the RPF to characterize stream channel conditions is not acceptable to the comment writers, but this does not mean that the methodology is flawed. As discussed in the General Discussion, quantitative data is not required to be collected for these evaluations, although the Plan Submitter has included site specific metrics for stream conditions as described elsewhere. The RPF must use professional judgement in the evaluation and reporting of stream conditions. The RPF is further required to only conduct such work if they are qualified to do so (see PRC §752(b)) and is responsible for all work products produced for the plan. Using a "person known to be trained in hydrology" when such a standard is unknown and undefined, is not required under the Rules. CAL FIRE determined the information provided in the plan to be adequate to evaluate the pre-project conditions found within the plan area.

Response #24: When examined, SPI determined that the table in question has 2 typos that need to be noted. The values for Drainage Density and Road Density were not correctly entered in the table for the THP. The values should be 2.8 and 4.0 respectively. The correct

[14] https://prism.oregonstate.edu/

values were used to derive the values presented in other tables and in the report. CAL FIRE GIS staff conducted an evaluation and came up with a number of 6.9 miles per square mile, if proposed roads were included.

Original THP Table:

Table 5.

Study Basin	Area in km^2 Total (SPI)[a]	Elevation Range (m)	Average Slope (rise/run)[b]	Drainage Density (km/km^2)	Road Density (km/km^2)[c]	Annual Precipitation cm, SPI (PRISM)	Rock Type
Powerhouse	82 (47)	1057-2789	18%	1.29 ★	1.93 ★	138	Quaternary Volcanic

[a] Sierra Pacific Industries ownership
[b] Basin average slope estimated from 1/3-arc-second digital elevation model
[c] Sierra Pacific Industries roads and ownership area only

FPGIS Analysis:

	SPI Ownership in WAA		Miles of Roads on Ownership	Density of Roads on Ownership (Miles/sq mile)	Kms of Roads on Ownership	Density of Roads on Ownership (kms/sq km)
Sq miles	9.7125	Abandoned	1.797685	0.185089833	2.89308638	0.11500912
Sq kms	25.15527788	Existing	62.482629	6.433217915	100.555794	3.997403434
		Proposed	3.096026	0.318767156	4.98255848	0.198072091
		Grand Total	**67.37634**	**6.937074903**	**108.431439**	**4.310484645**

Response #25: It is important to note that just because CDFW did not choose to attend the PHI, that does not mean they did not participate in review. The CalTrees database shows 2 different CDFW employees actively participated in First review by asking 4 questions of the RPF. CDFW did not attend the PHI but also participated in Second Review where they indicated there were no further issues requiring clarification or revision.

As to the concern noted over the Pacific Marten, this species is classified as threatened by the USWFS for the “coastal distinct population segment” found in California and Oregon[15] and Endangered by CDFW for the coastal populations[16]. There are no listed populations of Marten found in the THP area. A closely related species is the Pacific Fisher, which is listed as endangered by the USFWS for the “Southern Sierra Nevada Distinct Population Segment”[17] and Threatened by CDFW for populations south of the Merced River[18].

While no populations of marten or fisher are listed within the THP area, the THP has a robust discussion not only of the Pacific fisher and potential impacts, but also provides mitigation

15 https://ecos.fws.gov/ecp/species/9081

16 https://nrm.dfg.ca.gov/FileHandler.ashx?DocumentID=109405&inline

17 https://ecos.fws.gov/ecp/species/3651

18 https://nrm.dfg.ca.gov/FileHandler.ashx?DocumentID=109405&inline

measures on pages 41and 62-63. These voluntary measures were taken by SPI in order to enter into a Candidate Conservation Agreement with Assurances (CCAA) with the USFWS in 2016 for their ownership within the Klamath, Cascade and Sierra Nevada Regions (U.S. Fish and Wildlife Service, 2016). This agreement places additional restrictions on SPI management above and beyond those required under the Rules and is intended to provide conservation benefits for fishers.

CAL FIRE has reviewed the plan and determined that no significant adverse effect will occur to wildlife species as a result of the proposed plan.

Response #26:
As discussed in the General Discussion, there is uncertainty about future climate conditions in California and their effects on the growth potential of forests. With this said, active forest management and efforts to perpetuate healthy forests into the future remains an important climate mitigation strategy and is central to achieving many of the carbon sequestration goals set by the state. Models about future climate trends (temperatures, rainfall, etc.) are limited in their confidence relative to a specific outcome. As a result, making conclusions today about approving a THP based upon speculative future conditions is inappropriate.

Comment writers are justified in being skeptical about the ability for SPI management to produce the results they have forecasted in their Option a document. Much like the climate prediction models, SPI used measurements of the past combined with expert opinion and assumptions to produce a forecast of a future condition. While CAL FIRE approved the SPI Option a based upon their detailed analysis, future conditions can change such that the projections made in the SPI Option a are no longer attainable. Fortunately, the SPI Option a demonstration of MSP is not a monolithic document. Each THP that is submitted under the Option a opens the MSP document up to review. If at any time CAL FIRE concludes the Option a is no longer valid, it must be revised. This is not a theoretical discussion.

For at least the last decade, public comment has questioned the accuracy and reliability of the SPI option a (and other MSP documents produced by industrial landowners). In each case, CAL FIRE examines the provided evidence to determine if adjustments are required. One way to track compliance with the Option a is with reports provided by the landowner to demonstrate that implementation is consistent with the original projections. CAL FIRE has been working with all landowners in the Cascade Region to ensure that they are providing us with the necessary information to validate that implementation is consistent with the demonstration of MSP.

In addition to the monitoring documents provided to CAL FIRE, each preharvest inspection provides the opportunity for the Inspector to comment and provide insight on how the proposed prescription is or is not consistent with the demonstration of MSP contained within the Option a. Changes to THPs are made based upon these field observations and some THPs are even returned at First Review for failure to demonstrate compliance with the Option a.

The comment writers are also justified in questioning the ability for planted trees to grow to the size classes predicted by SPI. The science of modeling tree growth is complicated and influenced by a variety of factors. The SPI Option a relies upon their ability to grow trees to a target size within a specified number of years, based upon site productivity and the species of tree involved. If there are significant changes in the climate impacting tree growth (e.g. higher temperatures and lower precipitation), then the ability for plantations to meet those growth objectives may fall into question. It is reasonable, therefore, to ask the question "What if these trees don't grow like they are modeled?" or "What recourse does CAL FIRE have if the forecasted result does not materialize?" This is where the constant review of the Option a comes into play.

Because SPI provided CAL FIRE with detailed plantation schedules during the Option a review[19], we know the exact trajectory that plantations should be following in order to meet the growth targets. Specific information such as tree frequency, size, height and volumes are calculated for the entire rotation of the plantations and this is provided for all species and productivity classes. This information can be validated in an ad-hoc fashion by a CAL FIRE inspector during a routine inspection or it can be achieved in a more systematic fashion by a formal survey by CAL FIRE. If these plantations are not growing at the forecasted targets at any point in time, changes to the Option a (including invalidation) can be initiated.

It is important to note that the Redding office conducts routine administrative reviews of all Option a documents to determine if implementation is consistent with projections. This involves comparing harvest volumes, acreage and silviculture to actual harvesting. Since every Option a is different both in the modeling and in the monitoring documents provided, the administrative review is likewise tailored to the information needed to evaluate consistency between the Option a and actual implementation.

Response #27:

The concern begins with the premise that the THP will create hazards that would require mitigation measures above and beyond what are required by the rules. The RPF conducted an analysis of wildfire risk and hazard as required under the Rules. This analysis is found on pages 261-262 and concluded that the plan would not result in a significant adverse effect. CAL FIRE concluded that not only would the proposed Fuelbreak meet the intentions as defined under the Rules, but that there were no additional measures necessary to reduce fire hazard.

CAL FIRE reviewed the letter from Mr. Hansen, along with the supporting literature and does not agree with his broad-brushed conclusion that logging results in fires that "burn faster or more intensely-sometimes towards communities". Additionally, the suggestion that the devastation and loss of life that occurred during the Camp Fire being caused by forest management is wholly unsupported by the information provided.

A scientific analysis of the Camp Fire progression was released earlier this year by the National Institute of Standards and Technology, a department of the US Department of Commerce

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[19] In addition to the information contained within the public portion of the plan, additional detailed information was provided for confidential review by CAL FIRE. This information is protected as Trade Secret pursuant to Government Code §§6254(k) and 6254.7(d), Civil Code §§3426—3426.11, and Evidence Code §1060. This information contains additional detail with respect to current inventory, the growth of the ownership within the Northern Forest District and harvests expected from the ownership over time. Both the public and Trade Secret portions of the Option "a" document were reviewed as part of THP 2-97-359-SHA and found to be in conformance with the Forest Practices Act and Forest Practice Rules.

(Maranghides, 2021). This study examined the fire progression in extreme detail and reached several conclusions on the causation of the fire intensity:

> *The Camp Fire ignited on November 8, 2018 in the foothills of the Sierra Nevada in Butte County, California. The first 24 hours were characterized by a fast-moving fire with initial spread driven by high winds up to 22 m/s (50 mi/h) and long-range spotting up to 6.3 km (3.9 mi) into the community. The fire quickly impacted the communities of Concow, Paradise, and Magalia. The Camp Fire became the most destructive and deadly fire in California history, with over 18 000 destroyed structures, 700 damaged structures, and 85 fatalities. After a preliminary reconnaissance, it was determined that abundant data was available to support an in-depth case study of this devastating wildland-urban interface (WUI) fire to increase our understanding of WUI fire spread, fire behavior, evacuation, and structure response. The methodology guiding the case study and a detailed timeline reconstruction of the fire progression and fire behavior are presented. Over 2200 observations about fire spread and behavior were collected during the case study. Subsequent reports will detail additional aspects of the incident including emergency response and evacuation, and defensive actions and structure response. This study has identified that Butte County and the Town of Paradise were well prepared to respond to a WUI fire, that the Camp Fire grew and spread rapidly and that multiple factors contributed to the rapid growth and spread of the Camp Fire. Additionally, this study identified the importance of the wildland fire ignition location relative to the community, that multiple parcel-level fire spread pathways caused structure ignitions, and that WUI fire spread impacted the affected communities in multiple ways beyond the destruction of residential and commercial properties.*
>
> *What were the primary causes of the extensive devastation?*
> *There are many factors that may impact individual structure survivability and the effectiveness of defensive actions at a parcel level. When viewing the Camp Fire in its entirety, four factors were identified that most significantly influenced overall fire losses:*
> *i. Fuel ignition potential,*
> *ii. Density of vegetative and structural fuels,*
> *iii. Wind and terrain, and*
> *iv. Extent/size of fire front reaching the communities.*
>
> *Fuel Ignition Potential*
> *Fuel receptivity to embers and ignition potential was a result of over 200 days with almost no precipitation. Fuel moisture contents were at or near record low for the time of year. The presence of fine fuels, including but not limited to pine needles and ornamental vegetation stressed by limited precipitation, enabled a number of spot ignitions by embers traveling well ahead of the fire front. Fuel receptivity and ignition from embers was clearly conveyed in multiple first responder statements reporting "100 % ember ignitions." It was this fuel receptiveness that caused the large number of ignitions within the communities. In Paradise, these ignitions started approximately 30 min to 40 min before the arrival of the fire front and rapidly grew in number when the front reached the community.*
>
> *Density of Vegetative and Structural Fuels*
> *All three communities, Concow, Paradise, and Magalia, are intermix communities that have developed over decades among the local wildland vegetation. Concow can be considered low population density intermix with 10 people/km2 (26 p/mi2), while Paradise and Magalia can be classified as high-density intermix communities with 552 p/km2 and 312 p/km2 (1433 p/mi2 and 808 p/mi2) respectively.*

The absence of fire within most of Paradise and Magalia for many decades had resulted in significant vegetative fuel accumulation. The vegetative fuel loading was further increased by diseased vegetation (specifically pines). Seasonal needle dropping, combined with diseased trees and further enhanced by high winds, resulted in extensive needle accumulation before and during the fire. The historic growth of Paradise and surrounding communities, going back over a century, resulted in many structures placed on smaller lots. The short structure separation distances, together with the vegetative fuel loading, enabled rapid structure-to-structure fire spread.

Fuel treatments have been used extensively to compartmentalize the landscape in the area around Paradise, Magalia, and Concow. The intent was to provide access for firefighting operations and reduce the total impact of wildfires by reducing the total acreage burned. Fuel treatments were used not only to influence wildland fire behavior but also to protect critical infrastructure such as the primary pumping station and treatment plant of the Paradise Irrigation District. Together with defensive actions, these specific fuel treatments met their objectives during the Camp Fire, and the critical infrastructure was undamaged. This specific fuel treatment example is included here to highlight the value of pre-fire preparation and vegetative fuel reduction in protecting critical infrastructure. The systematic analysis of the effectiveness of fuel treatments and their impact on fire behavior are beyond the scope of this report.

Wind and Terrain
The terrain of eastern Butte County is defined by the Sierra Nevada foothills and numerous deep river canyons and ravines.

The Feather River Canyon and Jarbo Gap, near the fire's origin, are known for their particularly high winds. Ridgetop gusts over 22 m/s (50 mi/h) are not uncommon, and the downslope north winds bring dry air through the foothills and the Town of Paradise.

The north wind event that occurred in the early morning on November 8 combined with receptive fuels, and the restricted access associated with topography contributed to the rapid growth of the fire, exceeding the ability for initial containment.

It is the confluence of these four factors (fuel ignition potential, high fuel density, wind and terrain, and extent of the fire front reaching the communities) that caused the aggressive fire behavior resulting in dangerous conditions for residents and first responders and in extensive damage and destruction.

Multiple Factors Contributed to the Rapid Growth and Spread of the Camp Fire

> *F5. Dry winds, with recorded gusts at Jarbo Gap exceeding 22 m/s (50 mi/h) from the northeast, increased fire spread in vegetative and structural fuels.*
> *F6. Steep topographical features including river canyons and creek drainages channeled north winds and accelerated fire spread through vegetative fuels.*
> *F7. Extremely dry vegetative fuels, associated with over 200 days without any significant precipitation, increased the fuel ignition potential around and within Concow, Paradise, and Magalia.*

F8. Fire spread toward Paradise from Concow was fueled by heavy conifer forests with brush understory. At lower elevations oak woodlands and savannah grass were primary fuels.

5.2. Fuels Description

Fuels around the point of origin and downwind towards and within Paradise and Magalia consisted of heavy conifer timber with brush understory. At lower elevations, oak woodland and grass savannah were the primary fuels. The area near the fire origin had burned previously in 2008; however, fuels west of the West Branch of the Feather River, in Paradise and Magalia, had not burned in recorded history (see Section 5.4). Timber was characterized by close crown spacing with heavy manzanita and oak cover underneath.

Fuel moisture levels were uncharacteristically low for the time of year due to the protracted dry period and late arrival of rain beginning the wet season. Fuel moisture levels [34] for 1000-hour time lag fuels measured at the Pike County Lookout south east of the fire area were at 5 % on November 1, well below the 17 % average for the Northern Sierras in November. Live fuel moisture in manzanita was 74 %; the critical level, in terms of fire hazard, for manzanita is 80 %. The average for November is 93 % [TD-131].3

The Energy Release Component (ERC) output by the National Fire Danger Rating System (NFDRS), a measure related to the total fuel energy availability per unit area (J/m2, Btu/ft2), which increases as fuels cure/dry, trended slightly above average for the northern Sierras during the summer, but in early October it began trending well above average. On the day of the fire the ERC calculated amongst a grouping of nearby fire weather stations was 80, above the historic record for the date (60) and above the 90th percentile for all dates in the previous 10 years (80). ERC values are presented in ***Figure 4****, developed by Aviva Braun from the National Weather Service. A slideshow by Ms. Braun on the weather conditions during the Camp Fire is presented in Appendix D [35].*

5.3. Weather

Weather before and during the Camp Fire, as for many rapidly spreading fires, was characterized by dry and windy conditions. In California, the windy conditions are often brought by downslope north wind events, bringing warm, dry air through fire prone regions. Jarbo Gap is known for locally high winds, particularly during north wind events which align with the Feather River Canyon. The Big Bend of the Feather River channels and forces winds up and over the ridge at Jarbo Gap. While dry or windy conditions are not unusual in Butte County, the overlap of late season dryness with a north wind event was relatively uncommon. Wetting rains typically begin in September before the frequency of north wind events increases in November and December [TD-003, TD-131].

It was very unusual to have fuel dryness levels so low in November in Butte County. In most years significant rain would have fallen by November, dampening fine fuels and lowering the ignition hazard. However, with the exception of a small amount of rain in early October leading up to the Camp Fire, it had been over 200 days since 13 mm (0.5 in) or more of rain had fallen at the lower elevations of Butte County. The U.S. Drought

Monitor [38] reported much of Butte County in the "D0 Abnormally Dry" condition for the 19 weeks leading up to the fire, between June 26 and November 6, moving into "D1 Moderate Drought" on November 13Figure 6 [39].

Gusty winds were measured at the Jarbo Gap Remote Automated Weather Station (RAWS) [37] starting around 19:00 on November 7, becoming very strong by 21:00. Sustained winds of 12 m/s (27 mi/h) continued overnight with gusts over 22 m/s (50 mi/h). <u>At the time of ignition on November 8, the RAWS station reported 8 m/s (18 mi/h) winds gusting to 18 m/s (40 mi/h) with relative humidity of 23 %. Wind direction across the foothills and ridgetops was almost exclusively from the northeast, driving the fire toward Concow and Paradise.</u> Wind gusts during the day on November 8 were around 13 m/s (30 mi/h) with sustained winds of 5 m/s to 9 m/s (12 mi/h to 20 mi/h) from the northeast. Relative humidity dropped to 10 % during the day.

<u>While selective fuel treatments were conducted in and around both communities (see Section 13.2), the lack of fire history throughout Paradise and Magalia was directly connected to the vegetative fuel loading in both communities.</u>

9.4. Impact of Winds, Wildland Fuels, and Terrain on Fire Behavior
Section 5.3 in this report presents an overview of the weather during the Camp Fire. Local observations and video documentation provided additional resolution and information on how the wind affected local fire behavior. <u>Firsthand observations on Rim Road at 07:20 on November 8 talked of "softball size rocks hitting the engine" [TD-005]. These reports were consistent with the short video from the TD and likely indicated local winds in the range of 22 m/s to 27 m/s (50 mi/h to 60 mi/h). These values agree with the forecasted ridgetop winds.</u>

Figure 25. Strong wind gusts blew dirt and rocks whipping across the ridgetop at Rim Road.

<u>Terrain also directly impacted fire behavior, resulting in dramatic fire behavior as observed around 18:00 on November 8, with flame lengths of 30 m to 60 m (100 ft to 200 ft) breaking out of the Butte Creek Canyon into Wilder Drive [TD-117]. Similar effects of topography, compounded with high fuel loading and possible alignment with local winds, resulted in</u>

significant fire activity in other areas within the fire perimeter, including the drainages to the north of Nelson Bar Road where flame lengths of 15 m to 30 m (50 ft to 100 ft) were reported.

The terrain also impacted fire spread indirectly by restricting or slowing down access by first responders. An example is provided here to illustrate the impact of topography on access. A straight line from Rim Road (39° 47' 34.89" N, 121° 28' 24.00" W) to the intersection of Pentz Road and Skyway is 9.3 km (5.75 mi); however, it takes 40 km (25 mi) and 43 minutes of drive time to get there. The fire is thus able to travel much faster than ground suppression forces. Further information on incident response and defensive actions will be presented in NIST Camp Fire Report #5.

The extensive spotting, caused by ember transport and the low ignition threshold of abundant dry vegetative fuels, such as pine needles, discussed below, resulted in multiple ignitions of vegetation and structures that quickly spread and overwhelmed the available firefighting resources. The spot fires then grew and "backfilled," causing severe local fire exposures in many cases. These high intensity exposures might have then generated strong local winds and blackout conditions downwind.

Needle drop associated with drought-stressed vegetation, time of year, and disease resulted in piles of needles throughout town, even though the Town of Paradise had just swept the streets. The same buildup also occurred on properties and roofs that had been recently cleaned. This further accentuated the hazard on properties that might not have been recently maintained.

It is abundantly clear from reading the report that the factors influencing the devastation caused by the Camp Fire are numerous and complex. Attempting to tie the impacts of the Camp Fire to forest management are not supported by the record and are entirely speculative.

The crux of the Hansen letter appears to be that any logging would cause increased fire risk and hazard. Such a position is not supported by the evidence. Even if CAL FIRE agreed with the position of Mr. Hansen, it would be illegal to deny landowners the ability to use the methods prescribed by the Board as authorized by the legislature.

Response #28:
Some of the concerns noted here are either not specific concerns to this THP or are already addressed in previous responses. Below are responses to issues raised that are not previously addressed:

- The 1/3 of watershed being logged appears to be an interpolation of the total "industrial" timberlands within the HSA (76,519 acres) divided by the total acreage of the HSA (222,368). This assumes that 100% of these lands have been logged in recent history. An analysis by FPGIS staff shows 77 plans, covering approximately 46,881 acres, or 21% of the HSA, were placed under THP from 1997 to 2020. Those acres include the Rio Gatito THP. 62 Emergency Notices for 16,862 acres within the Ponderosa Fire perimeter (approximately 61% of total area burned). What the letter is potentially referring to is the acres also included under ministerial permits such as the "10% dead, dying and diseased" exemption (14 CCR 1038(b)). These permits are submitted annually by large landowners to allow for the incidental harvesting of trees that will die within the next year. Per-acre intensity of harvesting is low and sporadic. Since these are ministerial in nature and not subject to CEQA review, they do not qualify as a Project under CEQA (14 §CCR 21065).

- There is criticism of the methodology used by SPI in some of the site specific analysis conducted in the THP area, but it is also noted that the letters of concern express that there is no site specific information. Ultimately, it appears that there is site specific information, but the comment writers simply disagree with the results and methodology used.
- Only a portion of 2-04-166-TEH “Hazen” was located in the Watershed Assessment Area so only those acres were reported.
- Only a portion of 2-10-003-TEH “Dry Gulch” was located in the Watershed Assessment Area so only those acres were reported.
- As explained in a previous response, THP 2-03-158-TEH “Digger” was not required to be included.

Response #29:
Because the use of herbicides is likely but still speculative, SPI is not required to predict the specifics of herbicide applications that could be used in the future. With this limitation, a discussion of herbicides used in the past and likely to be used again is appropriate. Additionally, the specific chemicals that could be used must be discussed, along with potential impacts that could occur from their use. The SPI herbicide discussion on pages 176-185 is adequate to disclose and evaluate the potential impacts that could occur from herbicide use.

As to the concern about the amount of herbicide applied to the landscape, CAL FIRE does not agree with the comment writer’s assertion that SPI was deceitful in their discussion. The SPI discussion states that herbicides are generally applied once or twice during the rotation for a stand. The comment writer notes the pounds of reported herbicide used by section, but this does not mean that SPI has been deceitful in their discussion. Herbicide application occurs within a specific harvest unit based upon vegetation treatment needs but herbicide use is reported by section so herbicide application can be reported for the same section over multiple years but it was actually applied to different harvest units.

Response #30:
Any plant protection measures included in the THP are enforceable by CAL FIRE. Violation of any plan provision is a misdemeanor and CAL FIRE can prosecute the offender or bring a suit against the party in civil court for damages. As to the concerns noted in the Lookout THP, CAL FIRE has no way of investigating or pursuing actions in this plan that was logged almost 14 years ago. Additionally, the area was burned by the Ponderosa Fire, making any follow up surveys impossible.

A botanical survey was conducted for all harvest units and protection measures for discovered species is located on Pages 60-62. As discussed above, the mitigation measures described in the plan are enforceable by CAL FIRE and failure to follow any measure prescribed in the plan can leave SPI open to criminal and civil prosecution.

The last portion of the concern relates to loss of soil nutrients from surface erosion. Photos are provided to show “unusual yellowing” in trees planted along the public roads west of the plan area in the Ponderosa Fire burn scar but outside of the THPs assessment area.

To follow up on this condition, CAL FIRE Forester Adam Deem conducted a survey of the public roads. Rock Creek, Forward Mills and Forward Roads were examined to verify the nature and extent of the concern. Within the perimeter of the Ponderosa Fire, there are obvious signs of yellowing within the regeneration, with even some mature trees that survived the fire and on the fire perimeter. Additionally, some of the planted trees were showing signs of extreme distress, with one Douglas-fir that was barely 2 feet tall producing a cone crop. The nature of the survey was not sufficient to characterize how widespread this phenomenon is in the burned area, but it was anecdotally noted that the areas with more rhyolitic soil types showed the effect more prominently. Also, there were areas where this phenomenon was not occurring, or only occurred sporadically. Several RPFs were queried about this issue and while nutrient deficiency was the predominant opinion provided, a definitive conclusion is not possible without further study. It is likely that the Ponderosa Fire destroyed the upper organic soil layers through a combination of high heat and subsequent post-fire erosion. If sufficient nutrients are still in the soil, the lack of a specific element or other factor is inhibiting the bioavailability of these nutrients to the trees. It is unclear what long-term effect this could have on the trees planted in this area.

Response #31:
With respect to potential changes in climate and impacts to the Option a, these have been addressed in other responses and in the General Discussion. CAL FIRE notes that the criticism of the CAL FIRE GHG calculator is not germane, as SPI has produced their own methodology for assessing carbon emission and sequestration. Concerns over the water cycle are addressed in other responses.

Response #32:
CAL FIRE has determined that the THP accurately and adequately disclosed the potential for operations to effect anadromous salmonids. The Upper Digger Creek watershed is not subject to the ASP rules as determined by CDFW:

> *Watersheds with Listed Anadromous Salmonids means any planning watershed where populations of anadromous salmonids that are listed as threatened, endangered, or candidate under the State or Federal Endangered Species Acts are currently present or can be restored. This definition does not apply to those portions of watersheds that are upstream of barriers, including large dams (where removal and/or fishway construction has been determined by NMFS and California Department of Fish and Wildlife to not be feasible) and natural barriers, such as long term bedrock falls or large static ancient slides with high-gradient or high-velocity barriers, that NMFS and California Department of Fish and Wildlife have determined are permanent and preclude anadromous fish passage.*

A small portion of the THP (6 acres) is inside of the Canyon Creek planning watershed, which is designated as “Upstream of ASP Watersheds” but this area is on a ridgetop and not adjacent to any watercourses. The confusion appears to be with the term “upstream”, which has perhaps been oversimplified in the THP form. The introduction to 14 CCR §936.9 “Protection and Restoration of the Beneficial Functions of the Riparian Zone in Watersheds with Listed Anadromous Salmonids" states the following:

> ***Geographic scope -*** *Requirements for watersheds with listed anadromous salmonids differ depending on the geographic location of the watershed and geomorphic characteristics of the Watercourse. Unique requirements for watersheds with listed anadromous salmonids are set forth for 1) Watercourses in the coastal anadromy zone with confined channels, 2) Watercourses with flood prone areas or Channel Migration Zones, and 3) Watercourses with confined channels located outside the coastal anadromy zone.*
> *Watersheds which do not meet the definition of "watersheds with listed anadromous salmonids" are not subject to this section except as follows: The provisions of 14 CCR §§ 916.9 [936.9, 956.9], subsections (k)-(q) also apply to planning watersheds immediately upstream of, and contiguous to, any watershed with listed anadromous salmonids for purposes of reducing significant adverse Impacts from transported fine sediment. Projects in other watersheds further upstream that flow into watersheds with listed anadromous salmonids, not otherwise designated above, may be subject to these provisions based on an assessment consistent with cumulative Impacts assessment requirements in 14 CCR §§ 898 and 912.9 [932.9, 952.9] and Technical Rule Addendum No. 2, Cumulative Impacts Assessment. These requirements do not apply to upstream watersheds where permanent dams attenuate the transport of fine sediment to downstream Watercourses with listed anadromous salmonids.*

In order for a portion of the ASP rules to apply, the watershed must be upstream and adjacent to an ASP watershed. The Board intent for the extend to which ASP rules were provided was specifically clarified so this misunderstanding would not occur. It appears, however, that a revision to the THP form may allow for a clearer understanding by the public.

As to the concern over cumulative effects to salmonids, the plan briefly notes the absence of salmonids from the assessment area on page 209 and summarizes a few of the improvement projects resulting from this plan that would reduce potential sediment inputs. As described in great detail in the General Discussion, sediment is a concern in the lower reaches of Battle Creek. With the application of the Rules which are designed to minimize potential sediment inputs along with the road and watercourse upgrades included in the THP, a net decrease in sediment production is anticipated from this plan.

SUMMARY AND CONCLUSIONS

The Department recognizes its responsibility under the Forest Practice Act (FPA) and CEQA to determine whether environmental impacts will be significant and adverse. In the case of the management regime which is part of the THP, significant adverse impacts associated with the proposed application are not anticipated.

CAL FIRE has reviewed the potential impacts from the harvest and reviewed concerns from the public and finds that there will be no expected significant adverse environmental impacts from timber harvesting as described in the Official Response above. Mitigation measures contained in the plan and in the Forest Practice Rules adequately address potential significant adverse environmental effects.

CAL FIRE has considered all pertinent evidence and has determined that no significant adverse cumulative impacts are likely to result from implementing this THP. Pertinent evidence includes, but is not limited to the assessment done by the plan submitter in the watershed and biological assessment area and the knowledge that CAL FIRE has regarding activities that have occurred in the assessment area and surrounding areas where activities could potentially combine to create a significant cumulative impact. This determination is based on the framework provided by the FPA, CCR's, and additional mitigation measures specific to this THP.

CAL FIRE has supplemented the information contained in this THP in conformance with Title 14 CCR § 898, by considering and making known the data and reports which have been submitted from other agencies that reviewed the plan; by considering pertinent information from other timber harvesting documents including THP's, emergency notices, exemption notices, management plans, etc. and including project review documents from other non-CAL FIRE state, local and federal agencies where appropriate; by considering information from aerial photos and GIS databases and by considering information from the CAL FIRE maintained timber harvesting database; by technical knowledge of unit foresters who have reviewed numerous other timber harvesting operations; by reviewing technical publications and participating in research gathering efforts, and participating in training related to the effects of timber harvesting on forest values; by considering and making available to the RPF who prepares THP's, information submitted by the public.

CAL FIRE further finds that all pertinent issues and substantial questions raised by the public and submitted in writing are addressed in this Official Response. Copies of this response are mailed to those who submitted comments in writing with a return address.

ALL CONCERNS RAISED WERE REVIEWED AND ADDRESSED. ALONG WITH THE FRAMEWORK PROVIDED BY THE FOREST PRACTICE ACT AND THE RULES OF THE BOARD OF FORESTRY, AND THE ADDITION OF THE MITIGATION MEASURES SPECIFIC TO THIS THP, THE DEPARTMENT HAS DETERMINED THAT THERE WILL BE NO SIGNIFICANT ADVERSE IMPACTS RESULTING FROM THE IMPLEMENTATION OF THIS THP.

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Appendices

20PC-000000417 PC #1

Japp, Jeannie@CALFIRE

Reviewed by: GAO
Dist. by: SO
Dist. Date: 10-14-2020
RU SHU, PS, FG, TO, WQ, ILO, ARCH, LTO, RPF, DMG, INSP Larson, BOE, OTHER:, FPS, Status: LOC

From:	Marily, Battle Creek Alliance <battlecreekalliance@gmail.com>
Sent:	Wednesday, October 14, 2020 9:45 AM
To:	Ramaley, John@CALFIRE; Redding Public Comment@CALFIRE
Cc:	Michael Lozeau; Justin Augustine
Subject:	Preliminary comment on THP 2-20-00159
Attachments:	Lewis 2018 comment 2-17-070SHA.pdf

Warning: this message is from an external user and should be treated with caution.

THP #2-20-00159, Powerhouse, has been submitted to the Review Team. Upon our preliminary review we have found that it is a re-named version of the Artemis THP (2-17-070) submitted in 2017 and withdrawn in 2018. In 2018 analyst Jack Lewis wrote the attached letter about the Artemis THP. Since only negative changes have occurred since then (2 more years of climate change related higher heat and drier conditions, and all the cumulative effects those circumstances influence), we are submitting this letter to the Review Team prior to the first review meeting.

In one paragraph, Mr. Lewis wrote:
"Processes linking clearcutting to surface erosion and changes in turbidity include (1) destruction of herbaceous cover, (2) exposure of bare soils to raindrop impacts, (2) compaction and destruction of soil structure, (3) reduced infiltration, (4) delayed revegetation from herbicides, (5) increased overland flow leading to sheet erosion, rilling and gullying, (6) delivery of augmented overland and subsurface flows to erodible road cutbanks, (7) erosion of roadside ditches from increased surface runoff, (8) reduced evapotranspiration augmenting subsurface flows, (9) erosion of subsurface pipes, (10) loss of soil cohesion due to reduction in the subsurface root network, (11) increased blowdown and rootwad upheaval in the WLPZ (12) heavy logging equipment and increased truck traffic, especially during wet conditions, (13) expansion of the road network to facilitate timber access and hauling, (14) mass wasting of roads and hillslopes due to augmented pore water pressures, (15) culvert failures due to increased debris-laden runoff. No amount of care in executing a THP can eliminate all these processes. The data suggest that past salvage logging as well as clearcutting, which has become routine practice in the area, has impacted turbidity in Digger Creek and other Battle Creek tributaries."

Because the 2017 THP was withdrawn, we never received any response to the letter. It's important you pay attention to it now.

--
Marily Woodhouse, Director
Battle Creek Alliance &
Defiance Canyon Raptor Rescue
Manton, CA (530) 474-5803
www.thebattlecreekalliance.org
YouTube channel:
https://www.youtube.com/channel/UCKpWFjIs-AhmugZobutqirg

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OCT 14 2020
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FOREST PRACTICE

Jack Lewis
Statistical Hydrologist
County of Humboldt License #8748
647 Elizabeth Dr.
Arcata, CA 95521
Phone: (707) 822-2652
Cell: (707) 496-6189
jacklewis@suddenlink.net

Water and Sediment Data
Analysis and Visualization

Feb. 3, 2018

Cal Fire Timber Harvest Review Team
6105 Airport R.
Redding, CA 96002

Subject: THP 2-17-070 SHA "Artemis"

Dear Timber Harvest Review Team,

Thank you for the opportunity to comment on THP 02-17-070 SHA. Please consider these comments in your evaluation of the THP and post them as part of the official public record in the Cal Fire THP Library for download.

I conducted research as a mathematical statistician, more functionally as a statistical hydrologist, for the Pacific Southwest Research Station (PSW) from 1984 through 2007 where I worked on a team whose focus was understanding the effects of forest management on hillslope processes, fishery resources, and downstream environments. During my employ with PSW, I authored or co-authored approximately 40 journal and conference papers. I was deeply involved in research at the Caspar Creek Experimental Watersheds, where I developed and implemented methodologies for sampling and analyzing data from multiple watershed studies, including analysis of cumulative watershed effects (CWEs). Since retiring from PSW, I have worked continuously as an independent consultant and one of my clients has been the Battle Creek Alliance (BCA). In 2009, BCA began collecting an extensive data set (over 8000 samples to date) including water temperature and turbidity from about a dozen sites in the Battle Creek watershed. I've written reports for BCA on the water temperature data through May of 2016 and the turbidity data through March 2015. These reports are on the Library page of the BCA web site (http://www.thebattlecreekalliance.org/library.html). In this letter I'll touch briefly on the relevance of those reports to this THP. For any references cited below, refer to the reports.

#1 THP 02-17-070 SHA (hereafter referred to as "the" THP) is located in the Digger Creek watershed not far above the portion that burned severely in the September 2012 Ponderosa Fire. The proposed THP drains to and is in close proximity to BCA's site DC, which is located roughly 0.6 mi upstream of the fire boundary. Their site DCH is located 4.8 mi downstream of DC and roughly 0.7 mi downstream of the fire boundary. Approximately 16% of the DC watershed and 28% of the DCH watershed have been logged since 1998. The difference is due to pre-fire clearcutting and post-fire salvage logging that affected about 4000 acres of watershed between the two sites. Comparison of measurements at the DC and DCH sites permits an evaluation of the impacts of these disturbances in the intervening area.

The THP states that (1) there are no continuing significant adverse impacts from past land use activities that may add to the impacts of the proposed project, and (2) there are no reasonably potential significant effects in combination with past, present, and reasonably foreseeable future projects. There certainly are past and reasonable foreseeable projects in the area, so the validity of the negative declarations of cumulative impacts thus hinges on the assumption that the impacts of the projects, when taken together, are not significant. To my knowledge "significant" is not well-defined, so a great deal of subjectivity is apparently involved. However, there is a abundant evidence, both in the literature and in this watershed, that clearcutting and salvage logging generally do impact both turbidity and water temperature. The BCA data sets show very clearly that the combination of wildfire and salvage logging have had major impacts and that the water quality downstream from the project area (measured at DCH) is severely impaired, especially with regard to water temperatures and salmonid tolerances. Although, SPI didn't create a perfect experiment for separating the effects of wildfire and salvage logging, the reports make a strong case that salvage logging was a substantial factor in raising turbidity; there is also evidence, backed by well-understood physical processes, suggesting that it raised summer water temperatures above and beyond the fire's influence.

Should wildfire effects be exempt from cumulative impacts considerations, and if so, is it reasonable to attribute all observed adverse effects to the fire in service of avoiding a serious cumulative impacts assessment? If protection of water quality is the objective, it should not matter whether current impairments have been caused by land use activity or a natural disturbance. Recognizing the current highly impaired condition, no project should be approved that could reasonably add to those effects. While it is difficult to quantify, there can be little doubt that more clearcutting will add to those effects.

Water temperature

#2 The data collected by BCA show that summer water temperatures were strongly affected by the combination of fire and salvage logging in Digger Creek. Maximum summer water temperatures at DC and DCH followed similar trends prior to disturbance. After some clearcutting in the summer of 2012, DCH summer temperatures began to rise, while those at DC continued to decline. After severe wildfire and salvage logging eliminated nearly all vegetation and shading of intermittent and perennial streams, maximum water temperatures in DCH were 8-10°C higher

#2 than in DC and clearly inhospitable (MWMT>20°C) for steelhead and chinook migration or holding during the summer months. Temperatures high enough to eliminate all salmonids (>22-24°C) are now common during the summer in lower Digger Creek as well as in nearby Rock Creek, Canyon Creek, and the South Fork of Battle Creek. All of these overheated streams create a cumulative impact on the main stem of Battle Creek.

Harvesting with riparian buffers should moderate stream temperature increases and changes to riparian microclimate, but substantial warming has nevertheless been observed in many studies of harvesting near streams with both unthinned and partial retention buffers (Moore et al., 2005). Forest harvesting increases advection and sensible heat exchange from clearings to the riparian zone, and conduction between stream water and nearby soils or substrates also may be an important factor (Johnson and Jones, 2000). The magnitude of stream temperature change and the degree of influence on riparian microclimate are typically reduced as buffer width increases (Moore et al., 2005). Thus the relatively narrow buffers designed to limit sediment delivery on less-than-30% slopes in this THP do not offer optimal protection against changes in water temperature.

WLPZ zones in the THP require only 50% retention of under and overstory cover on Class 1 streams, 50% of total canopy on Class 2 streams, and 50% of the understory vegetation on Class 3 streams. While this affords some protection for maintenance of water temperature, any harvesting in the WLPZ will increase solar radiation, and may increase exposure in the riparian zone to warm air advected from clearings. The expected result is higher summertime air, soil, and stream temperatures (Moore et al., 2005).

Turbidity

#3 Processes linking clearcutting to surface erosion and changes in turbidity include (1) destruction of herbaceous cover, (2) exposure of bare soils to raindrop impacts, (2) compaction and destruction of soil structure, (3) reduced infiltration, (4) delayed revegetation from herbicides, (5) increased overland flow leading to sheet erosion, rilling and gullying, (6) delivery of augmented overland and subsurface flows to erodible road cutbanks, (7) erosion of roadside ditches from increased surface runoff, (8) reduced evapotranspiration augmenting subsurface flows, (9) erosion of subsurface pipes, (10) loss of soil cohesion due to reduction in the subsurface root network, (11) increased blowdown and rootwad upheaval in the WLPZ (12) heavy logging equipment and increased truck traffic, especially during wet conditions, (13) expansion of the road network to facilitate timber access and hauling, (14) mass wasting of roads and hillslopes due to augmented pore water pressures, (15) culvert failures due to increased debris-laden runoff. No amount of care in executing a THP can eliminate all these processes. The data suggest that past salvage logging as well as clearcutting, which has become routine practice in the area, has impacted turbidity in Digger Creek and other Battle Creek tributaries.

My turbidity report presents the evidence for the influence of salvage logging on SPI lands in Battle Creek and it need not be repeated here. The effects in Digger Creek were not as dramatic

#3 as in some other subwatersheds. During the post-fire period at the DC site, mean turbidity trended downward above the fire zone at DC (a sign of recovery from earlier disturbance), while mean turbidity trended flat below the fire at DCH. The proportion of extremely high turbidity measurements (>7.4 times predicted) was greatest following completion of salvage logging. There were no such extreme observations prior to the fire.

There is evidence that clearcutting prior to the fire also raised turbidity, though not nearly to the levels reached after the fire and salvage logging. During the pre-fire period, there were no statistically significant declines in turbidity, while 5 Battle Creek subwatersheds that experienced clearcut logging (including DCH), all increased significantly ($p<0.004$).

The THP permits all timber operations to be conducted during the winter period, Nov 15 to Apr 01. These operations include logging, site prep, road and landing construction, road abandonment, and truck traffic. Carrying out these activities during the rainy season will increase the likelihood of turbidity impacts.

Miscellaneous

#4 Section II – Plan of Timber Operations lists the average slope gradients of each evenage regeneration unit. Listed slope gradients vary from 3% to 23%, placing all units in a Low EHR class, therefore exempt from the 20-acre size for ground-based harvesting. These slope gradients appear to be at odds with the CGS Memorandum of Nov. 20, 2017, which states that most slopes in the THP are between 25 and 35%, with maximum slopes of about 75%.

Closing Comments

#5 The THP does not mention prior disturbances in the Digger Creek watershed including the Ponderosa Fire, subsequent salvage logging of most of the burned area, and earlier clearcutting (THP's 2-06-173TEH, 2-03-158TEH, 2-04-181TEH and 2-10-003TEH) all of which is plainly visible on the 2017 Google Earth image as predominantly unvegetated bare ground. It is remarkable that many of these cutblocks are more than 8 years old and still have barely any regeneration. Clearly, recovery is very slow and past timber operations have left a strong imprint on this watershed. It is my considered opinion that the proposed THP will add to the existing cumulative impacts that have already done significant damage to water quality (esp. temperatures) in lower Digger Creek as well as the surrounding tributaries that flow into the lower North and South Forks of Battle Creek, affecting all points downstream.

Sincerely,

Jack Lewis
Statistical Hydrologist

20PC-000000424

PC #2

Battle Creek Alliance
Defiance Canyon Raptor Rescue
Rock Creek Rd.
Manton, CA 96059
(530) 474-5803
www.thebattlecreekalliance.org

Protecting Water, Forests and Wildlife

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DEFIANCE CANYON RAPTOR RESCUE

Reviewed by: GAO
Dist. by:
Dist. Date:
SKU RU — PS
FG — TO
WQ — TLO
ARCH LTO
Feller RPF — DMG
INSP — BOE
OTHER:
FPS
Status: LOC

Timber Harvest Review Team

Redding, CA

Sent electronically

Oct. 18th, 2020

Erroneous paragraph in THP #2-20-00159, "Powerhouse"

#6 Page 216-217 of the THP contains the following erroneous paragraph regarding the published research paper about our water quality data from Battle Creek watershed:

In the article *Turbidity Responses from Timber Harvesting, Wildfire, and Post-Fire Logging in the Battle Creek Watershed, Northern California* published in Environmental Management the authors incorrectly distinguish the effects between the Ponderosa Fire and Salvage logging. On pages 13-14, Tables 3, Figures 3 and S3 they categorically define the 2012-2013 Water Year as "post-fire" and the following water years as "post-salvage". This is an incorrect distinction as salvage logging commenced immediately following the fire and most of the salvage logging in the sampled watersheds of Canyon Creek and Rock Creek had been completed by late fall 2012. Additionally, most, if not all, of the salvage logging was completed on the Ponderosa fire within one year from the start of the fire itself. As a result, all the data collected and analyzed in this paper should be treated as either *pre-* or *post-fire*, and the effects of the fire and the salvage logging

SECTION IV Powerhouse THP Page 216 2020

cannot be separated. On page 11 in Lewis et.al. (2018) the authors themselves state "Our statistical findings are based on estimated logging rates. Because it is not known precisely when salvage logging occurred at each site, the strength of these results could be limited by the accuracy of the estimates of the rates and areas logged". SPI can verify that the authors inaccurately classified the data into Post-Fire and Post-Salvage Water Year categories. Therefore, SPI supports the claim they raised on page 11: that the study results are not accurate, and therefore no longer useable or valid.

#6 There is no attribution to identify the author of this paragraph, so the writer's hydrological background is unknown. Additionally, there is no evidence provided to uphold the statement that the logging in Canyon and Rock Creeks had been completed by "late fall 2012". Evidence we received from a Public Records Act request detailed by Jack Lewis further on shows that statement is false. Furthermore, Mr. Lewis already answered the similar assertions from CalFire employees that are repeated in the THP paragraph above during the journal's pre-publication review.

The paragraph is demonstrably false and should be removed from the THP document.

Context

This logging plan is primarily a copied-and-pasted version of the 2017 Artemis plan, which we commented extensively on before it was withdrawn in 2018. We have submitted numerous documents to CalFire regarding the Lewis et al. study on many occasions. The following comments were included on pages 27-28 of our August 20th, 2018 comments on the Artemis plan. These comments detail CalFire employees' earlier involvement in attempts to discredit the results of the study:

"We learned from PRA emails in the past that these staff members have exhibited biased and prejudicial conduct towards our work when our research paper by Lewis et al. was in the publication process. To summarize:

Scientific journals request that the author provide some suggestions for potential reviewers. Mr. Lewis suggested Pete Cafferata of CF as one reviewer. BCA questioned this choice because Mr. Cafferata is an employee of the lead agency which has made the decisions for decades to allow intensive clearcutting to occur in California watersheds. Mr. Lewis informed us that he believed Mr. Cafferata would give a "fair review".

We obtained the following sequence of events and information from a PRA request:

--Between 3/30 and 4/4/16 Mr. Cafferata agreed to review the manuscript.

--5/5/16 Mr. Cafferata sent another CF employee, Drew Coe, the manuscript.

--5/21/16 After 2 months, the Journal editor sent a reminder that the review hadn't been received.

--5/31/16 Mr. Coe sent his review to Mr. Cafferata and said:
"Here's my review. I only tackled general comments, although I think they are substantive enough to reject the paper. I didn't feel the need to offer specific comments, as many them are influenced by the general comments. Note that I put a sentence in the overview talking about the paper being an advocacy piece rather than an objective analysis. You can remove that, or include it in the confidential comments to the editor if you feel it's necessary."

Note Mr. Coe's verbiage that showed his goal was to have the paper rejected, and their plan to send "confidential" comments to the editor.

--6/1/16 Mr. Cafferata responds to Mr. Coe: "I did put the key piece I pulled out about advocating limits on harvesting rates in the confidential language to the editor."

#6 Mr. Cafferata's and Mr. Coe's actions contributed to the long length of time (two years) it took to get our research paper published. In his review, Mr. Coe referenced several of SPI's documents. Some of those are the same documents used in this THP. We have submitted professional reviews to CF regarding the flaws in these documents since 2011."

On Oct. 17th, 2020 we corresponded with the study's author, Jack Lewis, regarding the erroneous paragraph in this plan, 2-20-00159. This is his response:

Jack Lewis <jacaronda@gmail.com> Sat, Oct 17, 2020 at 7:45 PM
To: Battle Creek Alliance <battlecreekalliance@gmail.com>

I responded to this objection (from Cafferata & Coe) during the review process and EM published the paper. They would not have accepted it if they agreed with the objection. I'll go back and see if i can find my original response. This is not rocket science, it is fairly simple logic. The "post'salvage" period reflects a greater amount of salvage logging than the "post-fire" period, so there is a valid contrast to be made.
[Quoted text hidden]

Jack Lewis <jacaronda@gmail.com> Sat, Oct 17, 2020 at 11:12 PM
To: Battle Creek Alliance <battlecreekalliance@gmail.com>

Below is the response (in red) that I sent to the Journal editors when that objection was raised. Esp relevant is the last paragraph, which establishes that the "post-salvage" period reflects a greater amount of salvage logging than the "post-fire" period, so there is a valid contrast to be made between measurements in the two periods. CALFIRE states that SPI can verify that salvage logging was mostly completed before the winter of 2012-2013, but I have not seen any documentation and I wonder if it based on recollections. I don't believe that CALFIRE can document the claim; indeed, their documents state that operations were active in Rock, Canyon, and Digger Creeks during the winter period.

I've attached the entire response to Reviewer #1, which I believe to be Cafferata and/or Coe.

"The Authors Incorrectly Distinguish Effects Between the Fire and Salvage Logging"

The fire was fully contained by Aug 31. The article referenced by the reviewer doesn't say anything about when the salvage logging was completed. It only says logging began the week of Sep 12, 2012 and the harvesting and reforestation was expected to take 3 years. Private landowners do not make this sort of information with the public, so we relied on CALFIRE inspection reports and documents. CALFIRE states that they keep no permanent record of where or how many acres are cut during an Emergency Notice (EM) operation. For the first draft of this manuscript we only knew that an Emergency Notice was issued on Sep 4, 2012 that permitted logging for a period of one year. However, we recently succeeded in obtaining inspection reports through a Public Records Act request (see paragraph after the next).

The review claims that the fire effects cannot be distinguished from the salvage logging effects because most of the logging had been completed in the Fall of 2012. The statement is based on unsubstantiated information. If the logging had indeed been completed in November, then the reviewer might have a point – there was 8" of rainfall during the fall period but it might not have been an adequate test of the erosion response. I've done a new analysis redefining the "post-fire" period as 8/18/12 to 11/29/12, i.e. the period from the start of the fire to the first weather-related shutdown of logging operations. There were 65 measurements during this period at sites draining the Ponderosa Fire area and none produced residuals greater than 2. This compares to 66 of 731 after 11/29/12. The difference is significant and would suggest that the fire had no effect at all. This analysis, which is not included in the paper, does not support the reviewers claim that the fire was a primary cause of turbidity, but we acknowledge the result may be misleading because there was relatively little hydrological driving force. The 8" of rainfall during the period had the potential to produce some overland flow and erosion but did not wet up the soils enough to result in significant streamflow.

#6

In response to the reviewer's claim that logging had been completed in the Fall of 2012, we submitted a public records access request to CALFIRE, the agency that oversees private logging in California, for more specific information about the timing of the salvage logging. The documents supplied to us show that that logging operations in Canyon and Rock Creeks were restarted in early February of 2013, were active as of March 27, and that "On Aug. 30, 2013 all work on the operation was completed". In Digger Creek south of Forward Mill Rd and in the South Fork of Battle Creek, inspection reports indicate that operations were active from October through February or March, with one interruption due to weather, and most operations were completed by Mar. 21, 2013. This means that the measurements taken in these watersheds during the one-year period after the fire do not all reflect the full extent of salvage logging, but rather a progression. Certainly most measurements taken during high winter flows reflect incomplete salvage operations. As explained in the manuscript, this creates a contrast with subsequent measurements taken after salvage logging was completed.

Ultimately, arguing about if the cumulative effects are from clearcutting, fire, or salvage logging is picayune. What is of the upmost importance is that cumulative impacts are occurring, as the study shows. There is nothing in the rules or laws that limit cumulative impacts considerations to being from only one source. The paragraph regarding our study in this THP is an unsourced, petty attempt to omit relevant information that disproves the plan's assertion that it "will not have a significant adverse impact on the environment" (THP page 7). This continues the long-time practices of both SPI and CalFire to avoid a scientifically defensible cumulative impacts analysis. We have been detailing this failure since 2007. These practices continue to refuse to provide factual, quantitative evidence that no cumulative impacts are occurring, despite the many years of evidence that we have submitted. We have offered substantive evidence here that justifies the removal of the paragraph on pages 216-217 that tries to invalidate our peer-reviewed and published study.

Marily Woodhouse

Marily Woodhouse, Director

#6

Japp, Jeannie@CALFIRE

From: Ramaley, John@CALFIRE
Sent: Monday, October 19, 2020 7:45 AM
To: Japp, Jeannie@CALFIRE
Subject: FW: Erroneous paragraph in THP 2-20-00159 Powerhouse
Attachments: Erroneous paragraph in THP.pdf

From: Marily, Battle Creek Alliance [mailto:battlecreekalliance@gmail.com]
Sent: Sunday, October 18, 2020 1:15 PM
To: Ramaley, John@CALFIRE <John.Ramaley@fire.ca.gov>; Woessner, Jonathan@CALFIRE <Jonathan.Woessner@fire.ca.gov>; Wilson, Angela@Waterboards <Angela.Wilson@waterboards.ca.gov>
Cc: Michael Lozeau <michael@lozeaudrury.com>; Becky Davis <rebecca@lozeaudrury.com>; Justin Augustine <jaugustine@biologicaldiversity.org>
Subject: Erroneous paragraph in THP 2-20-00159 Powerhouse

Warning: this message is from an external user and should be treated with caution.

Please see attached comment regarding a false assertion included in the THP which we want removed.

--
Marily Woodhouse, Director
Battle Creek Alliance &
Defiance Canyon Raptor Rescue
Manton, CA (530) 474-5803
www.thebattlecreekalliance.org
YouTube channel:
https://www.youtube.com/channel/UCKpWFjIs-AhmugZobutqirg

20 PC - 000000466

PC #3

#6

Japp, Jeannie@CALFIRE

Reviewed by: GAO
Dist. by: GG
Dist. Date: 11-5-2020
SNU RU FS
FG TO
WQ TLO
ARCH LTO
RPF DMG
INSP BOE
Larson
OTHER:
FPS
Status: LOC

RECEIVED
OCT 29 2020
REDDING
FOREST PRACTICE

From:	Marily, Battle Creek Alliance <battlecreekalliance@gmail.com>
Sent:	Thursday, October 29, 2020 9:31 AM
To:	Ramaley, John@CALFIRE
Subject:	Re: THP 2-20-00159
Attachments:	Expert reviews of SPI docs list.pdf

Warning: this message is from an external user and should be treated with caution.

For many years now and within many logging plans, we have submitted factual evidence to refute SPI's misleading claims in their self-produced documents. Most of the SPI documents have not been published, and when hydrologists and other environmental scientists reviewed them, the SPI documents were found to be scientifically flawed. (A list has been provided to you many times before, but will be included here also.) Yet, in plan after plan and year after year, these documents have been accepted by your agency and the plans have been approved. None of the Official Responses from your agency have ever once acknowledged any of the disputes about these documents while they continue to approve every plan. When you say in your email that you "will review all the information" regarding the erroneous paragraph in this plan, i can find no reason to think that means anything, given your history. All that it has meant in your ongoing practices is that you will again approve a plan based on SPI's unsound and misleading statements that are not based on facts, evidence, or science, while ignoring anything anyone else proves.

You should be ashamed of the job you do.

On Wed, Oct 28, 2020 at 4:45 PM Ramaley, John@CALFIRE <John.Ramaley@fire.ca.gov> wrote:

The Plan Submitter has stated what they feel about the Lewis publication. You and Mr Lewis have stated a counter to that. We will review all the information prior to Second Review and again during the Directors Determination period. They feel what they have submitted is accurate, you feel otherwise. The lead agency will review this during the statutory time period.

Sent from my Verizon, Samsung Galaxy smartphone

-------- Original message --------
From: "Marily, Battle Creek Alliance" <battlecreekalliance@gmail.com>
Date: 10/28/20 4:17 PM (GMT-08:00)
To: "Ramaley, John@CALFIRE" <John.Ramaley@fire.ca.gov>
Subject: Re: THP 2-20-00159

Warning: this message is from an external user and should be treated with caution.

Yes, i understand you forwarded the comment to the regulated party, but what i'm asking is if you, as the regulatory agency, are taking any action to ensure the THP is accurate?

#6

On Wed, Oct 28, 2020 at 4:06 PM Ramaley, John@CALFIRE <John.Ramaley@fire.ca.gov> wrote:

They will close out the PHI soon. Close of PC will be 30 days from 10/26. I don't believe there is another PHI day scheduled, though I am unsure.

As I said, I have forwarded the comment on to the Plan Submitter.

From: Marily, Battle Creek Alliance [mailto:battlecreekalliance@gmail.com]
Sent: Wednesday, October 28, 2020 4:03 PM
To: Ramaley, John@CALFIRE <John.Ramaley@fire.ca.gov>
Subject: Re: THP 2-20-00159

Warning: this message is from an external user and should be treated with caution.

CalTrees still says that the PHI is "scheduled". Is there a definite close of comment date then if the PHI has already occurred?

If you are only forwarding the comment on to the submitter, does that mean CalFire is not taking any responsibility for ensuring the accuracy of the THP?

On Wed, Oct 28, 2020 at 1:58 PM Ramaley, John@CALFIRE <John.Ramaley@fire.ca.gov> wrote:

The PHI occurred this last Monday, 10/26.

We forward all comments on to the Plan Submitter, which is what we did with the comment you sent in on the paragraph.

I have collected all the THPs you listed last week and have them in an electronic folder. I will just add them to the other items you send me

---

From: Marily, Battle Creek Alliance [mailto:battlecreekalliance@gmail.com]
Sent: Wednesday, October 28, 2020 1:33 PM

#6

To: Ramaley, John@CALFIRE <John.Ramaley@fire.ca.gov>
Subject: THP 2-20-00159

Warning: this message is from an external user and should be treated with caution.

I see on CalTrees two dates for the PHI. One says Due on 10/15/20 but then below that it says Due on 11/5/2020 TBD. Is either the date or has it not been set yet?

Please let me know what is being done about the erroneous paragraph in the THP i notified you about, which is regarding our research paper.

I have the files assembled for our permanent attachment file also. How do you want to proceed with adding the past THPs?

--

Marily Woodhouse, Director

Battle Creek Alliance &

Defiance Canyon Raptor Rescue

Manton, CA (530) 474-5803

www.thebattlecreekalliance.org

YouTube channel:
https://www.youtube.com/channel/UCKpWFjIs-AhmugZobutqirg

--

Marily Woodhouse, Director

Battle Creek Alliance &

Defiance Canyon Raptor Rescue

Manton, CA (530) 474-5803

www.thebattlecreekalliance.org

#6

YouTube channel:
https://www.youtube.com/channel/UCKpWFjIs-AhmugZobutqirg

--
Marily Woodhouse, Director
Battle Creek Alliance &
Defiance Canyon Raptor Rescue
Manton, CA (530) 474-5803
www.thebattlecreekalliance.org
YouTube channel:
https://www.youtube.com/channel/UCKpWFjIs-AhmugZobutqirg

--
Marily Woodhouse, Director
Battle Creek Alliance &
Defiance Canyon Raptor Rescue
Manton, CA (530) 474-5803
www.thebattlecreekalliance.org
YouTube channel:
https://www.youtube.com/channel/UCKpWFjIs-AhmugZobutqirg

#6 2008. A Review of SPI's study: "Carbon Sequestration in Californian Forests; Two Case Studies in Managed Watersheds" by Peter Miller, NRDC.

2013. Tom Myers. "Tech Memo site inspection 030413". Review of SPI-produced "Post-Wildfire Salvage Logging, Soil Erosion, and Sediment Delivery-Ponderosa Fire, Battle Creek Watershed, Northern California" document.

2016. Jack Lewis. "Technical Memorandum re Swales". Review of SPI-produced "Post-Wildfire Salvage Logging, Soil Erosion, and Sediment Delivery-Ponderosa Fire, Battle Creek Watershed, Northern California" document.

2018. Green, Peter. 2018. Review of SPI Bioassessment of Digger Creek.

PC #4

Japp, Jeannie@CALFIRE

From:	Marily, Battle Creek Alliance <battlecreekalliance@gmail.com>
Sent:	Thursday, October 29, 2020 7:35 PM
To:	Ramaley, John@CALFIRE
Cc:	Becky Davis; Office of the Secretary CNRA
Subject:	THP 2-20-00159
Attachments:	CalFire Whistleblower emails.pdf

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OCT 29 2020
REDDING
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Reviewed by: GAO
Dist. by: SD
Dist. Date: 11-5-2020
RU PS
FG TO
WQ TLO
ARCH LTO
RPF DMG
INSP BOE
OTHER:
FPS
Status: LOC

SHU
Larsen

Warning: this message is from an external user and should be treated with caution.

Mr. Ramaley:
Since you have refused to remove SPI's erroneous paragraph from the current logging plan in the Battle Creek watershed (Powerhouse 2-20-00159) we are submitting the attached emails from the "CalFire Whistleblower" to be included in the Administrative Record for this plan. These emails demonstrate the patterns of disrespect and bias that women environmentalists have been treated with in the behind-the-scenes workings of CalFire and SPI. Clearly, with your refusal to provide the pre-harvest inspection information we requested and your refusal to remove a demonstrably false statement about our work, nothing has changed in the Timber Harvest Review Team practices.

--
Marily Woodhouse, Director
Battle Creek Alliance &
Defiance Canyon Raptor Rescue
Manton, CA (530) 474-5803
www.thebattlecreekalliance.org
YouTube channel:
https://www.youtube.com/channel/UCKpWFjIs-AhmugZobutqirg

CalFire Whistleblower emails 2015

Mike Bacca needs to be stopped

Herman Melville <calfirewhistleblower@

Wed 4/29/2015 5:12 AM

To: Hswriter <hswriter@frontiernet.net>; Jodi Frediani <jodi@jodifrediani.com>; Marily Woodhouse <marily-lobo@hotmail.com>; Rob DiPerna <rob@wildcalifornia.org>; Rose Flame <mysecretfires@gmail.com>; Susan Robinson <srmw@comcast.net>

Hello, I am contacting all of you because you need to know that Mike Bacca has been brought back to CAL FIRE to work as a retired annuitant in his old job performing the same old duties. They are trying to keep this a secret, by saying he is only working on special projects but he is in the same old office and doing the same thing he always does, which is working as a hit-man for industry and management.

I know many of you have made complaints against Mike for his behavior and conduct. It is much worse than any of you could know. He has zero respect for your concerns and the things he has said about several of you would result in him being fired immediately, if only you were state employees. These statements are offensive and vile. Everyone he works with knows he hates women, and strong women get the worst of his wrath.

Everyone on the inside is afraid of retaliation from management, which is swift. Nothing will change without outside pressure. I know that if a legitimate investigation was conducted that people would speak up and tell the truth about what he has said. I know there have been past complaints but I don't think any of his co-workers or subordinates were questioned. That is where all of the real information is.

Jodi, Marilee and Susan, the worst things were said about you three, notice any pattern here? He makes no attempt to hide his hate for you, I know that many people have heard his comments. Probably anyone who ever worked for him in Fresno, Redding or Sacramento could give you more.

update

Marily Woodhouse <marily-lobo@hotmail.com>

Tue 7/7/2015 7:47 PM

To: calfirewhistleblower@

Dear Herman (since i don't know what to call you),
I filed a PRA last month about Bacca, but received a call last week from CDF that i had to provide search words because otherwise their IT people said it would be hundreds of thousands of emails/docs that would tie up their server for days and take a lot of time for legal to go through. Don't really know what terms to look for that would turn anything useful up. They did finally answer my question about if anyone other than Bacca was interviewed during their "investigation" regarding my complaint. The answer was no.

Today Susan Robinson, Jodi Frediani, and i had a conference call with the CDF attorneys. Bottom line is they say your information is too general, so they will do nothing to investigate further. Yep, welcome to my world.

Marily Woodhouse, Director, Battle Creek Alliance
Volunteer Coordinator, Shasta Wildlife Rescue
www.thebattlecreekalliance.org
(530) 474-5803

CalFire Whistleblower emails 2015

Re: update

Herman Melville <calfirewhistleblower@
Tue 7/7/2015 8:25 PM
To: Marily Woodhouse <marily-lobo@hotmail.com>

The bottom line is that the department does not need to agree with you but you do deserve respect and concerns need to be given proper consideration. Someone who calls you a "fucking bitch" (and Jodi much worse) should not be representing the people. Managers who allow him to continue to serve shouldn't have their jobs either.

RE: update

Marily Woodhouse <marily-lobo@hotmail.com>
Tue 7/7/2015 9:06 PM
To: calfirewhistleblower@

Did you hear him call me/us a "fucking bitch"? Because the CDF people said they have to have a specific incident to do what they call an investigation. Tell me when and where it happened.

Marily Woodhouse, Director, Battle Creek Alliance

Re: update

Herman Melville <calfirewhistleblower@
Wed 7/8/2015 4:46 AM
To: Marily Woodhouse <marily-lobo@hotmail.com>

I do not have a specific date but yes I did here him say it more than once. It was about 2 years ago, during and before the same time period of the battle creek lawsuits.

SPI surveillance

Herman Melville <calfirewhistleblower@
Sat 10/24/2015 8:17 PM
To: Marily Woodhouse <marily-lobo@hotmail.com>

Marily, did SPI ever let you know that they supposedly have video of you and Justin Augustine trespassing on their lands? Makes me wonder what else they are keeping track of.

CalFire Whistleblower emails 2015

RE: SPI surveillance

Marily Woodhouse <marily-lobo@hotmail.com>
Mon 10/26/2015 7:01 AM
To: Herman Melville <calfirewhistleblower@

Yes, they sent a sheriff's deputy out in 2012 to threaten me about that. I had an activist attorney who had helped me before with SPI's stupidity; he called the sheriff's office and DA, who both said SPI had no case, and it was dropped. SPI people are big on trying to bully everyone into submission, and it usually works for them.

Are you asking because this came up recently? A statistical analyst is getting ready to publish his findings regarding my water quality data, and SPI is pitching fits and grasping at straws to try to stop him--the data shows what disastrous effects their practices have had.

Marily Woodhouse, Director, Battle Creek Alliance

Re: SPI surveillance

Herman Melville <calfirewhistleblower@
Mon 10/26/2015 11:56 AM
To: Marily Woodhouse <marily-lobo@hotmail.com>

No this was from the past but I always wanted to ask because you never know what is BS around here.

RE: SPI surveillance

Marily Woodhouse <marily-lobo@hotmail.com>
Mon 10/26/2015 6:37 PM
To: Herman Melville <calfirewhistleblower@

I hear that--
For clarity: they accused me of trespassing to get water samples when i was on a county road which has a 30 foot deeded easement.

Marily Woodhouse, Director, Battle Creek Alliance

Re: SPI surveillance

Herman Melville <calfirewhistleblower@
Mon 10/26/2015 8:11 PM
To: Marily Woodhouse <marily-lobo@hotmail.com>

It's funny that they would try to scare you off when they were so adamant that your concerns were of no value.

CalFire Whistleblower emails 2015

RE: SPI surveillance

Marily Woodhouse <marily-lobo@hotmail.com>
Tue 10/27/2015 6:56 AM
To: Herman Melville <calfirewhistleblower@

Yeah, that falls under the category of "methinks they doth protest too much" to paraphrase Shakespeare. They know what they're doing is wrong and has significant impacts, but seem to believe that loud, constant denial will cover it up forever. And, it has covered it up long enough for them to do irreparable harm and make a lot of money.

Marily Woodhouse, Director, Battle Creek Alliance

20 PC-000000468

PC #5

Japp, Jeannie@CALFIRE

From:	Marily, Battle Creek Alliance <battlecreekalliance@gmail.com>
Sent:	Friday, October 30, 2020 8:09 AM
To:	Ramaley, John@CALFIRE
Cc:	Becky Davis
Subject:	Additional emails for THP 2-20-00159
Attachments:	Response to April 5 Addison Letter - Vers. 2.pdf

RECEIVED
OCT 30 2020
REDDING FOREST PRACTICE

Reviewed by:
Dist. by:
Dist. Date: 11-5-2020
RU FG WQ ARCH RPF INSP OTHER: FPS Status: LOC

Warning: this message is from an external user and should be treated with caution.

Attached are additional emails for the Administrative Record for THP 2-20-159 that are pertinent to your allowing the inclusion of SPI's erroneous statement in the plan, or for your Review Team using it as a reason to dismiss our work again.

In 2019 we worked with Erick Burres at the State Waterboard on our QAPP, that details our water monitoring protocols. The QAPP was part of the process for uploading our data to the State CEDEN site. As has been their practice since 2011 (which we have additional documents to prove), SPI attempted to suppress our data by spreading fallacious information:

Sample Site Access

Burres, Erick@Waterboards <Erick.Burres@waterboards.ca.gov> Mon, Apr 29, 2019 at 6:26 PM
To: "Marily, Battle Creek Alliance" <battlecreekalliance@gmail.com>

Marily,

This evening I received an email from SPI's QA advisory. The sample site coordinates they found in CEDEN are on SPI property and they are alleging that they were collected by trespass. Previously we discussed trespass and I alerted you to documents on the CWT website regarding trespass (see below). If sampling adhered to the guidelines then there shouldn't be an issue, but they are threatening to take actions. The email stated that their lawyer previously sent you an email regarding this. Are you available to talk with me on Wednesday afternoon or later in the week?

Thanks,
Erick

Marily, Battle Creek Alliance <battlecreekalliance@gmail.com> Mon, Apr 29, 2019 at 8:17 PM
To: "Burres, Erick@Waterboards" <Erick.Burres@waterboards.ca.gov>

Hi Erick--
I have to have a surgery on Wed, but this is something they've been trying for years. Was it Cajun James who emailed you? She has had a letter from an attorney for me in the past that i'll attach. All of the sites are on county roads, although some pass through SPI's land. There is a 30' from center line easement on the county roads which i don't go off of.

I can talk sometime in the morning tomorrow, if needed. It's possible the coordinates aren't perfect as i don't have a GPS and did them from hovering the cursor over the sites on Google Earth.
[Quoted text hidden]

--
Marily Woodhouse, Director
Battle Creek Alliance &
Defiance Canyon Raptor Rescue

--
Marily Woodhouse, Director
Battle Creek Alliance &
Defiance Canyon Raptor Rescue
Manton, CA (530) 474-5803
www.thebattlecreekalliance.org
YouTube channel:
https://www.youtube.com/channel/UCKpWFjIs-AhmugZobutqirg

René Voss – Attorney at Law
15 Alderney Road
San Anselmo, CA 94960
Tel: 415-446-9027
renepvoss@gmail.com

April 5, 2012

Provided by Electronic Mail
to sca@dunmartinek.com

Shelley C. Addison, Esq.
Dun & Martinek LLP
2313 I Street
Eureka, CA 95501

Ms. Addison,

My Client, Marily Woodhouse,[1] is in possession of your fallacious and highly inaccurate letter dated February 6, 2012 and has asked me to correct your false and misleading statements, as well as your libelous allegations of criminal trespass made on behalf of your clients, Sierra Pacific Industries (SPI) and Dr. Cajun James.

As you may now be aware, Dr. James provided erroneous notes to the Greater Battle Creek Working Group in reference to its May 17, 2011 meeting, accusing members of the Battle Creek Alliance of interrupting Dr. James during her presentation. On March 20, 2012, my client asked and received a correction from the members of the Working Group, now reflected in the record, that the disruptions were caused by other attendees and not members of the Battle Creek Alliance.

With regard to your allegations of criminal trespass, I have been in contact with both the Shasta County Sheriff's and the Shasta County District Attorney's offices who have confirmed that Ms. Woodhouse did not criminally trespass over SPI property. I previously informed you, and the Sherriff's office again confirmed, that the public and Ms. Woodhouse have every right to use the public road easements that cross SPI land. We demand that you immediately retract your libelous statement of criminal trespass, which follows Dr. James' slanderous accusations of criminal trespass at various public meetings.

Moreover, any maps my Client used in her February 3, 2012 comments to the Board of Forestry are public records, which were provided to my Client through a Public Records Requests. My Client and the public have a right to use these records to seek redress of their grievances against a government agency, as here, the Board of Forestry. The fair use doctrine allows limited use of copyrighted material without permission from the rights holder for commentary, criticism, teaching, etc. There is no copyright violation in Ms. Woodhouse's usage of public record maps.

SPI and Dr. James apparently have a double standard about copyright infringements. Dr. James has and may still be using one of the Battle Creek Alliance's proprietary photographs in her presentations. In her presentation to the Board of Forestry on December 6, 2011, Dr. James' presentation slide number 4 includes a panoramic photograph of a clearcut, which comes from the Home page of the Battle Creek Alliance website. *See*

[1] *See* Curiculum Vitae attached.

http://www.thebattlecreekalliance.org/.[2] This panorama was stitched together from three separate photographs, which are in my possession. The original files are in my Client's electronic files and provide evidence of Dr. James' copyright violation. Yet, Dr. James' has labeled this panoramic photograph as copyrighted by SPI. We demand that Dr. James and SPI immediately cease using my Client's photographs for their personal gain.

SPI's attempts to intimidate my Client and others must immediately cease. Moreover, SPI must respect the rights all citizens who are trying to ensure that our public agencies honestly evaluate the adverse impacts that SPI's logging practices are having on our public trust resources.

Sincerely,

René Voss – Attorney at Law

cc: To those persons and organizations who were sent your February 6, 2012 letter:
Virginia Phelps – Battle Creek Alliance
George Gentry – Board of Forestry and Fire Protection
Mike Bacca – California Department of Forestry & Fire Protection
Angela Wilson – Central Valley Regional Water Quality Control Board
Robert Crandall – Central Valley Regional Water Quality Control Board
Basic Laboratory
Curt Babcock – Department of Fish and Game
Joe Croteau – Department of Fish and Game
Kathyrn Phillips – Sierra Club Mother Lode Chapter
Jim Metropulos – Sierra Club Mother Lode Chapter
Laura Hoehn – Sierra Club

[2] Scroll down to the photograph below the caption: "**Clearcutting and the subsequent herbicide use** have obvious impacts on endangered and threatened species, but they affect all species, including our own.

Marily Woodhouse
32065 Rock Creek Rd.
Manton, CA 96059
(530) 474-5803 marily-lobo@hotmail.com

Curriculum Vitae

2011-2012: Watershed Ecology and Native Plant studies at Shasta College, Redding, CA. Top student in Watershed Ecology class.

2008-2010: Water monitoring training with: Department of Fish and Game, Western Shasta Resource Conservation District (including benthic macro invertebrate sampling and analysis of aquatic habitats), Jim Harrington of the CA Surface Water Ambient Monitoring Program (SWAMP), Bear Creek Watershed Group, Yreka Creek Citizen Monitoring, and Big Chico Creek Watershed Citizen Monitoring Group.

2008-present: Director of Battle Creek Alliance.

2008-2011: Consultant and organizer for the Sierra Club, Sierra Forest Legacy, and Lassen Forest Preservation Group.

2007-present: Independent study and research regarding forestry, watersheds and hydrology, wildlife, soils, forest related carbon storage and emissions, environmental law, and cartography. Field visits with various experts.

1989-present: Independent study of, and field work in, the Battle Creek watershed.

1983-1989 and 2007: Endurance ride manager. This included the use and study of USGS topographical maps to plan routes, and to determine distances and elevation changes; also it involved working with state and federal agencies to obtain permits, and private landowners to obtain permission to cross their landholdings.

2004: Internship at the International Wolf Center in Ely, MN working with the ambassador pups and studying wolf biology. This study included wolf behavior, nutrition, history, and radio and ground tracking of local free wolf packs.

1989-1991: Theatre and Art studies at Shasta College, Redding, CA.

1985-present: Independent research and study of wolf ethology.

1983-1989: 4,000 recorded horseback endurance miles throughout California, Oregon, Nevada and Utah that covered varied geological areas, habitats, and plant communities; associated independent research regarding the areas.

1979-1980: Horse husbandry studies at L.A. Pierce College, Los Angeles, CA.

1974-present: Traveling the western states of CA, NV, OR, WA, UT, AZ, and NM on foot or horseback, studying plants, wildlife, topography, waterways.

20PC-000000469 PC #6

Japp, Jeannie@CALFIRE

From:	Marily, Battle Creek Alliance <battlecreekalliance@gmail.com>
Sent:	Friday, October 30, 2020 1:57 PM
To:	Ramaley, John@CALFIRE
Cc:	Becky Davis
Subject:	Further evidence for THP 2-20-00159 AR
Attachments:	SPI intimidation of Myers, Augustine 2012.pdf

RECEIVED
OCT 30 2020
REDDING FOREST PRACTICE

Reviewed by: 140
Dist. by:
Dist. Date:
RU PS
FG TO
WQ LO
ARCH LTO
RPF DMG
INSP BOE
OTHER:
FPS
Status: LCC

Warning: this message is from an external user and should be treated with caution.

Tom Myers worked with us beginning in 2011 to analyze our early water quality data. We have submitted a number of his memos and reports in the past on logging plans we have commented on.

In 2012, he and Justin Augustine visited the Battle Creek area to look at our sites. Another example of SPI's practice of trying to suppress our data is detailed in the attached documents which show SPI's attempts to intimidate our colleagues.

Once again, we ask you to remove SPI's paragraph regarding our research paper from this plan on pages 216-217. We have presented ample evidence of SPI's decade long attempts to suppress our work. That paragraph is another such attempt.

--
Marily Woodhouse, Director
Battle Creek Alliance &
Defiance Canyon Raptor Rescue
Manton, CA (530) 474-5803
www.thebattlecreekalliance.org
YouTube channel:
https://www.youtube.com/channel/UCKpWFjIs-AhmugZobutqirg

From: Tom Myers [mailto:tom_myers@charter.net]

Sent: Saturday, June 02, 2012 12:51 PM

To: 'Justin Augustine'; 'Marily Woodhouse'

Subject: SPI

I received a nastygram from SPI today. You were both copied on it, and you'll note that most of the letter is crock of lies; I did not tell Cajun that I was there to collect wq data, and I did not.

Perhaps we could talk about this on Monday.

Tom

Tom Myers PhD

From: Tom Myers [mailto:tom_myers@charter.net]

Sent: Saturday, June 02, 2012 8:13 PM

To: 'Justin Augustine'

Subject: RE: SPI

Justin,

She did call me back the next day, and we talked for a while, I thought scientist to scientist, as she introduced the call, and she certainly did not let on that she was fishing for info to accuse me of – silly me. I don't know whether I acknowledged stepping off the road or not, but I certainly did not acknowledge trespassing. And I certainly did not say anything about collecting wq data, though I did acknowledge writing a report.

Would it have been legal for her to record the call?

Tom

Tom Myers PhD

Hydrologic Consultant

From: Justin Augustine [mailto:jaugustine@biologicaldiversity.org]

Sent: Saturday, June 02, 2012 8:34 PM

To: 'Tom Myers'

Subject: RE: SPI

Wow, that is really bizarre for them to send it up after having such a conversation. Why does she think you are taking water samples after that call you had—did that come up at all?

Their letter makes no sense to me.

I don't think it is legal to record the call: http://www.citmedialaw.org/legal-guide/california-recording-law

From: Tom Myers [mailto:tom_myers@charter.net]

Sent: Saturday, June 02, 2012 8:54 PM

To: 'Justin Augustine'

Subject: RE: SPI

Thanks for looking that up for me. I would agree that she could not have recorded the call legally. As I think of that call, it is clear that she called back fishing for information and that this letter is simply intimidation. I am almost certain there is nothing in our call that she could reasonably construe as me admitting to trespass; she did keep using that word to describe all that we did while there. She can say that all she wants but if she recorded my "admission" it was illegal.

I think the letter you wrote is reasonable.

Tom

Tom Myers PhD

Hydrologic Consultant

From: Justin Augustine [mailto:jaugustine@biologicaldiversity.org]
Sent: Monday, June 04, 2012 2:24 PM
To: 'dhd@dunmartinek.com'; 'CJames@spi-ind.com'
Cc: 'Mike.Bacca@fire.ca.gov'; 'Angela Wilson'; 'Duane.Shintaku@fire.ca.gov'
Subject: Re: SPI Letter to Tom Myers re Battle Creek

Hi David and Cajun,

I just wanted to quickly clear up a few statements you made in your letter to Tom Myers (attached). I am more than happy to discuss your concerns with either of you via phone, but wanted to state the following in written format since you also sent the letter to the Regional Water Board and Cal Fire.

First, no one (neither Tom nor I) has admitted to trespassing so I am not sure why you claim Tom admitted to doing so. I have spoken with Tom, and during his conversation with Cajun he did not admit to trespass.

Second, the purpose of the visit to the Battle Creek area was not to collect water samples. In fact, Tom collected no water samples at all. Therefore, it is not possible that you possess, as your letter alleges, "documentation of [Tom] obtaining samples on April 11, 2012."

Third, while I did confirm to Cajun that I was in the Battle Creek area in April, I did not state that anyone was there, as you allege, "for the purpose of collecting water samples." Cajun is well aware that when she contacted me I politely answered her questions and told her that a) I had been in the Battle Creek area, b) I had taken a water sample while there, c) Tom was with me while I was in the area, and d) I was not aware of any trespass. At that point, Cajun did not seek any further clarification and ended the phone call. The purpose of the visit to Battle Creek was to observe the area, and noone needs an SPI escort to do so.

Fourth, it is not possible that Tom "clearly violated SPI's access policy by obtaining water samples" because Tom did not obtain any samples, and I only took one sample (and do not believe I trespassed on anyone's property when doing so). Likewise, Tom could not, as the letter alleges, have "admitted to Dr. James that [his] purpose for [obtaining water samples] was to make analytical observations for a report" because Tom took no water samples.

Fifth, we too "have no knowledge of the water quality monitoring effort [we] plan to use" because Tom and I have no water monitoring effort.

In short, Tom and I travelled to the Battle Creek area in April with the desire to observe the area and learn about it. There was no reason to contact SPI to seek any type of permission. We had no intention of trespassing on SPI land and do not believe we trespassed on SPI's property or anyone else's property. Again, I would be more than willing to talk to anyone about SPI's alleged concerns, but be aware that your letter to Tom was unnecessary and contains numerous errors. Moreover, I would prefer that you discuss your concerns directly with me as there is no reason to waste any more of the Water Board's or Cal Fire's time with this issue.

--Justin Augustine

Public Comment ID: 20PC-000000468
Comment Received Date: 10/30/2020
Comment for Plan Number: Enter plan number manually
County: Shasta
Closest City: Manton, Shingletown
Email to Notify for Official Response: battlecreekalliance@gmail.com

Comment:
See uploaded document

Battle Creek Alliance
Defiance Canyon Raptor Rescue
Rock Creek Rd.
Manton, CA 96059
(530) 474-5803
www.thebattlecreekalliance.org

Protecting Water, Forests and Wildlife

DEFIANCE CANYON RAPTOR RESCUE

CalFire Timber Harvest Review Team
CALFIREReddingpubliccomment@fire.ca.gov

March 5, 2021

Comment on THP 2-20-00159 SHA "Powerhouse"

Table of Contents

I. Introduction

This comment is submitted to the Cal Fire Timber Harvest Review Team regarding plan number 2-20-00159 SHA named Powerhouse. This plan was previously submitted in 2017 as the Artemis plan, 2-17-070 SHA, which was withdrawn in 2018. All of the problems that we wrote of regarding the Artemis plan are still present or exacerbated. This resubmitted plan continues the ongoing practice of providing no factual, valid cumulative impacts analysis and continues to ignore the downstream cumulative effects which have been documented by many sources.

An approval of this plan by Cal Fire will fail to uphold the environmental protection requirements of the California Environmental Quality Act (CEQA) and will trigger a legal challenge.

The following comments are submitted on behalf of Battle Creek Alliance (BCA), California Chaparral Institute, Center for Biological Diversity (CBD), Environmental Protection Center (EPIC), John Muir Project, Shasta Environmental Alliance (SEA), and Wild Nature Institute regarding this plan submitted by Sierra Pacific Industries (SPI). Please consider these comments as significant environmental concerns raised during the review team process.

Our comments and substantive evidence show that the material submitted by SPI:

1. is largely not relevant to the logging plan, the watershed area affected by the plan, or plan-related adverse cumulative watershed effects;

2. contains confusing, false, contradictory, insufficient, and purposely misleading information;

3. fails entirely to address the significant environmental concerns raised here;

4. is based on subjective, unsupported conclusions and speculation;

5. does not provide a substantial, factual, evidentiary basis for Cal Fire to determine that the Powerhouse logging plan is in conformance with the Forest Practice Act and Rules and will not add to significant cumulative impacts which already exist. In light of the full record, approval of this plan would be an abuse of discretion.

A full list of additional information and materials being submitted as part of these comments is at the end of this document. These materials were provided to Cal Fire Nov. 12th, 2020 on a flash drive delivered to their office on Airport Road, in Redding, CA; more have been sent by email subsequently. Cal Fire agreed to add the past logging plans and their Official Responses to the record for this plan. (Logging plans and Cal Fire's Official Responses to plans 2-03-158 Digger, 2-04-166 Hazen, 2-04-181 Willow Spring, 2-06-173 Lookout, 2-08-052 Bailey's, 2-08-097 Long Ridge, 2-09-027 Plateau Flat, 2-10-003 Dry Gulch, 2-10-034 Grace, 2-10-067 Blue Ridge, 2-12-026 Reynolds Flat, 2-12-031 Hendrickson-Defiance, 2-17-070 Artemis, 2-18-055 Graceland, 2-19-00180 Rio Gatito.)

II. BCA Background

BCA was formed in 2007 by local residents due to the ongoing logging, primarily by clearcutting, of the industrial timberland in the mid-zone of the Battle Creek watershed. Since that time we have read dozens of logging plans submitted for this, and other, California watersheds. We have submitted comments on over a dozen THPs, and spent thousands of hours on research regarding the natural resources of this, and other, areas. All of our comments have raised concerns about the declining health of the biological resources in this watershed which support and enhance the common good of the inhabitants of California. (Eg. SPI logging plans, BCA comments, and Cal Fire's Official Responses to plans: 2-06-173 Lookout, 2-08-052 Bailey's, 2-08-097 Long Ridge, 2-09-027 Plateau Flat, 2-10-003 Dry Gulch, 2-10-034 Grace, 2-10-067 Blue Ridge, 2-12-026 Reynolds Flat, 2-12-031 Hendrickson-Defiance, 2-18-055 Graceland, 2-19-00180 Rio Gatito.) Table 1 and Figure 1 illustrate the industrial timberland area and acreages that the logging plans mentioned above are part of.

In 2009, BCA began collecting water quality data, and has collected nearly 14,000 (as of Dec. 2020) samples since then. The record of these samples is in the California State Water Resources Control Board's CEDEN site (California Environmental Data Exchange Network online). A research paper by two hydrologists and a GIS specialist/senior scientist regarding this data was published in the scientific journal, *Environmental Management*, in 2019 (Lewis et al.) Previous technical reports regarding our data include Myers 2012, Lewis 2014, and Lewis 2016. BCA felt compelled to collect data due to the fact that the regulatory agencies were collecting little to no data to base their decisions on. As far as we know, we collect the only long-term, year round water data in the Sierra/Cascade region to track upland disturbance's impacts. Cal Fire acts as the lead agency in the logging plan review process and has consistently approved plans as having "no significant impacts" while using no factual, quantitative data. The Review Team spends little time in the field; this writer has spent over 30 years and many thousands of hours in the field.

Delineation	Acres	% of Watershed
Battle Creek HSA	222,367	100%
Timber Production Zone (2014)	84,443	40%
Federal lands	66,687	30%
State lands	1205	<1%
Industrial timberlands	75,874	34%
Non Industrial timberlands	6940	3%

Table 1. Cal Fire FPGIS table of timberland in Battle Creek watershed. Industrial timberlands represent the majority of the acreage and are the predominant land use in the mid-elevation range of the watershed.

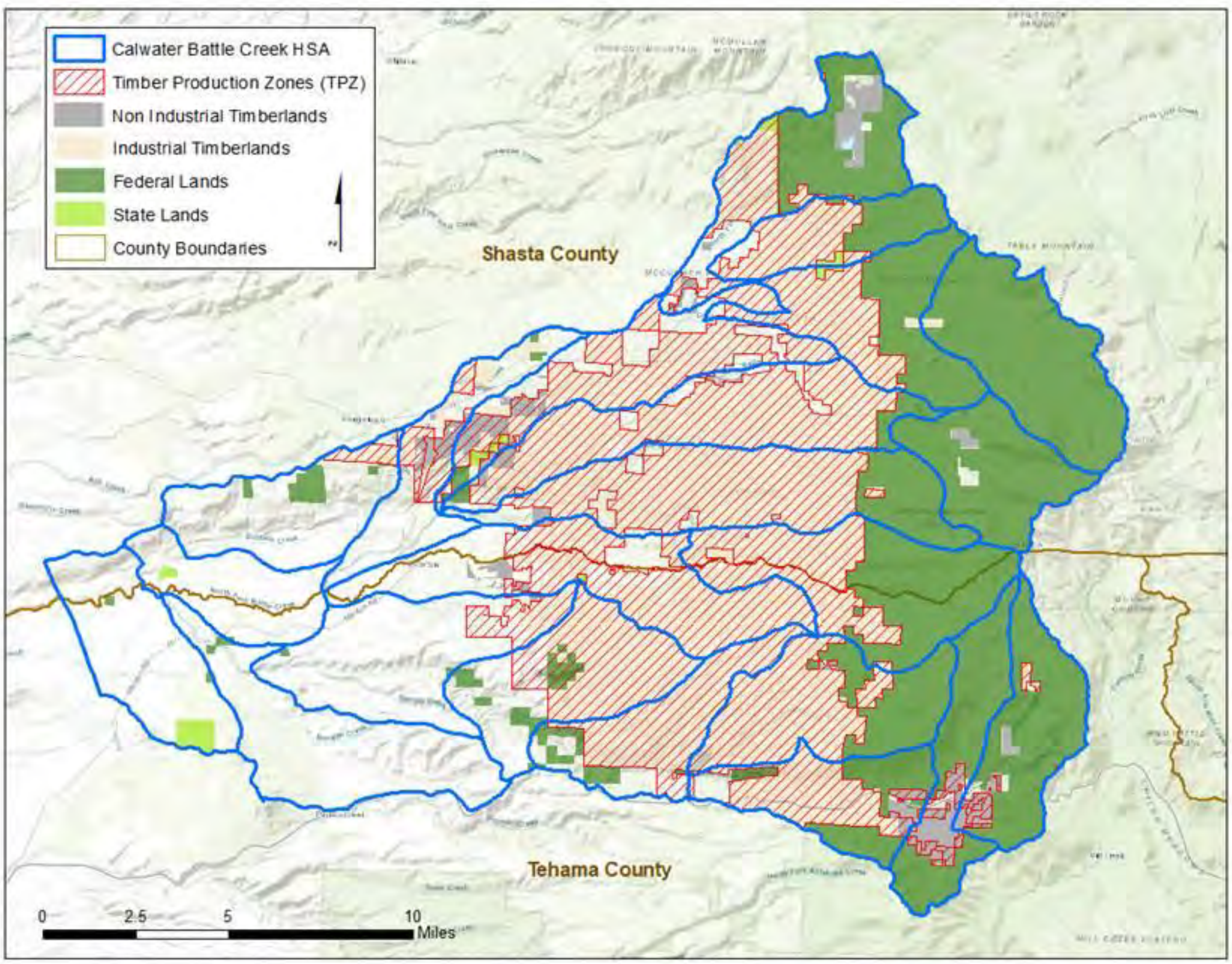

Figure 1. Cal Fire FPGIS map of timberland in Battle Creek watershed. Industrial timberland accounts for 34% of the watershed's land area, as detailed in Table 1.

III. Cal Fire's Ongoing Practices Demonstrate a Prejudicial Abuse of Discretion

#7 A. Cal Fire practices do not require, gather or disperse information needed by their agency and the public to make informed decisions.

The Rio Gatito logging plan, 2-19-00180, which is slightly south of this plan, was approved in April 2020. During the comment period for that plan we requested that Cal Fire provide us with documentation (map, written description) of where their Review Team went during the pre-harvest inspection, how many acres were reviewed, and how they looked for cumulative impacts, as required by law. They refused to give us the information stating that "Routes taken, or acreages actually reviewed, are not required to be reported, and would be difficult to actually determine. " (Cal Fire Ramaley, 2019.) Once again, on Oct. 14th, 2020, with this plan we requested documentation of the pre-harvest inspection with a record of GPS locations kept and given to us. Once again, Cal Fire refused. "There are no requirements for this to be completed. I am cc'ing my supervisor Dennis Hall and he can provide any additional information if he wants to." (Ramaley 2020.) Apparently Dennis Hall "didn't want to" since we received no information or contact. On Oct. 28th we found that the pre-harvest inspection had occurred on Oct. 26th, not because it was updated on the Cal Fire CalTrees site, but because we sent an email to John Ramaley since there were different dates listed on the CalTrees site, neither accurate. The public may only be allowed 30 days to comment after the inspection; it is crucial to have accurate information, but the Cal Fire system is often behind, adding an additional burden on public commenters. This is part of the ongoing obstruction that Cal Fire has practiced for many years which blocks public knowledge regarding logging plans and comments as much as possible. The continuation of that practice with this plan does not uphold the law.

The California Code of Regulations addresses logging plans (THPs):

14 CCR 897 The information in [THPs] shall also be sufficiently clear and detailed to permit adequate and effective review by responsible agencies and input by the public. . .

14 CCR 898.2 The Director shall disapprove a plan as not conforming to the rules of the Board if . . .there is evidence that the information contained in the plan is incorrect, incomplete or misleading in a material way, or is insufficient to evaluate significant environmental effects.

Cal Fire is violating both of these regulations by not collecting or providing sufficient information needed by the public to effectively review the plan or Cal Fire's process. Withholding this information also does not provide the public with sufficient information to ascertain whether Cal Fire has adequately evaluated significant environmental effects. This practice is part of Cal Fire's ongoing pattern of dismissing the public and refusing to answer questions the public asks. (See BCA comments and Cal Fire Official Responses regarding logging plans 2-06-173 Lookout, 2-08-052 Bailey's, 2-08-097 Long Ridge, 2-09-027 Plateau Flat, 2-10-003 Dry Gulch, 2-10-034 Grace, 2-10-067 Blue Ridge, 2-12-026 Reynolds Flat, 2-12-031 Hendrickson-Defiance, 2-18-055 Graceland, 2-19-00180 Rio Gatito.)

An important part of any cumulative impacts analysis is comparing current conditions with past conditions to track what changes are occurring. The Powerhouse logging plan continues on the path of significant adverse effects being amplified because no baselines or thresholds are ever set or used. 14 CCR 15064.7 states: "(a) [e]ach public agency is encouraged to develop and publish thresholds of significance that the agency uses in the determination of the significance of environmental effects. A threshold of significance is an identifiable quantitative, qualitative or performance level of a particular environmental effect, non-compliance with which means the effect will normally be determined to be significant by the agency and compliance with which means the effect normally will be determined to be less than significant."

The Board of Forestry is responsible for enacting rules to uphold the legislative intent of the CCRs, but has never created any rules to set "thresholds of significance". Therefore, there are not any "identifiable quantitative, qualitative or performance levels" to adequately determine what significant cumulative environmental impacts are occurring in the physical reality of California's forests and watersheds. Nonetheless, the legislative intent is clear, and this plan offers only SPI-produced concealments which do not adhere to the intent of California's lawmakers.

This logging plan is more fiction on paper to disguise the facts which are occurring on the ground.

B. Cal Fire practices demonstrate bias against environmentalists.

#8 During the comment period for the former iteration of this plan (Artemis) we submitted a Public Records Act Request and received emails between the Cal Fire Review Team. The following emails exhibit a pre-determined approval on the Review Team's part, and an intent to use their Official Responses from a decade ago for a copy and paste response to our comments. These practices do not uphold the guiding principle for the review of projects under CEQA, including the review of logging plans. That principle is that CEQA must be interpreted so as to afford the fullest possible protection to the environment. There is nothing in the rules or law that upholds the regulatory agency acting in the manner demonstrated in the following emails. Our experience is that these cursory practices will be repeated with this plan.

The first email image is a Cal Fire Review Team email from Adam Deem on Feb. 2, 2018, before the close of the Public Comment deadline for the Artemis plan. This email exhibits a planned decision made on how to reject our comments before weighing the evidence we presented, by using their Official Responses to our comments from plans in 2010 and 2012:

#8

Past ORs for the Battle Creek Alliance
Deem, Adam@CALFIRE (Adam.Deem@fire.ca.gov) Add contact
To: Meese, Dale@CALFIRE;
Cc: Woessner, Jonathan@CALFIRE; Ramaley, John@CALFIRE;
10-003-TEH_OR_final_3.21.11... 10-067-TEH OR_Final_11.16.11.d... 12-026_SHA_OR_Final_12.6.1...

These are the three most recent plans in the area with concern letters from BCA
2-10-003-TEH
2-10-067-TEH
2-12-026-SHA

These two older plans have an index that was developed for the Administrative Record. If there is an issue that was not answered above you may want to look at these for an idea of where to start.
\\FPNORTHOPS01\Root\data\Resource Management\Old Legal Cases\Oliviera V CAL FIRE\Plateau Flat\Plateau Flat OR Index
\\FPNORTHOPS01\Root\data\Resource Management\Old Legal Cases\Oliviera V CAL FIRE\Long Ridge\Long_Ridge_OR_Index

Adam Deem, RPF #2759
Review Team Chair
Northern Region H.Q. - Redding
6105 Airport Road
Redding, CA 96002
530-224-2488

The following are Cal Fire Review Team emails during the Artemis plan, Jan. 26th to 29th, 2018. These emails show the behind-the-scenes actions to undermine public comments, including contacting an employee (Ed Murphy) of the company (SPI) Cal Fire is supposed to be regulating, to obtain information to use against our comments:

#9

RE: Comment on THP 2-17-070 SHA
Cafferata, Pete@CALFIRE (Pete.Cafferata@fire.ca.gov) Add contact 1/29/201
To: Ramaley, John@CALFIRE;
Cc: Coe, Drew@CALFIRE; Huff, Eric@CALFIRE;

John: I will read over Marily's letter as well.
Pete

From: Ramaley, John@CALFIRE
Sent: Monday, January 29, 2018 7:39 AM
To: Cafferata, Pete@CALFIRE <Pete.Cafferata@fire.ca.gov>
Cc: Coe, Drew@CALFIRE <Drew.Coe@fire.ca.gov>
Subject: RE: Comment on THP 2-17-070 SHA

I called Ed Murphy to see if they have data for Upper Digger Creek, but he didn't think so. He is going to check. The plan is located above the Ponderosa Fire, and half the watershed is federal. It's been over 10 years since SPI was in the watershed. Drew said he would read the letter.

Public comment is still open so I want to wait until it closes before starting the response. I believe Marily was going to send supporting documents but we have not received them yet.

From: Cafferata, Pete@CALFIRE
Sent: Friday, January 26, 2018 4:46 PM
To: Ramaley, John@CALFIRE <John.Ramaley@fire.ca.gov>
Cc: Coe, Drew@CALFIRE <Drew.Coe@fire.ca.gov>
Subject: RE: Comment on THP 2-17-070 SHA

Hi John. What do you want from Drew and me on this comment letter?
Pete

These emails do not reflect regulatory staff having an attitude or practice of striving to do a thorough and honest evaluation of cumulative impacts. The emails show a biased and discriminatory practice in their treatment of our comments. Further evidence of these practices and treatment are included in our references (Battle Creek Alliance 2010, 2011, 2012, 2013, 2017, 2018, 2019, 2020, Cal Fire whistleblower emails 2015, Cal Fire Official Responses to our past comments) and summarized in Battle Creek Alliance (2020) "Intimidation and Suppression Timeline".

This writer has been reading logging plans for the Battle Creek watershed since 2007 along with Cal Fire's Official Responses to public comments. I have found that the majority of the plans are copied and pasted repetitions of the same information, with no site-specific verifiable or factual evidence provided. Cal Fire's Official Responses utilize the same repetitive copy and paste dismissal of anything that disagrees with the timber industry, while offering no factual evidence to support their approvals. No ongoing factual data is collected or presented to detect trends and changes over the two decades that the majority of the forest cover in the industrial timberland has been logged. Credible science collects evidence over time to compare the changes which have occurred in order to determine what impacts there are. None of that has happened over the course of the 2 decades Cal Fire has blindly approved logging plans as having "no significant effects".

State agencies, including Cal Fire, are bound by ethics laws. One of the key concepts of those laws is that a public agency's decisions should be based solely on what best serves the public's interest.

Cal Fire's behind-the-scenes biased review practice does not uphold the intent of the State's laws and rules, nor does it uphold the part of Cal Fire's stated mission to protect California's natural resources.

The Powerhouse plan at issue here suffers from the same ongoing deficiencies that the past plans have by not providing a robust and defensible cumulative impacts analysis.

IV. Information in the Logging Plan is Incorrect, Incomplete, and Misleading, and Therefore Insufficient to Evaluate Cumulative Impacts

#10 A. Contrary to law, Cal Fire has a pattern and practice of accepting and approving logging plans that lack factual, quantitative data or valid Cumulative Impacts analyses

The following map (Figure 2) shows the withdrawn 2017 Artemis plan (the previous iteration of the current plan) in red with the white borders around the red representing the current Powerhouse plan. The purple borders are the Rio Gatito plan that was approved in April 2020. This plan abuts the 2012 Ponderosa Fire area which was heavily logged post-fire under Emergency exemptions, as well as being situated upstream of tens of thousands of acres cut in the past ~20 years. Contrary to law, no analysis has ever been performed to ascertain the cumulative impacts or the cumulative watershed effects (CWE) downstream of all the plans together. This plan continues that practice.

According to Cal Fire's records (CA Dept. of Forestry and Fire Protection FPGIS 2018), 67 logging plans covering over 61,000 acres have been filed primarily in the industrial timberland block of the Battle Creek watershed between 1997 and 2016. (Figure 2.) The 61,000 acres of plans do not include additional acres logged under emergency and other types of exemptions, such as the post-fire salvage logging of the 2012 Ponderosa Fire which covered over 27,000 acres. 61,000 acres is over 80% of the 75,874 acres of industrial timberland. The Rio Gatito plan added 822 acres; this plan adds another 1,102 acres.

#10

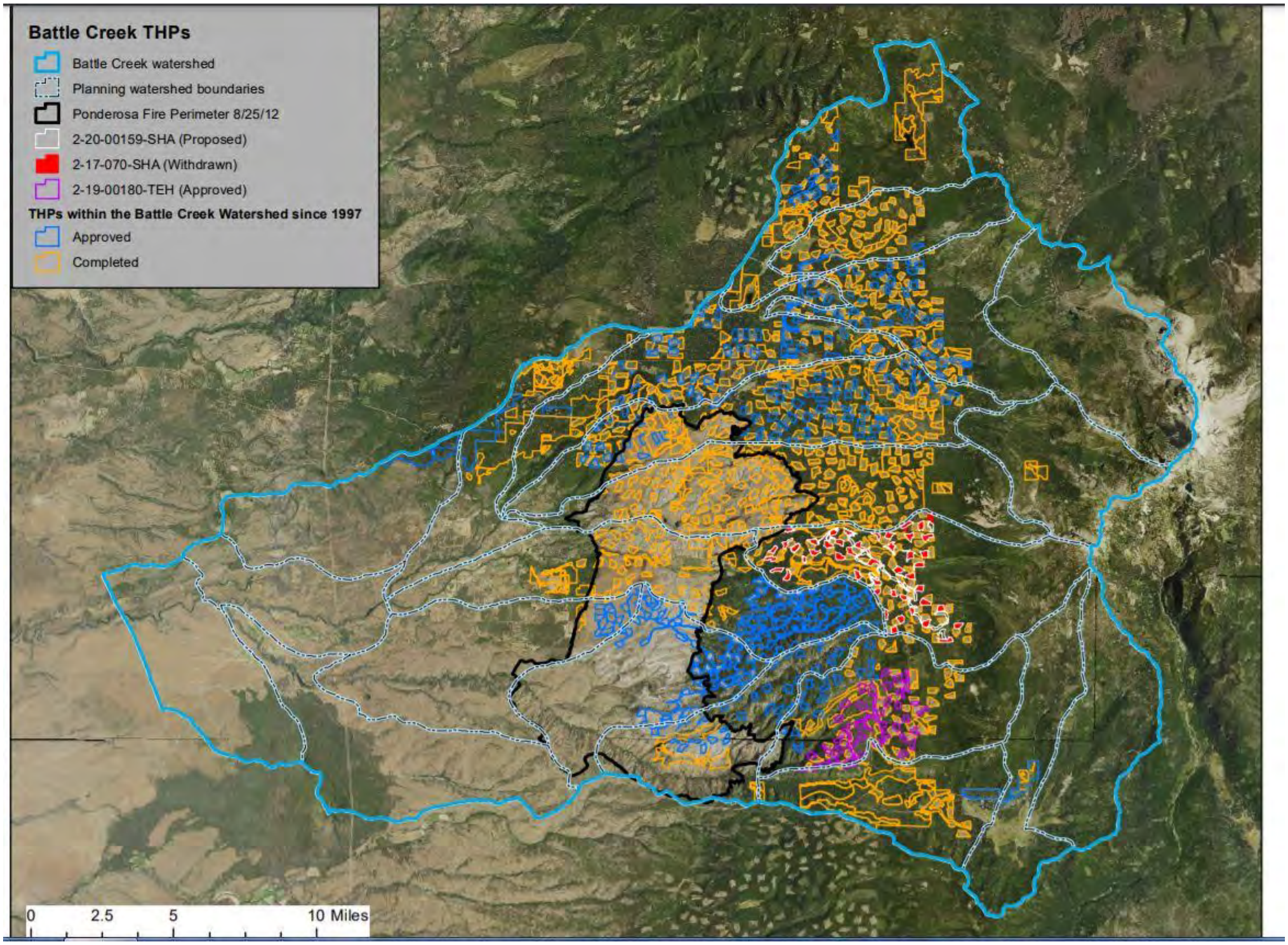

Figure 2. GIS map of the current Powerhouse plan units laid over the 2017 Artemis plan units that was withdrawn, shown in red and white markings. The purple markings are of the 2019 Rio Gatito plan, approved in April 2020.

According to Cal Fire Forest Practice GIS data (FPGIS), over 75,000 acres of industrial timberland exists in a large, contiguous block in the Battle Creek watershed. (Figure1, Table 1.) The cumulative impacts to this large block of land have never been analyzed in SPI's logging plans under the practices Cal Fire has followed for decades. The effects on downstream waterways have not been monitored or accounted for or protected from significant effects, by these ongoing practices. The biota population was not assessed prior to the major landscape changes, and no ongoing study has been undertaken to assess what changes have occurred. For decades, professional hydrologists have made observations such as: "**Examination of recently approved THPs and SYPs indicates that plans are being approved that do not contain technically valid cumulative impact assessments.**"(Reid 1999, see also Dunne et al. 2001.)

Cal Fire has a historical pattern and practice of accepting the same type of factually-void logging plans throughout the Battle Creek watershed, never providing the public or other decision makers with the information necessary to knowledgably assess the cumulative environmental impacts of each logging plan. While decisions concerning whether or not to ultimately approve a plan are matters left to the judgment of Cal Fire, Cal Fire does not have discretion to take short cuts through the environmental review process, compromise its core obligations under CEQA, and approve a plan with significant impacts that have not been fully analyzed.

#11

Although the Forest Practice Rules contain a number of generic best management practices ("BMPs") or mitigation measures to reduce the environmental impacts of logging, experts have understood for decades now that the measures are not sufficient to prevent cumulative watershed effects ("CWEs") from occurring. CEQA does not permit mitigation measures to be used to avoid assessing whether a project's cumulative impacts will be significant (San Joaquin Raptor Rescue Center v. County of Merced (2007) 149 Cal.App.4th 645, 663). Merely the inclusion of mitigation measures in the plan description does not make any potential impacts automatically less than significant (Lotus v. Dept. of Transp. (2014) 223 Cal.App.4th 645, 656).

In a report titled, "A Scientific Basis for the Prediction of Cumulative Watershed Effects" (Dunne et al. 2001, "CWE Report") a "blue ribbon panel of experts" on the University of California Committee on Cumulative Watershed Effects comprehensively reviewed the Forest Practice Rules, dozens of logging plans, and ongoing water quality impacts. The CWE Report explains the inadequacy of Cal Fire's application of the Rules to avoid cumulative watershed effects. The CWE Report pointed to three reasons why CWEs are occurring, despite Cal Fire's application of the Forest Practice Rules. The first problem is that Cal Fire does not require that plans contain sufficient data to allow the agency and the public to assess existing and expected impacts. ("Information provided in individual THPs that we examined was often incomplete or too subjective to assess current resource conditions, lingering cumulative effects, or the potential for additional impacts.") The second problem, the CWE Report explains, is that Cal Fire operates under the premise that, even if a logging plan may have adverse impacts, "it can be mitigated out of existence by application of a Best Management Practice" found in the Forest Practice Rules. The third problem is that Cal Fire never looks at the watershed as a whole in assessing cumulative impacts. Having reviewed dozens of logging plans, the CWE Report records the damage caused to watersheds when Cal Fire allows the "postage stamp" approach, looking only at a small fraction of the watershed in which the logging plan is located. This "'postage-stamp', or 'parcel-by-parcel', approach, in which only the immediate project area of a single, small timber harvest is ever reviewed . . . does not capture the cumulative influence of multiple harvests over a long period of time in a large, complex watershed." Ultimately, the CWE Report concluded that a process – indistinguishable from the review relied on in all of the past Battle Creek watershed logging plans – "contains no method for recognizing damage across entire ecosystems or watersheds" and "needs to be replaced with a true, watershed-scale assessment." While the CWE Report was written nearly 20 years ago, each of these problems remains, and can be seen again in the Powerhouse plan at issue here.

B. Powerhouse plan similarly lacks scientific, site-specific data regarding cumulative impacts; therefore, approval would be contrary to law.

The following section will demonstrate that this logging plan lacks the scientific, site-specific evidence required for a cumulative impacts analysis. As such, if Cal Fire were to approve this plan as currently presented (lacking the required elements of a cumulative impact assessment), Cal Fire would be committing an abuse of discretion by failing to proceed in the manner required by law. (Joy Road Area Forest and Watershed Assn v. Cal. Dept. of Forestry & Fire Prot. (2006) 142 Cal. App.4th 656, 674-78.)

#12 Plan page 7 and 209 refer to the "Campbell Creek" watershed. There is no Campbell Creek in the Battle Creek watershed. We presume the plan means the Canyon Creek planning watershed. The plan's lack of even knowing what creeks are in the area does not inspire confidence in the preparer's ability to accurately determine cumulative effects. This plan continues the practices used in the past dozens of plans and 61,000 acres of logging--practices that every plan has stated are causing "no significant adverse impacts" while providing no factual evidence.

#13 Plan pages 139- 155 are the same copied and pasted pages which SPI has put in every plan for over a decade. They contain no verifiable evidence and are not site-specific to this plan, although on page 139 they write that they have "site-specific data and scientific studies on a number of terrestrial and aquatic wildlife species that are incorporated into our individual THPs". Where is it then? Writing baseless sentences such as this does not make them true. In our experience, the small amount of site-specific water quality data SPI presents has been collected at the highest upstream points of SPI's land, making the data worthless for assessing downstream cumulative impacts. We examine some other SPI documents throughout this comment that have been copied and pasted into their plans for years. There is almost nothing regarding wildlife in the upper Digger Creek planning watershed included in the plan, other than generic lists of species which provide no level of understanding how populations are being affected or are changing.

Plan page 7 Item 13 marked the box that the logging operations WILL NOT HAVE A SIGNIFICANT adverse impact on the environment, and Page 167 of the plan presents a box divided into 8 different resources with a question regarding if the project will impact any of the resources and will "have a reasonable potential to cause or add to significant cumulative impacts...". The "no" box is checked for every resource including Watershed, Soil Productivity, Biological, Recreation, Visual, Traffic, Greenhouse Gases, and Wildfire Risk and Hazard. Every one of SPI's past plans has said the same thing. The information we present in this comment (and past comments) shows that there are existing significant impacts to the listed resources, which have been completely ignored in the plan. It's reasonable to assume that further logging from this additional proposed plan will be an additive factor to existing adverse effects.

C. Powerhouse Plan will Affect the Downstream Areas

#14 *1. Limiting the Assessment Area in the Powerhouse Plan is an Attempt to Avoid the Required Cumulative Impact Analysis of the Downstream Watershed.*

Although the Rules permit “planning watersheds” to be used as a starting point for cumulative watershed assessments, Cal Fire is required to look beyond the planning watershed to ensure all relevant information is considered (such as the greater watershed and fluvial system). 14 CCR § 898; see also East Bay Mun. Utility Dist. v. Cal Dept. of Forestry & Fire Prot. (1996) 43 Cal.App.4th 1113, 1133 (“duty to require supplementations is entirely consistent with the agency’s duty under CEQA to use its best efforts to find out and disclose all that is reasonably can”).

The small geographic scope used by SPI in this logging plan is exactly the type of inadequate analysis that the cumulative impact assessment is intended to prevent (EPIC v. Cal Dept. of Forestry & Fire Prot. (2008) 44 Cal.4th 459, 525). CEQA requires the scale of the cumulative impact assessment area to be based on the nature of the impacted resource, not the scale of the project (Kings County Farm Bureau v. City of Hanford (1990) 221 Cal.App.3d 692, 722-723).

The following section demonstrates how SPI has tried to avoid a full cumulative impact analysis by limiting the scope of the project, thereby ignoring the devastating cumulative impacts the addition of this plan will have – in combination with prior plans – within the Battle Creek Watershed.

Plan page 139 SPI states: "According to the SNEP analysis, for project planning and management decisions, the scale should be the CALWATER planning watershed units (a subdivision of the major river basins, used by SNEP and delineated by the California Department of Water Resources) (SNEP 1996)."

This appears to be more purposely misleading information in the logging plan. SNEP (Sierra Nevada Ecosystem Project) was a multi-volume, thousands of pages document produced in 1996. SPI's 3 references to it on page 173 list 3 titles which do not exist in the report. As far as we can tell, the titles are headings in the Appendices which include multiple chapters from the report. We can find nothing in SNEP which recommends the use of the CALWATER planning watershed system for practices such as SPI employs or Cal Fire approves; the CALWATER system was in its earliest stage of development in 1996.

According to this USGS link online, https://water.usgs.gov/GIS/metadata/usgswrd/XML/ca_provinces.xml

> "This digital data set was created to provide a context for developing a statewide, comprehensive ground-water monitoring and assessment program as per the requirements of the California State Assembly bill AB599. The development of this data set facilitated analysis and identification of the priority basins and areas outside basins.

This data set was developed from previously developed digital data sets of ground-water basins (California Department of Water Resources, 2002) and watersheds (California Department of Forestry and Fire Protection, 1999)."

AB599 was filed in 2001, 5 years after the SNEP report was released:

http://leginfo.legislature.ca.gov/faces/billTextClient.xhtml?bill_id=200120020AB599&search_keywords=groundwater

"AB 599, Liu. Groundwater contamination: quality monitoring program.

Existing law declares that groundwater is a valuable natural resource in the state and should be managed to ensure its safe production and its quality. Existing law authorizes specified local agencies to adopt and implement groundwater management plans.

This bill would require the State Water Resources Control Board to integrate existing monitoring programs and design new program elements, as necessary, for the purpose of establishing a comprehensive monitoring program capable of assessing each groundwater basin in the state through direct and other statistically reliable sampling approaches, and to create an interagency task force to identify actions necessary to establish the monitoring program and to identify measures that would increase coordination among state and federal agencies that collect groundwater contamination information. The bill would require the state board to convene a described advisory committee to the task force. The bill would require the state board, in consultation with other specified agencies, to submit to the Governor and the Legislature, on or before March 1, 2003, a report that includes a description of a comprehensive groundwater quality monitoring program for the state."

On Nov. 23rd, 2020 we emailed Cal Fire to ask for the document in SNEP that the plan on page 139 (mentioned above) referred to. On Dec. 2nd we received this reply:*"The original CALWATER digital production occurred during 1993. The current version of the digital boundaries was finalized during 1999, with additional attribute data updated during 2004 (CALWATER version 2.2.1). Some of the assessments described in The Sierra Nevada Ecosystem Project (SNEP) used CALWATER data, which was readily available at the time of the 1996 publication. References to CALWATER appears in several locations in the SNEP reports. The SNEP reference used in the THP refers to SNEP Volume I, page 106, which is part of the Distributed Forest Conditions (DFC) Strategy discussion included in the Management Strategy section of the Late Successional Old-Growth Forest Conditions Chapter (Chapter 6). The DFC strategy distributes forest seral diversity across the landscape, benefitting organisms and ecological functions using a patchy distribution. Existing small patches of late successional forest would be maintained where they occur, and these stands would be evenly distributed across the landscape. The CALWATER planning watershed unit scale is the appropriate planning and management scale for such a strategy.*

Document reference:

Sierra Nevada Ecosystem Project (SNEP). 1996. Final report to Congress. Vol. I, Assessment Summaries and Management Strategies. Wildland Resources Center Report No. 37. Centers for Water and Wildland Resources, University of California, Davis."

We reviewed the SNEP chapter mentioned in the reply, which is about "Late Successional Old-Growth Forest Conditions" which does not describe SPI's land at all. The map shows the study areas as only national forest lands (which are managed completely differently than industrial timberland) and the text states: "The objective of the DFC strategy is to meet overall forest goals by creating a forest landscape on the east side of the Sierra Nevada (primarily east-side pine)".

The industrial timberland in Battle Creek and most of the Sierra Nevada is on the **west** side of the mountain range, does not consist of east-side pine, and very little of it is in old-growth condition due to logging throughout the 20th century. This SNEP Chapter has no relevance to SPI's practices and the use of one sentence from it to justify decades of utilizing misleading, reductive assessment areas is contrary to the intent of environmental protection laws.

SPI has chosen to confine their assessments to the small planning watersheds for many years and Cal Fire has approved thousands of plans in California using this faulty assessment system. In past plans and approvals within Battle Creek watershed, neither SPI nor Cal Fire have ever provided adequate justification, supported by substantial evidence, as to why they refuse to look for water quality impacts downstream of the individual plans beyond the planning watershed boundaries. As a result, both the past logging plans and this current one fail to inform the public and decision makers of the true environmental consequences which are occurring.

The practice of the misuse of the planning watershed delineations has prevented any meaningful cumulative impact analyses and allowed many of California's important watersheds to be over-cut. There is no excuse for this and it must stop. Cal Fire's approvals are not upholding the laws or the intent of the laws, and are not preventing or repairing the well-known significant adverse effects that were detailed in the SNEP report and throughout many scientific studies.

The SNEP report is the antithesis of an approval of SPI's practices. Cal Fire has the report in their files, but apparently neither they, nor SPI, have ever read any of it. In Volume I Chapter 8, "Watersheds and Aquatic Diversity" the report writes:

"CRITICAL FINDINGS

Aquatic Habitats: The aquatic/riparian systems are the most altered and impaired habitats of the Sierra.

Stream Flow: Dams and diversions throughout most of the Sierra Nevada have profoundly altered stream-flow patterns (timing and amount of water) and water temperatures, with significant impacts to aquatic biodiversity.

Riparian Status: Riparian areas have been damaged extensively by placer mining (northern and west-central Sierra) and grazing (Sierra-wide), and locally by dams, ditches, flumes, pipelines, roads, timber harvest, residential development, and recreational activities.

Sediment: Excessive sediment yield into streams remains a widespread water-quality problem in the Sierra Nevada.

Water Quality: Major water-quality impacts on the Sierra are (1) impairment of chemical water quality downstream of urban centers, mines, and intensive land-use zones, (2) accumulation of near toxic levels of mercury in many low- to middle-elevation reservoirs of the western Sierra, (3) widespread biological contamination by human pathogens (especially Giardia), and (4) increased salinity in east-side lakes as a result of water diversions.

Introduced Aquatics: Introduction of non-native fishes (primarily trout) has greatly altered aquatic ecosystems through impacts on native fish, amphibians, and invertebrate assemblages.

Amphibian Status: Amphibian species at all elevations have severely declined throughout the Sierra Nevada.

Anadromous Fish: Anadromous fish (chinook salmon, steelhead), once native to most major Sierran rivers north of the Kings River, are now nearly extinct from Sierran rivers.

Aquatic Invertebrates: Local degradation of habitats has led to significant impacts on aquatic invertebrates, which make up the vast majority of aquatic species in the Sierra Nevada.

California's economy derives enormous benefits from water diverted from the streams, rivers, and lakes of the Sierra Nevada. A major cost associated with these benefits has been deterioration of the biotic integrity and sustainability of the aquatic systems, as reflected in declines in the distribution and abundance of native aquatic and riparian organisms. Water determines the distribution and abundance of many plants and animals throughout the Sierra Nevada by shaping and providing habitat. Lakes and streams support rich communities of native organisms both in the water and in adjoining riparian areas. These water bodies also support cities, farms, and industries within and distant from the mountains...Development of streams and other resources of the Sierra Nevada over the past 150 years has met the downstream demands of society throughout California but has impaired the quality and availability of water for both ecological and social needs in many parts of the mountain range."

Also in SNEP Volume III, Chapter 2 "Cumulative Watershed Effects: Applicability of Available Methodologies to the Sierra Nevada" Berg et al. wrote: "Only recently has formalization of concerns gone beyond the effects of site-specific, single impact land management. Gooselink and Lee (1989), however, point out that the roots of the issue can be viewed as a communal response to accumulating individual acts of environmental degradation, none particularly large or damaging, but when taken together sum to significant and potentially dramatic impacts. Hardin (1968) described this principle elegantly as the tragedy of the commons: the unrestricted use of a common resource by individuals to maximize individual profits, leads to a loss of the resource for both individuals and the public."

Battle Creek-specific documents that include cumulative impacts aspects related to the SNEP findings detailed above are: Kier 2003, Kier 2009, Myers 2012, Henkle 2016, Pacific Watershed Associates 2017/2018, Lewis 2019, Battle Creek Watershed Conservancy 2019. All of these relevant reports are conspicuously ignored in the Powerhouse plan at issue, as well as having been ignored in past plans and approvals.

#15 This plan does not include the impacts of past projects, instead confining itself to the reductive area of a planning watershed and essentially considering its impacts alone, while willfully ignoring Battle Creek specific research. The Battle Creek Watershed Based Plan (2019), overseen by the Central Valley Regional Water Board and paid for with State funding, details impacts of past projects and occurrences in the area and in the downstream drainages which will be affected by this plan. Here are some examples in the document which support our concerns:

According to the geology map on page 8 of the 2019 Battle Creek Watershed Based Plan (WBP), part of the planning watershed in this plan has rhyolitic soil. Rhyolitic soil is known to be highly erosive. We see no discussion of this in the THP. In fact, this Powerhouse plan presents misinformation regarding the EHR (erosion hazard rating) on pages 224-225, and 265-269, rating the EHR as mostly low. There is no substantive discussion of the basic methodology used to determine the EHRs such as who was the person/what training the person had, how much of the area was actually surveyed, or when and how often, what specific measurements were collected in the field, or how the ratings were arrived at. This lack of substantive evidence regarding methodology is evident throughout this, and past, plans which leads to the conclusion that the ratings are just unsourced opinion on paper with no connection to the reality of the land.

#15 The Digger THP (2-03-158) is not listed in the "Past Projects" section of this plan, but some of its units abut the projected units to be logged by this plan (this is not shown on this plan's maps). On page 244 of the Digger THP file there is a Cal Fire letter that states there were active operations in 2011. In the Digger plan the Review Team wrote: "Published geologic mapping shows the southern part of the THP area 5 ~(south of South Fork Digger Creek) to be underlain by rhyolitic rocks. These rocks are known to weather to soils that (a) are highly erodible, and (b), in a manner similar to decomposed granite (DG) soils, may potentially erode at rates exceeding those that would be expected from the calculated erosion hazard rating (EHR). Sediment resulting from such erosion could then be delivered to downslope streams. Timber harvest operations have the potential to accelerate the erosion and sediment delivery rates significantly above the pre-harvest rates."

(See Figures 25 to 34 for some of the adjacent Digger plan's units which this plan will cut next to.)

The EHR rating tables on pages 265-268 of the THP appear to be generated by a computer program of some sort. The tables use specifically selected, repeated numerical designations, so are purely speculation. The tables do not mention rhyolitic soil at all.

WBP Pages 8-11 detail the loss and change in area of forest cover between 1985 and 2017. (A significant effect.)

WBP Page 12 describes Beneficial Uses and Sediment Stresses and states "beneficial uses of any specifically identified water body generally apply to all of its tributaries." In this plan, that would specifically pertain to Digger Creek and its downstream drainage into Battle Creek.

WBP Page 12-13 spells out the water quality objectives encoded in the Basin Plan. BCA's water quality data collection sites are all downstream of this plan; they show exceedances of turbidity, temperature, and pH standards (Lewis et al. 2019, Lewis 2018, Lewis 2016, CEDEN).

WBP Page 15 discusses that there has been some recovery, but a large amount of sediment is still being mobilized into the mainstem of Battle Creek, which is in a "likely altered" condition. (A significant downstream effect.)

WBP Page 16 states: Digger Creek has "the highest estimated rates of sediment delivery" and "The greatest sediment delivery contributions are spread throughout the mid to upper elevations" which encompasses the large contiguous block of timberland detailed in Figures 1 and 2. This plan is an additive factor to the past effects. This is another significant effect which is completely ignored within the Powerhouse logging plan.

WBP Page 19 states: Rhyolitic soils within the Ponderosa fire footprint are confined to Northern slopes of the South Fork Battle Creek watershed (lower South Fork and Panther Creek HUC 12's) and the Digger Creek watershed. Terraqua (2018) concluded that wildfire, wildfire prevention measures (fire lines) timber harvest activities, and roads have all

#15 contributed to the initiation of landslides in recent years. This is another significant effect which is completely ignored within the Powerhouse logging plan.

WBP Page 24 states "Areas within the Upper and Lower South Fork Battle Creek, Panther Creek, and Digger Creek indicate the highest relative sensitivity to combined factors of erodibility, landslide potential, and chronic road sediment delivery." (A significant effect.)

Our water quality data has been reviewed by 6 hydrologists, as well as the monitoring coordinator at the State Water Board (BCA QAPP 2019). The Battle Creek Watershed Based Plan document reinforces our water quality data findings and research paper (Lewis et al. 2019), and is additional evidence of the concerns we have been raising for years regarding the significant impacts which are occurring. This plan excludes our recent research paper, the Watershed Based Plan, and the other documents that speak of the ongoing declines in the watershed. Most of the declines are occurring downstream of this proposed project (Battle Creek Watershed Conservancy 2019, Bottaro 2019, Lewis et al. 2019).

There is a new example of SPI's evasion of relevant information regarding the Battle Creek watershed added to this logging plan, as follows:

Plan page 216-217 SPI has inserted an erroneous paragraph into this plan on these pages regarding the Lewis et al. research paper that was published online in 2018 and in the scientific journal "Environmental Management" in 2019. This paper analyzed BCA's water data that began being collected in 2009. We provided evidence to Cal Fire and asked for the paragraph to be removed, but Cal Fire refused (Battle Creek Alliance "Erroneous paragraph in THP letter (2020)" and Cal Fire Ramaley "Erroneous paragraph email, (2020)".) The inclusion of this paragraph in this logging plan is another attempt by SPI to invalidate evidence that demonstrates their ongoing practices have significant adverse effects. Cal Fire's acceptance of it is an extension of their past practices which have continuously evaded their responsibility to uphold environmental laws which would serve to maintain and protect functional ecosystems and safeguard the public trust.

Technical Rule addendum No. 2 states under Section C "Identification of Information Sources" that Records Examined can include "k. Relevant watershed or wildlife studies (published or unpublished)". As we detail later, this plan includes many references to information from far away from this plan's area. Yet, it includes no references to the
#16 documents which are actually about the area within, adjacent, and downstream of the Upper Digger Creek planning watershed that detail significant adverse impacts occurring. This is materially misleading and insufficient for an informed decision making process.

The following figures (Figures 3 to 7) demonstrate the progression of what the evasive practices of SPI and Cal Fire have done to the Battle Creek watershed since the 1996 SNEP report was released, the report which SPI has deceptively cited as supporting their practices.

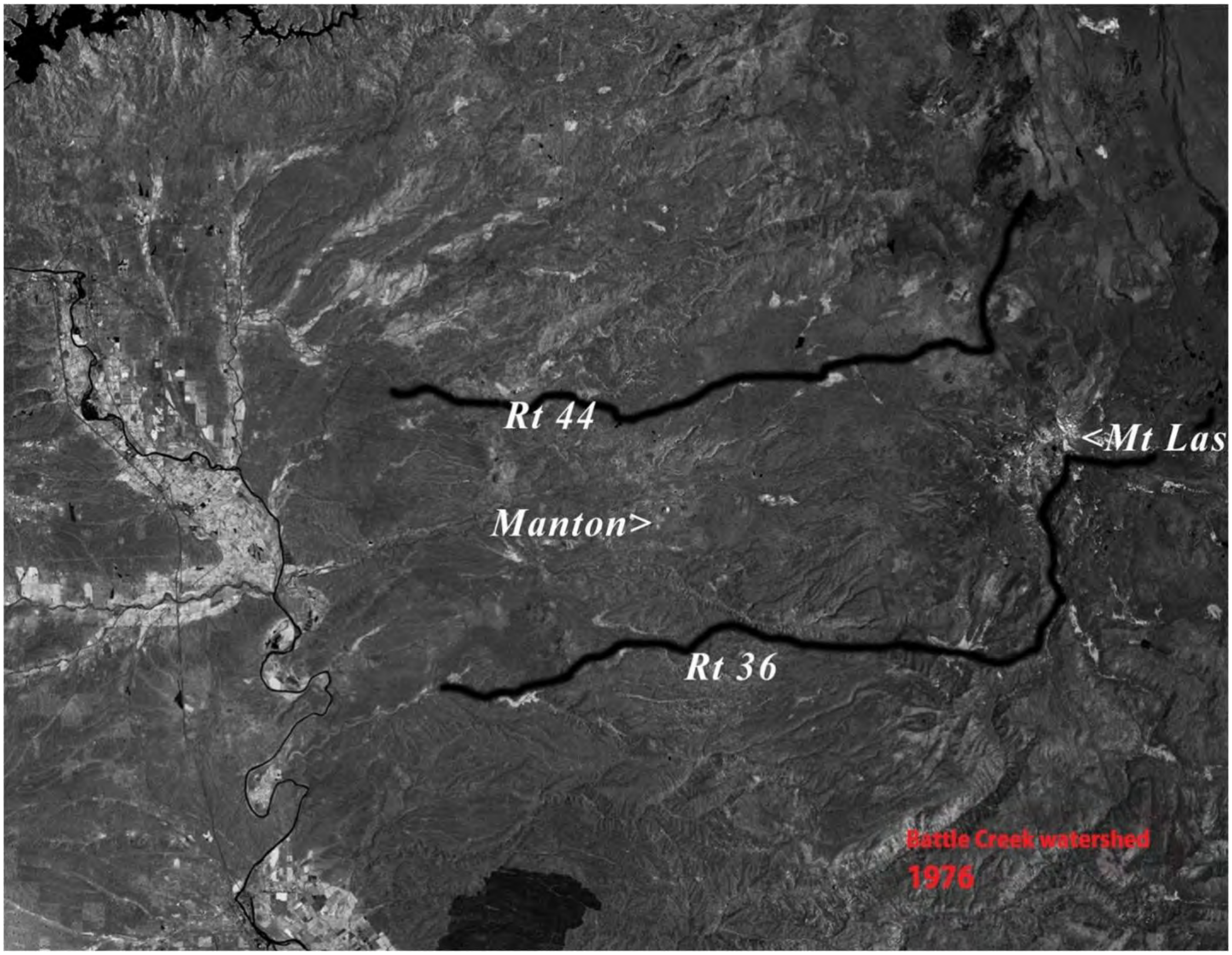

Figure 3. Battle Creek watershed in 1976. Hwy 44 and 36 are the approximate boundaries of the watershed.

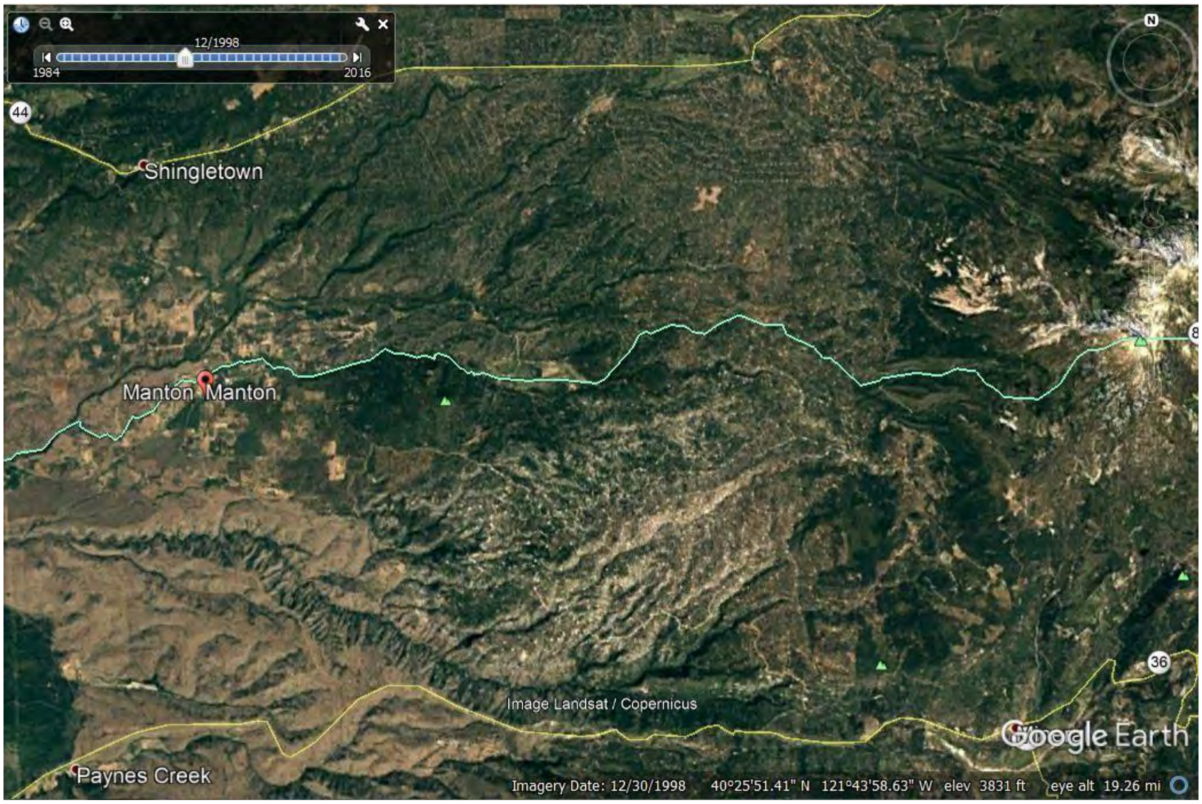

Figure 4. Battle Creek watershed in 1998, before the clearcuts began to appear. The blue line is Digger Creek, the boundary between Shasta and Tehama counties.

Figure 5. Battle Creek watershed in 2004. The brown holes which are ~20 acre clearcuts began to appear.

Figure 6. Battle Creek watershed in 2012, before the Ponderosa Fire.

Figure 7. Battle Creek watershed in 2017 with 2012 Ponderosa Fire imprint. 2017 is the most recent Google Earth image available.

All of the plans shown in Figures 3 through 7 were submitted and approved as having no significant, adverse impacts. None of the plans included one measurement taken of downstream water quality, or populations of plants, birds, animals, amphibians, and fish, or changes in climate.

Page 169 of the plan writes that "The assessment area was chosen because this [planning] watershed is of sufficient size to analyze cumulative biological and hydrological effects..."

This is an incomplete and misleading portrayal of how fluvial systems work. Water quality impacts do accumulate in the planning watershed watercourses but they do not stay confined there. Sediment moves during large storm events and that is when cumulative impacts become active and move downstream, outside of any smaller planning watershed. Our Citizen's Water Quality Monitoring Project has found evidence of this for over 10 years now. "*The data reveal strong associations of turbidity with the proportion of area harvested in watersheds draining to the measurement sites.*" (Lewis 2019, Figure 8.) There is more discussion of our evidence, and other entities' evidence, in our reference documents which have been supplied to the Cal Fire office. Our reference file is incorporated by reference into this comment. Some documents mention the data gaps which exist. This is a problem, but does not mean that this plan which has no evidence in it to prove anything it asserts, should be approved. BCA is a small, little-funded organization and cannot perform the large studies that cost hundreds of thousands of dollars that many reports have recommended. But those large studies have never been carried out, while we have accomplished collecting the data we are able to for over 10 years. Our downstream sites, which are downstream of this plan's planning watershed, show elevated turbidity, temperature, and pH and exceedances of the numerical limits of the Water Board's Basin Plan.

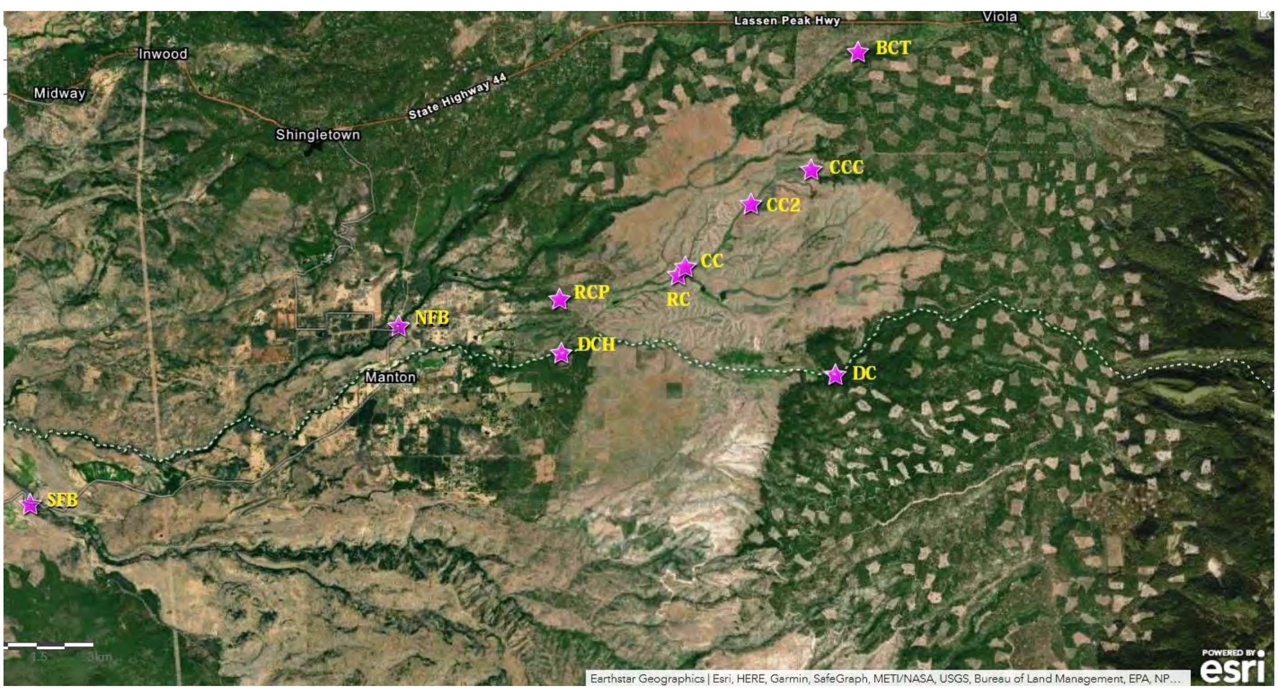

Figure 8. Purple stars mark BCA sampling sites in the Battle Creek watershed where data has been being collected since 2009. Digger Creek (white dotted line) is the boundary between Shasta and Tehama counties in this part of the watershed. SFB= south fork Battle Creek, NFB= north fork Battle Creek, RCP= Rock Creek Ponderosa, DCH= Digger Creek home, DC= Digger Creek, RC= Rock Creek, CC= Canyon Creek, CC2= second Canyon Creek, CCC= Canyon Creek culvert, BCT= Bailey Creek top.

Along with sampling data, we photograph each of our water monitoring sites. Figures 9 to 15 are a few visual comparisons of tributary creeks in Battle Creek watershed. All of our lower downstream monitoring sites have the same physical changes demonstrated in Figures 10, 11, 13, and14.

Figure 9. Above is a photo of our highest elevation site in January 2020, which is on Bailey Creek (BCT). Normally a reference site would be chosen by having no disturbance, but all the sites which are accessible to us have some disturbance. This site has the least. This photo demonstrates how little sand (known as fine sediment) is present, how clear the water is, and how the substrate is composed of loose rocks not embedded by sediment.

Figure 10. This is our Rock Creek (RC) site on the same day in January 2020. Here can be seen the sand (fines) embedding the rocks in the substrate. This site has changed significantly since we began our water quality sampling program in 2009. It used to be similar to the high Bailey Creek site.

Figure 11. This is our north fork Battle Creek site in January 2020. The sandy beach on the edge of the creek that extends into the streambed was not there in the past but has persisted for years now.

Figure 12 . Our upstream Digger Creek (DC) site on Jan. 26th, 2020. (See map figure 8.) This site has less disturbance above it than our DCH site, but is downstream of this potential logging plan. It measured 25.4 NTUs. There was 1.44" of rain that day (CDEC Shingletown station).

Figure 13. Our lower Digger Creek site (DCH) on Jan. 26th, 2020. This site is approximately 4 miles downstream of DC site in Figure 12. It measured 53.5 NTUs, an increase of 111% over the upstream site. Stream turbidity is highly influenced by amount of precipitation and its intensity, hence there is little turbidity if there is little rain. The turbidity levels between sites during heavier precipitation show marked differences in relation to how much logged land there is upstream of a site.

This writer has been wading the creeks since 1989, and personally saw what occurred in the 1997 flood which is discussed in logging plans and other documents. After that flood which cleared the banks of the streams for about 5 feet on each side, the rocks in the streambeds continued to be loose and have very little sand present. The substrate began changing in the mid-2000s as clearcutting upstream became prevalent, and escalated post-Fire and post- tens of thousands of acres of salvage logging that were cut after the fire. (See Figures 3-7.) The physical evidence in the streams shows significant changes have occurred, have persisted, and have not been prevented or mitigated by SPI's practices. The Appendix of Technical Rule Addendum No. 2 covers these effects under A. Watershed Resources, particularly 1.a.: "Sediment-induced CWEs occur when earth materials transported by surface or mass wasting erosion enter a Watercourse or Watercourse system at separate locations and are then combined at a downstream location to produce a change in water quality or channel condition. The eroded materials can originate from the same or different Projects."

#17 There is no evidence in the Powerhouse plan that anyone from SPI or the regulatory agencies spent an appreciable amount of time looking for any of these significant adverse effects downstream of the plan area.

Figure 14. Our south fork Battle Creek site in 2020. Sediment deposition may be seen on the bank in the lower right hand side of the photo. Significant channel modification has also occurred right above the sediment in the form of many more (and larger) boulders than in the past.

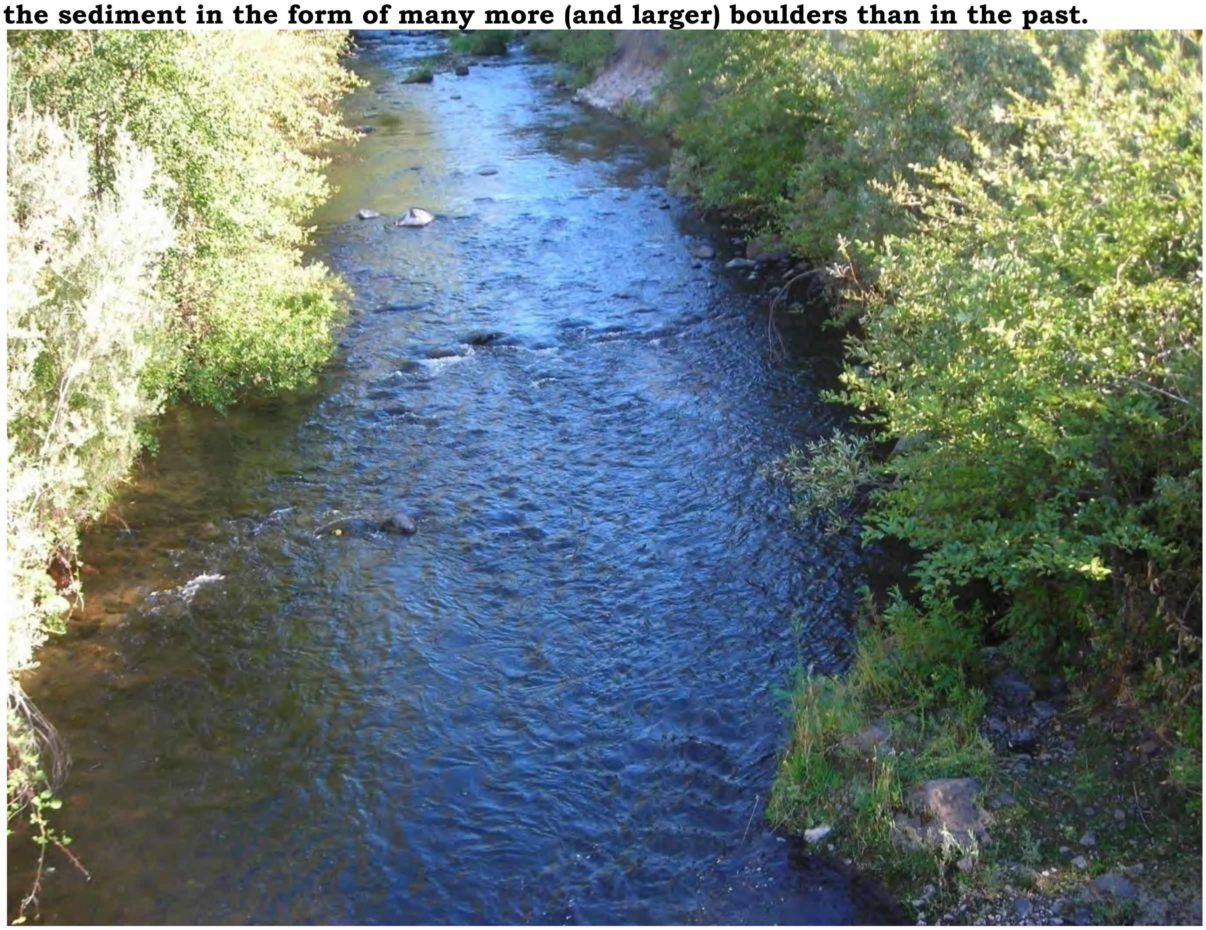

Figure15. Our south fork Battle Creek site in 2013 for comparison to the 2020 photo. There was neither as much prevalent sediment deposition nor channel modification yet.

#18

2. Plan Fails to Assess Cumulative Effects on the Water Cycle

The very foundation of ecosystem health is the water cycle, yet there is no discussion in the plan of the cumulative effects that the vast changes to the landscape are producing.

Removing forest cover opens the land to more solar radiation, producing land degradation effects by drying out the soil more quickly. Logging leaves combustible slash about while drying out the cutover and surrounding area because forests create their own microclimate by releasing water vapor (evapotranspiration). The ongoing practices this plan continues contributes to climate change, produces land degradation, and impacts the water cycle by:

- increasing soil and air temperature (impacts: less rain and humidity→ increased fire danger→ fire leads to more loss of forest cover)
- increasing erosion (impacts: soil loss→ water pollution from point- and non-point sources→ degradation of aquatic habitat→ population loss in aquatic species)
- causing loss of soil fertility from loss of nutrients and organic matter (impacts: less vegetation growth → less evapotranspiration→ less atmospheric moisture transport→ higher, drier air and soil temperatures→ more vegetation death and increased fire probability)

As far as we are aware, there has been no attempt at the local, regional, or state level to prevent or constrain these effects, or to collect factual evidence to determine what effects are occurring. There is no general or site-specific evidence provided in this plan regarding water cycle and climate change cumulative effects from logging, nor has there been in the multitude of past plans Cal Fire has approved.

Lukovic et al. (2021) observes: "Californian hydroclimate is strongly seasonal and prone to severe water shortages. Recent changes in climate trends have induced shifts in seasonality, thus exacerbating droughts, wildfires, and adverse water shortage effects on the environment and economy... We discover that the onset of the rainy season has been progressively delayed since the 1960s, and as a result the precipitation season has become shorter and sharper in California."

Ellison et al. (2017) presents the following figure to illustrate the interconnected function of forests to the water cycle (Figure 16):

#18

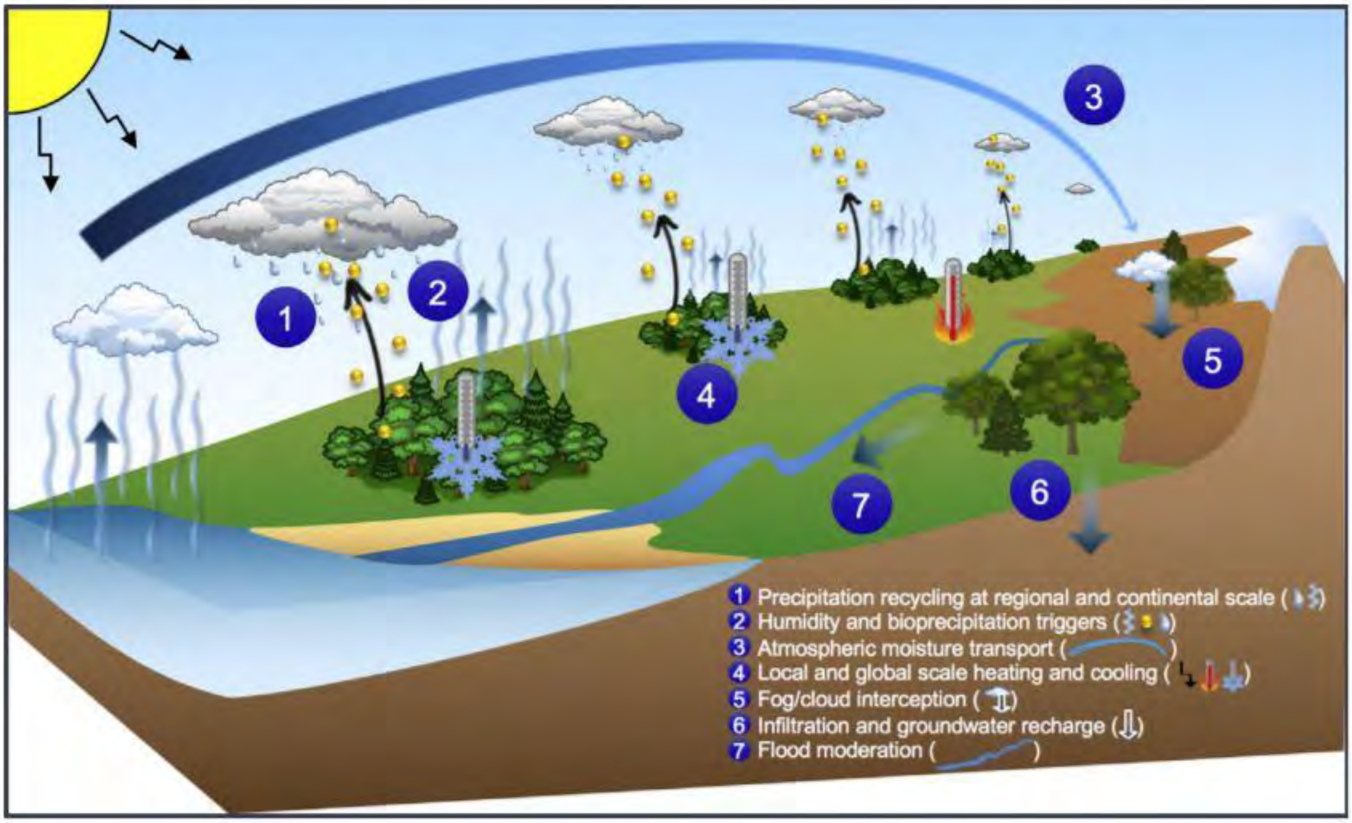

Figure 16. Ellison et al. 2017: "Effects of forests on water and climate at local, regional and continental scales through change in water and energy cycles. (1) Precipitation is recycled by forests and other forms of vegetation and transported across terrestrial surfaces to the other end of continents. (2) Upward fluxes of moisture, volatile organic compounds and microbes from plant surfaces (yellow dots) create precipitation triggers. (3) Forest-driven air pressure patterns may transport atmospheric moisture toward continental interiors. (4) Water fluxes cool temperatures and produce clouds that deflect additional radiation from terrestrial surfaces. (5) Fog and cloud interception by trees draws additional moisture out of the atmosphere. (6) Infiltration and groundwater recharge can be facilitated by trees. (7) All of the above processes naturally disperse water, thereby moderating floods."

Ellison further explains: "By evapotranspiring, trees recharge atmospheric moisture, contributing to rainfall locally and in distant locations. Cooling is explicitly embedded in the capacity of trees to capture and redistribute the sun's energy (Pokorný et al., 2010). Further, trees' microbial flora and biogenic volatile organic compounds can directly promote rainfall. Trees enhance soil infiltration and, under suitable conditions, improve groundwater recharge. Precipitation filtered through forested catchments delivers purified ground and surface water (Calder, 2005; Neary et al., 2009)."

Pokorny et al. (2010) wrote: "Ecosystems use solar energy for self-organisation and cool themselves by exporting entropy to the atmosphere as heat. These energy transformations are achieved through evapotranspiration, with plants as 'heat valves'... While global warming is commonly attributed to atmospheric CO2, the research shows water vapour has a concentration two orders of magnitude higher than other greenhouse gases. It is critical that landscape management protects the hydrological cycle with its capacity for dissipation of incoming solar energy."

This plan fails to provide any assessment or mitigation for these ongoing cumulative impacts that affect lives locally, regionally, nationally, and internationally. Barnosky et al.

#18

2012 wrote of these problems: "Localized ecological systems are known to shift abruptly and irreversibly from one state to another when they are forced across critical thresholds. Here we review evidence that the global ecosystem as a whole can react in the same way and is approaching a planetary-scale critical transition as a result of human influence. The plausibility of a planetary-scale 'tipping point' highlights the need to improve biological forecasting by detecting early warning signs of critical transitions on global as well as local scales, and by detecting feedbacks that promote such transitions. It is also necessary to address root causes of how humans are forcing biological changes."

There are many studies available throughout science that pertain to these effects. The availability of science that documents well-understood processes within the water cycle makes the absence of any discussion or consideration of the cumulative effects that this plan increases even more disturbing.(Some Battle Creek specific documents that include cumulative impacts aspects are: Kier 2003, Kier 2009, Myers 2012, Henkle 2016, Pacific Watershed Associates 2017/2018, Lewis 2019, Battle Creek Watershed Conservancy 2019.)

Battle Creek watershed is part of California's Mediterranean climate, defined as consisting of hot, dry summers and cool wet winters. The disruption from ongoing climate change, coupled with the loss of thousands to millions of acres of canopy cover, has produced lengthier hot and dry seasons and fire seasons both here and in California in general, as documented in Williams et al. 2019, and Williams et al. 2020. There is less snow than in the past. Droughts and low water years have been more frequent and extreme in the first 20 years of the 21st century, yet there is no mention in this plan, or past plans, of how intricately linked forests are with the water cycle (Fischer et al. 2014,EPA 2017, Vose et al. 2017, Cook 2018, CDEC 2004-2020).

#19 On page 169, the plan lists the precipitation average as 50". The CDEC station in Shingletown, situated near Highway 44 adjacent to SPI's land, has precipitation data beginning in 2004. As may be seen in the file BCA submitted, "CDEC 2004-2020", the average has been below that. Eight of the years each had less than 40" of rain with an average of 35". The 2019-2020 water year had only 33.64" of rain, with 17.84" by Feb. 15th, 2020, even though there was no rain at all in February. As of Feb. 15th, 2021 there has only been 15.49" of rain. It appears this water year will be another dry year in the ongoing sequence, which this plan fails to acknowledge or address as an important cumulative impact aspect. Ludovic et al. (2021) discuss ongoing weather pattern alterations in California and show a later and shorter rainy season.

#20 Figure 17 is a graph of the flow (cfs) at the CDEC Battle Creek station which covers 2011 to March 1st, 2021. It illustrates the lack of water in 2020 and currently in 2021. The creek levels have rarely been above summer level flows from June 2019 to currently in 2021. Our comments on the 2017 Artemis logging plan and the 2019 Rio Gatito plan both contain additional graphs which document water temperature increases as well. (See also Lewis 2016, " An Analysis of Water Temperature and the Influences of Wildfire and Salvage Logging in the Battle Creek Watershed, northern California.")

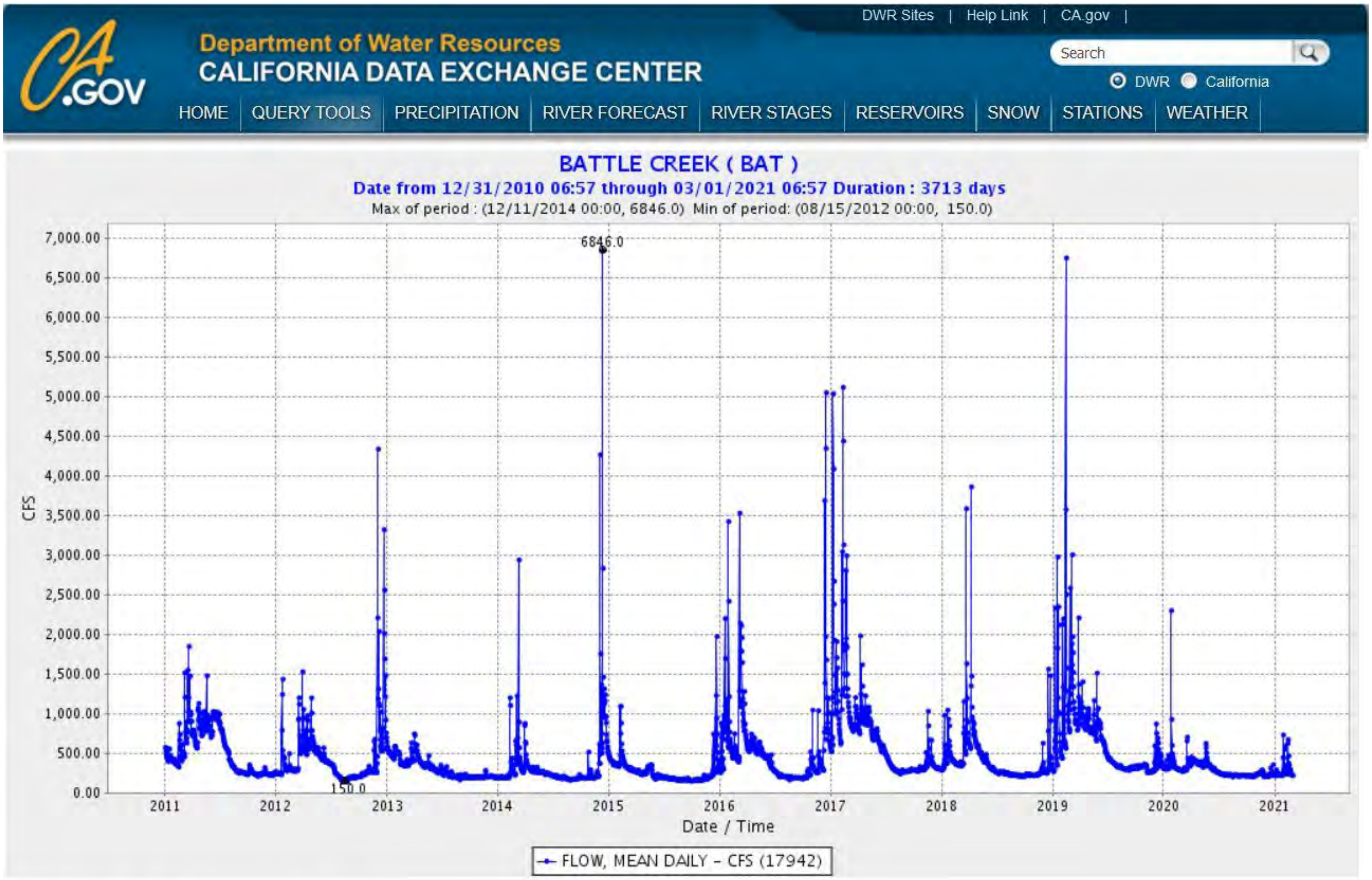

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Figure 17 . The mean daily flow at the CDEC Battle Creek station from 2011 to March 1st 2021, downstream of this plan. The creek levels have rarely been above summer level flows between June 2019 and March 2021.

#21

<u>Beginning on page 301 </u>SPI presents maps of the area of this logging plan. As has been SPI's consistently misleading practice for years, the maps show only the proposed units and show none of the past logging that abuts them. This practice is another attempt to circumvent environmental protection laws by providing only insufficient and misleading information.

The map in Figure 18 is an honest example of what the ground conditions are in reality. Some of the proposed units of this plan, colored orange, abut past logged areas (Willow Spring and Digger THPs), essentially creating solidly logged areas of hundreds of acres. This combination of more logged units added to existing ones create larger places in the landscape with the significant adverse effects associated with water cycle disruption, habitat fragmentation, higher heat and less humidity, and homogenous and flammable ponderosa pine tree plantations.

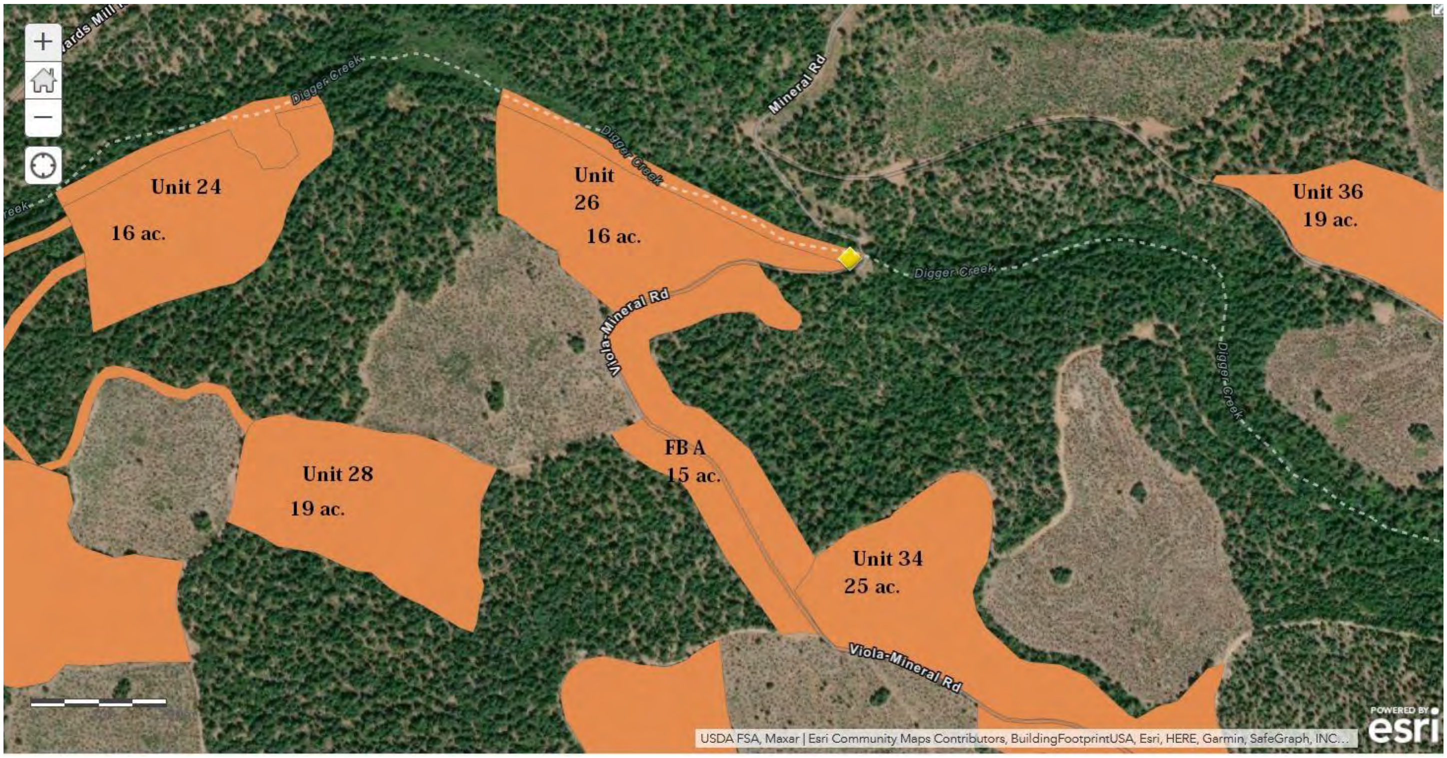

Figure 18. Some of the proposed units of this plan (in orange), abutting past units from the Willow Spring THP. These adjoining units from past plans are not shown on the plan's maps.

Figure 19 is a map of the same area that the plan provides on page 301. Providing maps that do not disclose past logging has been SPI's practice in past plans and is continued in this plan. The reality of the ground conditions is deceptively misrepresented in this plan, subsequently failing to provide a factual representation of cumulative impacts.

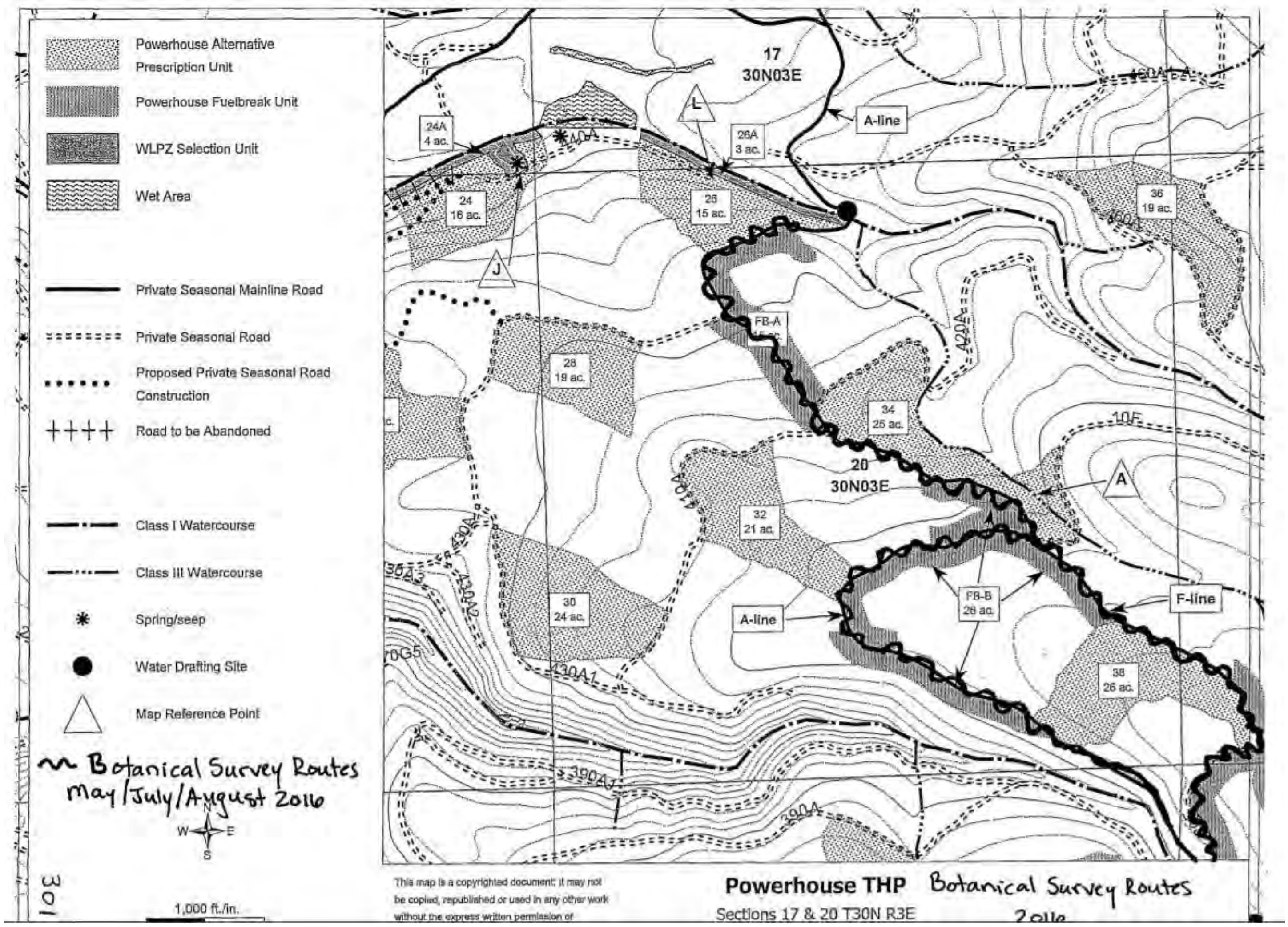

Figure 19. One of this plan's maps which fails to disclose past logging which is adjacent to the proposed units. This has been the common practice in past plans also.

Figure 20 shows the Rio Gatito logging plan (approved in April 2020) in red and this additional proposed plan in orange. Page 216 of this plan dismisses the Rio Gatito plan as being "a mile away" as if downstream cumulative impacts are defined by a distance. They are not. Both of these plans drain to tributaries of Battle Creek and both are upstream of planning watersheds that are designated as "Threatened and Impaired/Anadromous Salmonid Protection".

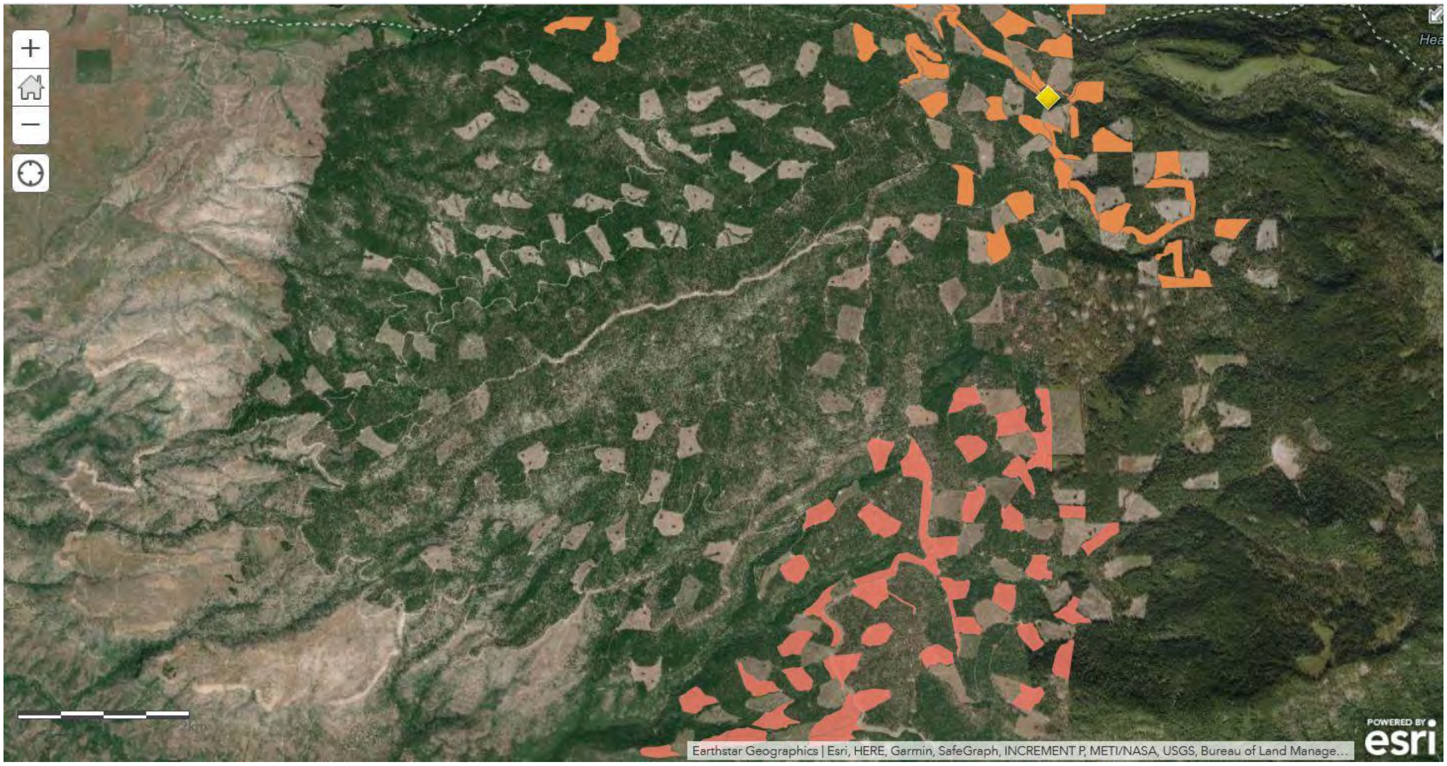

Figure 20. Some of the Powerhouse units are shown in orange. Red units are the Rio Gatito plan, approved in April 2020. The Rio Gatito plan was approved as having "no significant effects"; every single past plan has been approved as having no adverse impacts.

3. Cumulative Watershed Impacts Must Include Analysis of Past Logging Effects

Statistical hydrologist Jack Lewis wrote an expert opinion letter in 2018 regarding the earlier submission of this plan and known cumulative watershed impacts. He stated: "Processes linking clearcutting to surface erosion and changes in turbidity include (1) destruction of herbaceous cover, (2) exposure of bare soils to raindrop impacts, (2) compaction and destruction of soil structure, (3) reduced infiltration, (4) delayed revegetation from herbicides, (5) increased overland flow leading to sheet erosion, rilling and gullying, (6) delivery of augmented overland and subsurface flows to erodible road cutbanks, (7) erosion of roadside ditches from increased surface runoff, (8) reduced evapotranspiration augmenting subsurface flows, (9) erosion of subsurface pipes, (10) loss of soil cohesion due to reduction in the subsurface root network, (11) increased blowdown and rootwad upheaval in the WLPZ (12) heavy logging equipment and increased truck traffic, especially during wet conditions, (13) expansion of the road network to facilitate timber access and hauling, (14) mass wasting of roads and hillslopes due to augmented pore water pressures, (15) culvert failures due to increased debris-laden runoff. No amount of care in executing a THP can eliminate all these processes. The data suggest that past salvage logging as well as clearcutting, which has become routine practice in the area, has impacted turbidity in Digger Creek and other Battle Creek tributaries."

Lewis wrote of further linkages regarding water temperature: "Recognizing the current highly impaired condition, no project should be approved that could reasonably add to those effects. While it is difficult to quantify, there can be little doubt that more clearcutting will add to those effects...

Temperatures high enough to eliminate all salmonids (>22-24°C) are now common during the summer in lower Digger Creek as well as in nearby Rock Creek, Canyon Creek, and the South Fork of Battle Creek. All of these overheated streams create a cumulative impact on the main stem of Battle Creek. Harvesting with riparian buffers should moderate stream temperature increases and changes to riparian microclimate, but substantial

#22

warming has nevertheless been observed in many studies of harvesting near streams with both unthinned and partial retention buffers (Moore et al., 2005).
Forest harvesting increases advection and sensible heat exchange from clearings to the riparian zone, and conduction between stream water and nearby soils or substrates also may be an important factor (Johnson and Jones, 2000)".

This resubmitted logging plan continues to ignore the cumulative watershed impacts from past logging and addresses none of the impacts Mr. Lewis outlined in his letter. This has been SPI's ongoing practice which Cal Fire has approved for years, as demonstrated in the past plans and our comments (see: SPI logging plans, BCA comments, and Cal Fire's Official Responses to plans: 2-06-173 Lookout, 2-08-052 Bailey's, 2-08-097 Long Ridge, 2-09-027 Plateau Flat, 2-10-003 Dry Gulch, 2-10-034 Grace, 2-10-067 Blue Ridge, 2-12-026 Reynolds Flat, 2-12-031 Hendrickson-Defiance, 2-18-055 Graceland, 2-19-00180 Rio Gatito).

#23 *4. No Factual Evidence Provided for Stream Channel Conditions*

<u>Plan pages 210-212 Section C "Current Stream Channel Conditions"</u>

Here the plan answers questions regarding the "beneficial uses of water" by stating there are no impacts without offering any factual evidence. The plan conspicuously stays silent regarding cumulative impacts to the downstream waters. There is no mention of Battle Creek specific documents such as Kier 2003, Kier 2009, Myers 2012, Henkle 2016, Pacific Watershed Associates 2017/2018, Lewis 2019, Battle Creek Watershed Conservancy 2019, which all detail impacts throughout the watershed.

The plan offers a table (page 211) rating "Stream Inventory Segments" but as we have stressed in past comments, there is no factual detail of where the survey was performed, who performed the survey, what their training is, what stream length was surveyed, or what measurements were taken that the ratings were based on. Without such supporting information, the ratings given to the stream segments are meaningless subjective opinion.

The stream segments are listed as North and South Fork Digger Creek. No description is given as to where they lie in relation to the level of disturbance; no map is given. The potential logging units 26 and 66 the segments are listed as near made it possible for us to use the unit maps in the plan to create a map of where the stream segments were that were listed as having "none" or "slight" effects and "good" ratings. (Plan maps for Units 26 and 66, listed with the table, are on page 301 and 318 of the plan.) As may be seen on the maps, Figures 21-22, the stream segments for the survey were mostly, or completely, above any of the logging disturbance, just downstream of the edge of Lassen National Forest, which has suffered very little disturbance. That means the segments are likely to be the cleanest, least-impacted segments that could be found and are not representative of effects occurring in downstream reaches.

The use of two stream segments from the highest upstream portion of SPI's ownership in the watershed, coupled with them being on the edge of Lassen National Forest's undisturbed land, is not even vaguely representative of what is occurring in downstream stream reaches. It is insufficient and misleading information. It fails to provide the honest and adequate evidence needed to prove there are no significant impacts occurring already or with the addition of this plan.

The use of the cleanest upstream sites, and the omission of any downstream sites, does not uphold CEQA's rules regarding cumulative impacts analysis or prevention. The only usefulness of the highest upstream and cleanest sites is to determine a baseline that the lower, more impacted streams could be measured against to fully understand what significant impacts are occurring. Unfortunately though, the Tables on page 211 of the plan are not even really serviceable for that purpose because they offer only subjective one word rating opinions from an undisclosed person(s), instead of numerical measurements by a person known to be trained in hydrology.

- The stream ratings in this plan are the subjective, ocular opinions of a person(s) with unknown training, observed in the least damaged, upstream portion of the land. This person is in the employ of the company with vested economic interests in maintaining the fallacy that their practices have no adverse impacts. This is a wholly inadequate assessment of what downstream impacts are occurring due to the long-term practices that have been approved by Cal Fire. These practices are not providing the environmental protections encoded in the laws.

Figure 21. A closer view of where the stream segments listed on page 211 of the plan are, in relation to past disturbance. The segments are marked with yellow diamonds. The smaller brown holes are ~20 acre units logged by past logging plans. The large brown area on the left is part of the area of the 2012 Ponderosa Fire. The white dotted line is Digger Creek, which is the border between Shasta and Tehama counties. Streamflow is from east (right) to west (left).

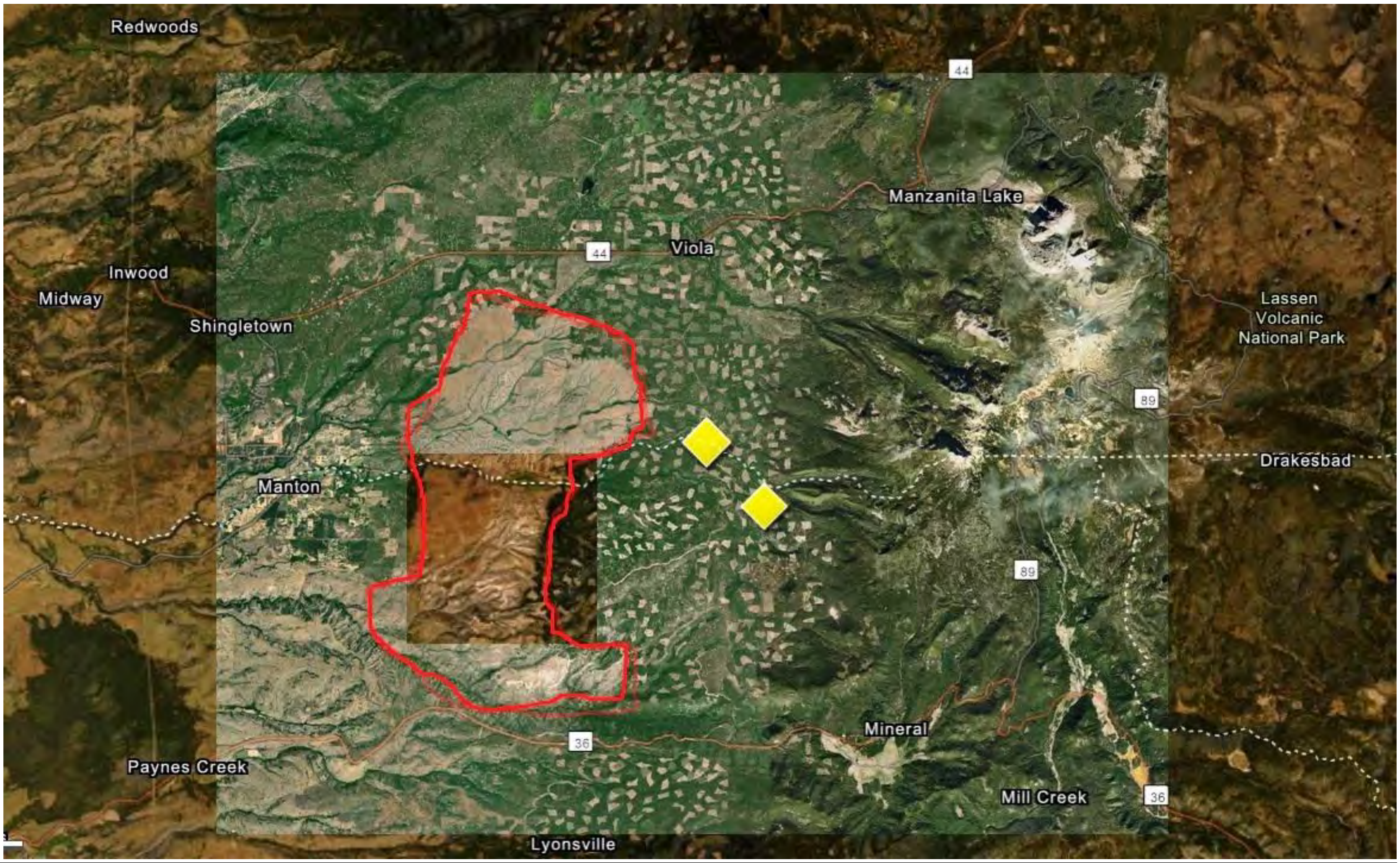

Figure 22. A more distant view of the Digger Creek surveyed stream segments (marked with yellow diamonds). The small brown holes are ~20 acre logged units from past plans, the red outline approximates where the 2012 Ponderosa fire burned and was logged. The border of Lassen National Forest is where the logged units stop, to the right of center in the map.

#24

5. Logging-Road Density Harms the Habitat and Increases Sediment in the Watershed

Page 228 and 251 of the plan address road density.

The previous submittal of this plan, the 2017 Artemis THP, stated the density of roads was 1.95 miles per square mile. When GIS specialist Curt Bradley mapped the road density it was actually an average of ~7 miles per square mile with some sections containing 8, 9 or 11 miles of roads per square mile (Bradley 2018, Figure 23). Page 228 of this plan states that the road density is 1.93 km/per sq. km. It isn't. Page 251 of the plan rates the road density of the plan area as "moderate". There is no science which supports such high road density as "moderate" (e.g. Trombulak 2000, Kier 2009).

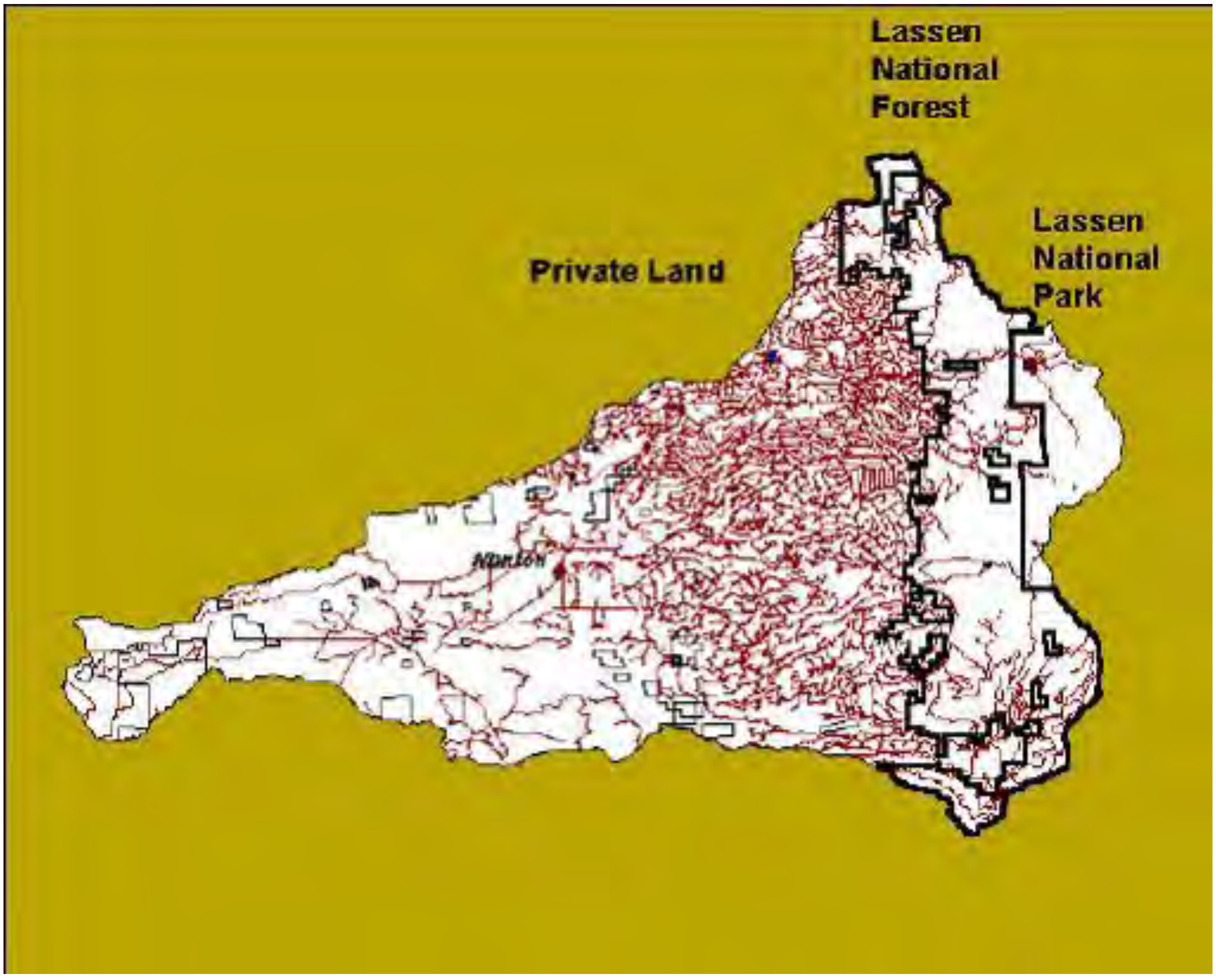

Figure 23. Road density. Red lines are roads, the majority in the industrial timberland, plotted in Kier 2003.

Road density and the heavy equipment use of roads during logging are a significant source of sediment in waterways (Lewis et al. 2019 e.g. "the effects of roads and harvesting are not only statistically confounded, but interact in ways that are not physically separable: much of the road erosion is induced by harvesting activities"). Road density also has significant impacts on terrestrial and aquatic lifeforms (SNEP 1996, Trombulak 2000). There is no description of how the number of km/miles per square km/mile in this plan was arrived at, or why this plan is using square kilometers for maps with sections that are in delineated in square miles. GIS Specialist Curt Bradley calculated the number of miles by section in the plan using the plan's maps. A logging plan is supposed to serve the same function as an EIR. With such blatant disregard for accuracy, the rules and laws are not being upheld. The requirement that the THP contain sufficient information is not being met.

Trombulak et al. (2000) was published in "Conservation Biology" and reviews 179 papers published regarding road density. The authors detail "seven general ways roads of all kinds affect terrestrial and aquatic ecosystems" and write "Numerous studies have demonstrated declines in stream health associated with roads...

#24

...Roads are often built into areas to promote logging, agriculture, mining, and development of homes or industrial or commercial projects. Such changes in land cover and land and water use result in major and persistent effects on the native flora and fauna of terrestrial... and freshwater ecosystems..."

SNEP Vol. I, Chapter 8 (1996) details road-related problems, while also addressing the decline of aquatic species, cumulative factors, the importance of the channel network and watershed upstream to aquatic health, and the lack of range-wide monitoring. These are all problems we have written of in past comments, which SPI and Cal Fire practices have ignored, and continue to ignore in this plan.

"The decline of native fishes and amphibians and changes in aquatic invertebrate assemblages in the Sierra Nevada largely reflect the deterioration of aquatic and riparian habitats. They have been altered by development of water and other resources. Of sixty-seven types of aquatic habitat categorized in the Sierra Nevada, almost two-thirds (64%) are declining in quality and abundance, and many are at risk of disappearing altogether. Factors contributing to this deterioration are many and cumulative. The health of any part of an aquatic system depends on all the influences of the channel network and watershed upstream of that point. In spite of better landuse practices, excessive sedimentation continues to be observed and documented in site-specific analyses, even though systematic, rangewide monitoring is lacking. Implementation of newer practices designed to prevent sedimentation (practices officially designated as best management practices under the federal Clean Water Act) may be too recent for positive results to be observed in some systems. But the close association between roads and sedimentation and the pervasive nature of roads within the streamside corridor mean that chronic problems may be persistent and difficult to overcome" (SNEP V I, Chap 8).

D. Plan is Missing Quantitative Data of Cumulative Impacts on Wildlife Habitat

#25 According to the Timber Harvest Review Team's pre-harvest inspection report, CDFW (CA Dept. of Fish & Wildlife) did not attend the inspection or make any comments regarding this plan. In other words, the regulatory agency responsible for wildlife and other biological resources has provided no review of this plan. SPI has provided no quantitative data regarding cumulative impacts on wildlife populations in their chosen small planning watershed assessment area, or downstream of that area. Consequently, there is no valid, factual evidence in this plan. Since there is no site-specific data for this plan, we can only refer to studies outside of the area which address habitat fragmentation, climate change impacts, and population declines, such as Barnosky et al. 2012, Bottaro 2019, Bull et al. 1997, Bury 2006, CA Senate Office of Research 2002, California Trout 2017, Carter 2005, Ceballos et al. 2020, Endangered Species Coalition Report 2011, Franklin 1993, Gil-Tena 2007, Graber 1996, Haddad et al. 2015, Hagar 2007, Hicks 1991, Intergovernmental Panel on Climate Change 2019 (a) and 2019 (b), IPBES 2019, Jules 1998, Karr et al. 2004, Karraker 2006, Katz 2012, Klein 2008, Leemans 2004, Magurran 2010, Marchetti 2010, Moriarty 2011, Noss 1990, Payer 1999, Pimentel 1992(a), Reeves et al. 1993, Rosenberg et al. 2019, Sauter 2010, Schultz 2010, Simon 1980, Soga 2018, Thompson 2011, Torras 2008, Trombulak 2000, Welsh 2011, Wilson 1989.

- If Cal Fire approves this plan as having no significant adverse cumulative impacts, as is their standard practice, the approval will be based on inadequate review by CDFW and a lack of substantive facts regarding both the planning watershed impacts, and the impacts downstream of the project.

Plan pages 144-147 presents many figures ostensibly showing that wildlife species are able to utilize SPI's land. However, the data was collected from 1990 to 2007, before their lands had been clearcut as extensively as now, and before the extremes of climate change that have become increasingly worse since 1990 to 2007. The plan speaks of the plots that were used, but there is not one description of where the sites were or what place on SPI's land the numbers came from, what condition the forest was in (cut or uncut), not even the county(s) the plots were in is mentioned.SPI owns 1.76 million acres in California over a number of counties. The total lack of any kind of specificity to the information makes it completely worthless for determining significant adverse impacts to wildlife populations and habitat. It is not site-specific to the area of this plan and provides no evidence regarding this plan. This ongoing non-information is rife throughout SPI's past logging plans as well as this one and is being used to camouflage the adverse cumulative impacts increasing over time due to their practices.

The unspecified place, time, and habitat SPI tables copied and pasted into this plan list martens as one of the species the counts are supposed to cover. Moriarty (2014) studied "Habitat Use and Movement Behavior of Pacific Marten (Martes caurina) in Response to Forest Management Practices in Lassen National Forest, California." This study was east/upstream of SPI's land in the Battle Creek watershed, on the significantly less disturbed national forest land (e.g. Figure 22). Martens are considered an indicator species due to their sensitivity to habitat loss and fragmentation from loss of forest cover. This study found that martens avoid simplified stands to some extent and avoid openings as much as possible. Other studies from different locations also drew these conclusions and found large population decreases associated with higher levels of logging (Moriarty 2011). Martens hunt and forage within forests and along their edges. They avoid open areas; most literature specifically mentions clearcuts as places that marten avoid, e.g. “Martens avoid large openings such as clear-cuttings, and if an area is cut over or severely burned, it is of little value to them for about 15 years” (Clark et al. 1987; see also Moriarty et al. 2011; Bull and Heater, 2001; Thompson and Colgan, 1999; Payer and Harrison, 1999, Fredrickson 1990.) This plan does not address, or even acknowledge, the known significant adverse effects of habitat loss and fragmentation on wildlife species. This plan continues SPI's practice of cutting and pasting generic information regarding species such as the marten in it, as if such repetition of vague verbiage means something to a robust and defensible cumulative impacts assessment. It doesn't.

Because there is no evidence provided in this logging plan or by CDFW regarding actual existing species health in the planning watershed, we must fall back on scientific discovery from a broader area. The 2019 paper "Decline of the North American Avifauna" (Rosenberg et al.) documents a huge loss of birds, including common ones, throughout the U.S. and Canada. The paper's one sentence summary is "Cumulative loss of nearly three billion birds since 1970, across most North American biomes, signals a pervasive and ongoing avifaunal crisis." While we expect Cal Fire will dismiss this, as is their practice with our submissions from outside the planning watershed, we do not believe that the Battle Creek area, or the planning

#25

watershed in this plan, is immune to the high loss this study finds. For one example, when this writer moved to the Battle Creek watershed in 1989 she often saw red-winged blackbirds (*agelaius phoeniceus*) within and below the timberland before it was sold to SPI. Over the years, as the immense landscape change occurred incrementally in the 75,000+ acre block of logged land, she saw fewer and fewer. Now, it's rare to see even one individual. No one is even looking for these losses in the less iconic species here. This plan is certainly not even attempting to provide any factual evidence about species population decline.

We submitted additional evidence regarding bird issues throughout the logged land within Battle Creek with our comments on the earlier submission of this plan (Artemis) and the Rio Gatito plan. The evidence and questions were ignored.

#26

<u>Page 147 Habitat Distribution Change over time graph</u>

This is another copied and pasted generalized graph that has been in SPI plans for years. It is a graph based on SPI's Option A ("Sierra Pacific Option A Demonstration of Maximum Sustained Yield for each Forest district in California, 1999", listed on page 173 of the plan.) SPI's Option A was filed in 1999, is a brief 32 pages, and is broadly about all their land and has never been updated to acknowledge changing or diverse conditions. This document is based on SPI's projections for the next 100 years (from 1999) yet has not one word about climate change or the associated higher fire risk and droughts or species loss in it. It is pure speculation based on information collected in the 20th century which scientists say was much wetter than most of California's history e.g.: Carle, 2004 "The twentieth century was not "normal" when compared to this longer record; it was, in fact, California's third- or fourth-wettest century of the past 4,000 years...Since statehood, Californians have been living in the best of climate times. And we've taken advantage of these best of times by building the most colossal urban and agricultural infrastructure in the entire world, all dependent on huge amounts of water, and all based on the assumption that runoff from the Sierra Nevada will continue as it has during the past 150 years." and Ingram 2013: "Engineered water management was an aid to building a large, modern society in the West during what is now understood to have been a century of benign, moderately wet times...Now, in the twenty-first century, there is evidence that this brief time of climate stability is slipping away, and we are entering a period of drier and more erratic conditions."

The graph in this plan provides no factual evidence that SPI's land will ever become large tree habitat and is based on past history rather than the increasingly alarming projections of present and future climate instability. Even with its rosy speculative projections for 60 years from 1999 when the graph begins to show large tree habitat increasing, the graph shows the majority of the habitat being "Small Tree" for the ~60 years between 1999 and 2060, and that is based on pre-climate change data. Figure 24 shows how hot and dry California has been for the 20+ years since SPI's Option A was submitted and is clear evidence that SPI's projections are only meaningless speculations rather than factual representations of what may occur in future decades. These speculations do not provide solid evidence that no adverse impacts have occurred or will continue to occur.

#26

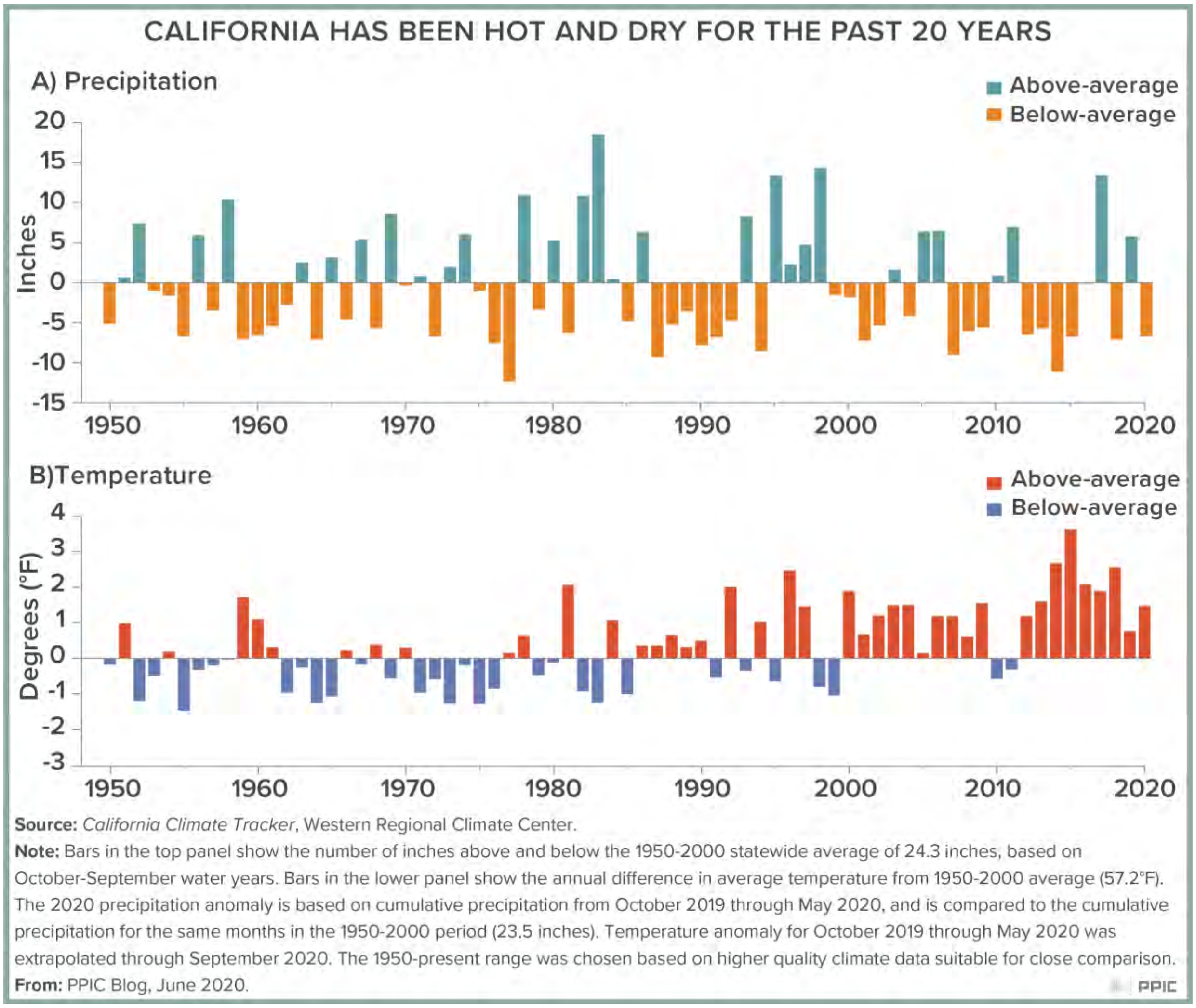

Figure 24. Hotter, drier conditions for the past 20 years, which affect wildlife, plants, fire probability and behavior. This plan ignores climate change, as have past plans and approvals.

#27

E. Wildfire Risk and Hazard are Not Mitigated in Powerhouse Plan

One of the citations which has been copied and pasted for years into SPI's THPs, and is also included in this plan, is the 1996 Weatherspoon paper entitled "Fire-Silviculture Relationships in Sierra Forests". Our review discovered that there is nothing in this paper that supports the removal of such a large area of canopy cover in the brief timeframe it has occurred in. In fact, the author states "Although even-aged [clearcutting] cutting methods are discussed briefly, this chapter emphasizes methods other than even-aged ones because (1) they more closely mimic the natural disturbance regimes prevailing in most Sierra Nevada forests, and (2) any landscape level needs for large, even-aged stands are likely to be met by severe wildfires and subsequent plantation establishment for the foreseeable future." This is the antithesis of SPI's past and present plans which have resulted in the large, contiguous block of the majority of 75,000 acres being turned into ponderosa pine tree plantations.

Regarding fire, Weatherspoon (1996) writes (over 2 decades ago, it must be pointed out, demonstrating this problem was already known) "It is noteworthy that the extensive changes in Sierran forests brought about largely by fire suppression and other human activities over the past 150 years have included a virtual reversal of fire types... Fire type 2 [low intensity, patchy high intensity], historically the dominant fire type in Sierra Nevada forests, has now been virtually eliminated. Conversely, fire types 4 and 5 [high intensity with patchy low, and uniform high intensity respectively], relatively rare historically, now account for a large proportion of wildfire acreage in the Sierra Nevada." Later he writes "even-aged forest stands in the Sierra Nevada were probably relatively uncommon in the pre-settlement era."

Another important finding this paper contains is: "A related but separate concern has to do with changes in microclimate brought about by stand opening. Thinning or otherwise opening a stand allows more solar radiation and wind to reach the forest floor. The net effect, at least during periods of significant fire danger, is usually reduced fuel moisture and increased flammability...The greater the stand opening, the more pronounced the change in microclimate is likely to be." This is a significant cumulative effect which has been ignored, and ties in to the 2012 Ponderosa fire which burned primarily (60+%) on SPI's cut and adjacent acres.

SPI has listed this paper in logging plan references for every plan that we have seen. This older paper does not support SPI's ongoing logging practices at all, regarding either ecosystem services or protection from higher severity fire. The paper does demonstrate SPI's ongoing practices, and Cal Fire's approval of them, are likely contributing to higher fire severity; it also shows that information was known in 1996, long before the landscape level changes were begun in the area of this plan. Fire severity is an additional significant cumulative impact which has been ignored in past plans as well as the current plan. (Figures 25 to 35.)

Fire danger, fire severity, and fire's subsequent water quality effects are significant environmental impacts which are not being acknowledged or mitigated within this THP, or the multitude of THPs in the Battle Creek watershed. Figures 25 to 35 are of other logged areas in the Upper Digger Creek (and surrounding) planning watershed, to demonstrate how slow the recovery process is. These photos are representative of the standard post-logging conditions on SPI land. We have submitted most of these photos before because of our concerns regarding cumulative impacts which are being ignored, but Cal Fire's Official Responses consistently ignore the real land conditions. This THP would be an addition to the significant impacts which already exist.

For additional references and comment, see ecologist Chad Hanson's letter regarding this plan (Hanson 2021).

Figure 25. Part of the 2012 Ponderosa fire area in February 2021, representative of the slowness of recovery, useful habitat loss and decreased diversity of plant species and diverse structure. This photo was taken west of Digger Butte, looking towards the east. Mt. Lassen is in the background. The Powerhouse plan is to the east of this area. Unit 19 from 2006 Lookout plan is marked in red.

Figure 26. Digger Butte area in 2011 pre-fire, when Unit 26 of the Lookout plan was cut. This photo is looking from north to south; the 2021 photo area in Figure 25 is outside the right side of this photo and was forested the same. Red circle marks the former fire lookout tower here and in next Figure.

Figure 27. Digger Butte in 2021. For comparison to Figure 26 the red circle marks where the fire lookout tower was. This area is downstream of the Powerhouse plan and demonstrates how little recovery has occurred.

Figure 28. A closer view of the 2012 fire area in 2021. Note invasive, non-native plants growing here, at higher elevations where they did not occur pre-logging. Mullein (*verbascum thapsus)* **and yellow star-thistle** *(centaurea solstitialis*) **are marked. The appearance of invasive plant species has commonly occurred post-logging throughout the industrial timberland in Battle Creek watershed. Invasive species crowd out the native species, causing more diversity loss.**

Figure 29. 2003 Digger THP, Unit 147, photographed in May, 2008. This plan will cut more nearby.

Figure 30. 2003 Digger THP, Unit 147, photographed 10 years later, April, 2018. Note the pruned, dead limbs left at the base of the single-species plantation trees also. This fire fuel was still present as of August 15th, 2018, at the height of fire season. This is common practice. Before the 2012 Ponderosa Fire, there were many young trees in the future fire area with dead, pruned branches around their bases.

Figure 31. Forward Road dead prunings, 2012 Ponderosa fire area in 2020. Yellow star-thistle in foreground where it didn't used to grow.

Figure 32. Roadside edge of 2003 Digger THP unit photographed in April, 2018. A proposed unit of the earlier 2017 Artemis THP, and now this Powerhouse plan, is adjacent to this in the background.

Figure 33. Another roadside edge of a 2003 Digger THP unit in April, 2018. A proposed unit of the earlier 2017 Artemis THP, and now the current Powerhouse plan, is adjacent to this in the background.

Figure 34. The opposite side of the road, across from the 2003 Digger THP units, and proposed 2017/2020 THP units, photographed in April, 2018. This WLPZ area was bulldozed during the 2012 fire. There is no regeneration or soil stabilization apparent. Pre-fire, there was a seep alongside the road here where we observed a western pond turtle residing. The habitat was destroyed by the bulldozers in 2012 and showed no recovery after 6 years. Post-fire emergency salvage logging is not subject to CEQA mandates, and is ignored in the THP cumulative impacts analysis.

Figure 35. A photo of a 15 year old plantation in SPI's industrial timberland on Ponderosa Way, in the Big Chico Creek area of the 2018 Camp Fire. This photo is from outside of the Battle Creek area, but is representative of SPI's plantations and practices, and is also relevant to any discussion regarding increased fire danger and fire severity.

#28

F. Misleading Documents Included in Plan

As we have written, this plan ignores many of the Battle Creek-specific publications that detail significant cumulative effects. The plan does include a few Battle Creek related documents. Our review finds that the plan omits any reference to details in the documents it cites that speak of significant adverse cumulative effects. Examples of the misleading nature of the documents the plan cites follow.

Example: MSG report in plan page 210 Section B The Watershed Assessment Area paragraphs refer to a Board Of Forestry's Monitoring Study Group (MSG) Report from 2000. The plan writes that this report is still "valid" despite the more than 20 years which have passed since the data was collected and the massive landscape-level changes which have occurred in that time. It's not. (Figures 3 to 7 and Battle Creek Alliance 2015, "Clearcut Nation".)

The MSG report itself states on page 8 that the evaluations of logging plans occurred between 1996 and 1998, and that only 8 of the 150 plans evaluated were in Shasta County.

There are no plans listed as being in Tehama County. There is no map provided of where the plans were. The timeframe is before SPI began logging the Battle Creek watershed extensively. There is no mention of main watersheds or planning watersheds. There is no pertinent detail in that report that is related to a new logging plan in 2020.

Throughout this plan what is missing is a discussion of the environmental impacts of any other logging plans on the watershed or aquatic species; this old MSG report does nothing to provide that discussion. Between 1997 and 2016, THPs covering more than 61,000 acres have been filed and approved, amounting to nearly 30% of the land within the entire Battle Creek watershed and at least 80% of the land in the industrial timberland block. (See CA Dept. of Forestry FPGIS file, 2018 and Figures 1 and 2.) Yet according to this plan, as well as the past plans, all of this logging and the associated roads used for it have had no impact on the environment and are not relevant to evaluating cumulative impacts that are occurring downstream. The plan includes no evidence to support this conclusion, nor does the MSG report.

Example: SPI 2020 report. Plan page 212 refers to the 2020 SPI-produced document "Digger Creek Tributaries Water Quality and Road Erosion Report" and adds the report on pages 570-583 of the plan. The majority of this report is the same text and graphs as the 2018 SPI-produced "Bioassessment and Water Quality for South and North Forks Digger Creek" referred to on pages 215 and 426-438 of this plan. (It was submitted for the earlier Artemis version of this plan; see our comments in the following example.) The same deficiencies of the 2018 report are repeated in the 2020 document-- i.e. the lack of any map or coordinates to provide evidence as to where the information was collected in relation to the land and the effects on it. The data was likely from the same sites shown in Figures 21 and 22 which renders it meaningless to detect downstream cumulative impacts.

These 2 SPI reports are the only documents in the plan that are actually about the small planning watershed and assessment area that SPI has chosen to confine its cumulative impacts assessment to. The placement of the instream monitoring equipment far upstream of the most impacted areas fails to capture any downstream impacts and:

- negates the use of the data as evidence to detect cumulative impacts
- is purposely misleading
- does not meet the analytical standards set by CEQA, which are intended to afford the fullest possible protection to the environment

Example: SPI 2018 report. Pages 215 and 426-438 reference the SPI-produced "Bioassessment and Water Quality for South and North Forks Digger Creek". This was submitted for the earlier Artemis version of this plan. The report had the same deficiencies in 2018 as it does now; we wrote of the deficiencies in our comments on the Artemis and Rio Gatito plans.

Please note, none of the maps for the area ever call the more northern fork of Digger Creek "North Fork". It's always labeled as "Digger Creek", while the south fork is labeled as "South Fork Digger Creek". We will use that nomenclature here.

Both forks begin to the east of the industrial timberland block (upstream), in Lassen National Forest land, and flow east to west. Digger Creek is the larger branch. The confluence of both branches is approximately ¼ mile east of the Tehama county end of Forward Road in Manton. As may be seen on the following map (Figure 36), one of our Citizen's Water Monitoring sites, marked with a green diamond, is ¼ mile west (downstream) of the confluence. BCA has had two monitoring sites on Digger Creek since 2009. A map of all of our sites is included in Lewis et al. 2019 and in Figure 8.

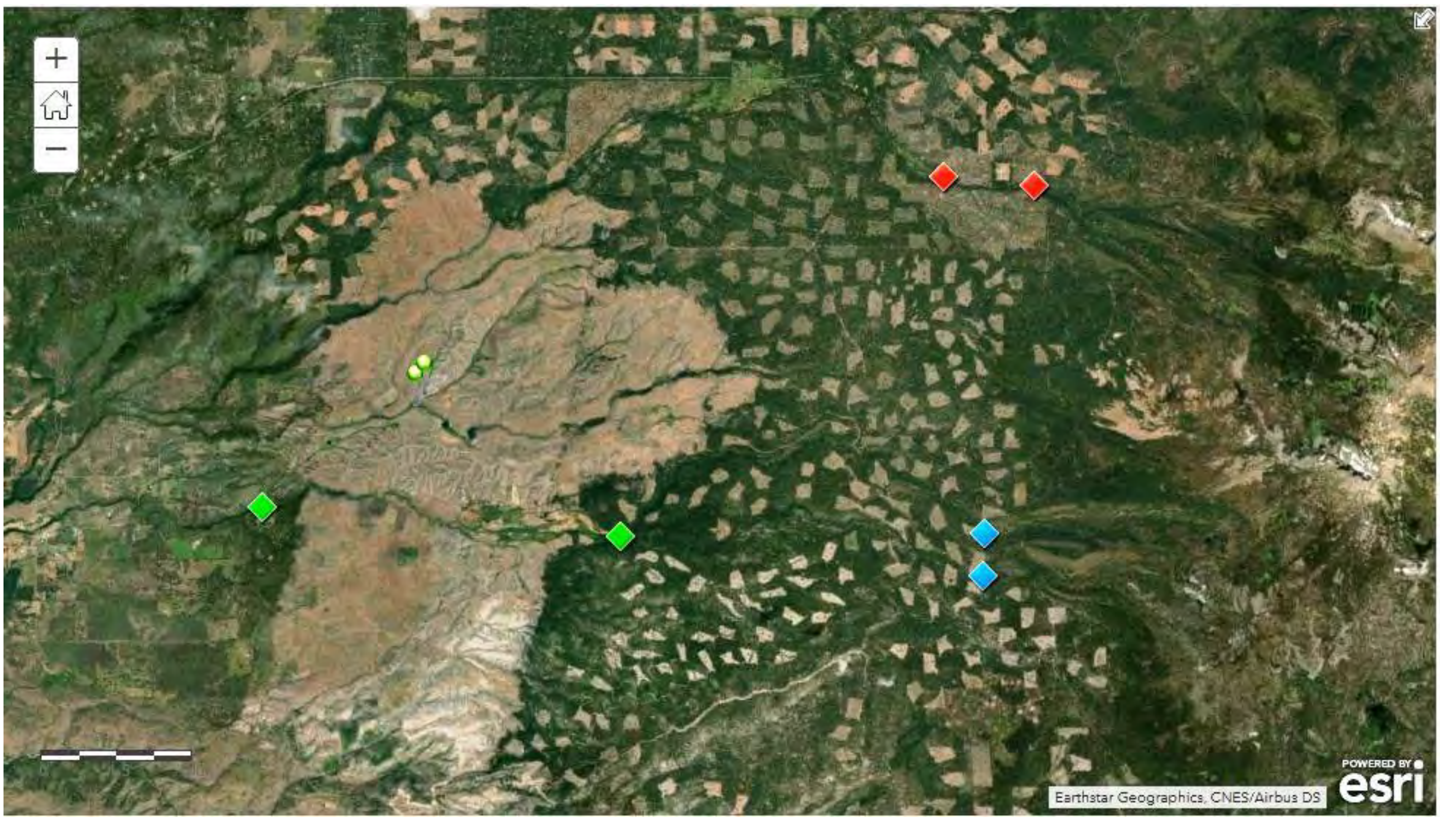

Figure 36. The industrial timberland area of Battle Creek watershed. The regularly spaced brown holes are clearcuts. The large brown area is from the Ponderosa Fire of 2012 and the subsequent salvage logging of it. The uncut area on the right hand side is Lassen National Forest where the Battle Creek tributaries, Digger, Bailey, and Panther Creeks, originate. The green diamond shapes mark 2 of our water monitoring sites on Digger Creek, the right hand being the higher (upstream) site, DC, and the lower, DCH. The blue diamonds mark the Digger and South Fork Digger Creek locations at the boundary near SPI and Lassen Forest land. The red diamonds mark SPI's data stations on Bailey Creek as detailed in the SPI James and MacDonald 2012 report regarding Bailey Creek; those stations are also placed upstream of most of the land disturbance.

The SPI Bioassessment referenced in this plan has no map or description of where their data is being collected from. If the data is being collected from near the upstream Lassen Forest boundary as their Bailey Creek data is, it has no relevance to what effects are occurring in the cutover industrial timberland downstream. All of the numerical and graph figures and conclusions in SPI's document are worthless for a reasonable judgment of cumulative impacts without the most basic foundation of knowing where the data was collected from in relation to the landscape. This document provides no evidence of having been peer-reviewed by a professional hydrologist. Dr. Peter Green from U.C. Davis reviewed the SPI document and submitted a comment to the Timber Harvest Review Team regarding it for the 2017 submittal of this plan: e.g. "This report does not identify, by either detailed map or coordinates, where the water quality sampling was conducted. Without this information, the report has no relevance to identifying impacts that may be present from past harvests." (Green 2018).

Our review of the SPI Bioassessment provides evidence to support our demand that the Timber Harvest Review Team does not lend credence to the deceptively misleading SPI document regarding Digger Creek when analyzing the impacts of this plan.

Along with submitting the information about the misleading SPI Bioassessment before, we have submitted professional reviews many times of other SPI-produced documents that purportedly analyze their own logging impacts. SPI cites to these documents again in this plan, even though independent professionals have written reports documenting the misleading content of them. We have not ever seen Cal Fire provide a response regarding SPI's deceptively misleading documents in its Official Responses, so we can only presume those documents are being accepted by Cal Fire without the dismissive attitude displayed to documents we have submitted. (See BCA past plan comments and Cal Fire Official Responses, as well as Britting 2008, Miller 2008, Myers 2012, Myers 2013, Lewis 2014, Lewis 2016, CV Water Board 2018, BCA 2020 erroneous paragraph.)

A technical report was prepared for the Central Valley Regional Water Quality Control Board by Henkle et al. (2016). Cal Fire has used short quotes from this document in past Official Responses (e.g. Graceland plan 2-18-055) to dismiss or disparage BCA's comments and data collection work. Cal Fire ignored the actual data evidence the report provided though. All of BCA's and Henkle's sites are downstream of this proposed Powerhouse plan.

Henkle collected some grab samples to measure turbidity during Water Year 2014-2015. BCA uses the same methodology, although we have collected samples since 2009 and have collected over 14,000 samples in the ensuing years. (See BCA QAPP 2019 and CEDEN.) Henkle had two sites that were the same or similar to BCA's; one was on south fork Battle Creek at the same site BCA uses and one was on Digger Creek; BCA's upper and lower Digger Creek sites are shown on a map of BCA's sites in Lewis et al. 2019. Upon examination of Henkle's records BCA found that both he and BCA had collected samples on December 4th, 2014 at nearly the same times. The Henkle and BCA results are consistent with sediment effects collecting and increasing as they travel downstream from the highest upstream site Digger Creek having the lowest NTUs, and lowest downstream site south fork Battle Creek showing the highest NTUs. The results show how closely all the results align, which we hope will deter Cal Fire's practice of dismissing our work in the Official Responses they write.

On pages 212-214 of this plan, SPI uses 25 NTUs as a reference for severe effects, citing to "Newcombe 2003". There is no hydrologist listed in SPI's personnel references on page 171 of this plan. SPI submits only misleading information gathered from high upstream in the watershed. That makes this plan another in a long line of fact-free black holes regarding significant effects that are occurring in this watershed.

There has been no numerical value applied by Cal Fire in past practices and approvals to define what they believe is an exceedance, but then there is no evidence in their Official Responses that they have ever even considered if there **are** any exceedances. As far as has been written in Cal Fire's Official Responses, they have never sought or reported any definition or results. (See Cal Fire 2019 regarding cumulative impacts, e.g.: In answer to our question "What you would consider a cumulative impact?" Cal Fire responded "as each plan is a unique project, and there are few thresholds that have been established for resources that may be impacted, I am not going to speculate as to when a significant impact may or may not occur."

Example: Lassen National Forest report. Pg 215 and 374-389 of the plan adds a document entitled "Aquatic Condition Report for the Upper Battle Creek Watershed". This report was written 20 years ago by Lassen National Forest (LNF) and is only about creeks upstream of SPI lands on LNF land. The LNF lands are primarily undisturbed. The plan says this report is "relevant" to this project. It isn't. The THP deceptively infers that this report applies to SPI lands. It doesn't.

The surveys were done upstream of SPI's land, 20 years ago. This fails to account for 20 years of significant impacts from logging, fire, drought and climate change.

The surveys were performed on undisturbed land, upstream of this plan, which is completely different from SPI land. (See Figures 21, 22.) Even if this report was produced a year ago, it would still have no relevance to SPI land. The LNF surveys were mostly around Nanny and Martin creeks far to the southeast of SPI's chosen small "planning watershed" (see Figure 52 for planning watershed boundaries). SPI's and Cal Fire's decades long practice of choosing to use small planning watersheds only serves to minimize significant effects. This practice does not uphold the rules or laws meant to prevent significant effects. As is the case here, and throughout the many past logging plans in the Battle Creek watershed, SPI quotes information from outside the planning watershed to try to support their practices, but does not quote any of the many documents that do show their kind of practices have significant effects. (See BCA references.)

Example: USFWS press release. Pages 215, and 405-407 add a March 2018 USFWS press release regarding Chinook salmon. It is copied and pasted from the earlier 2018 recirculated version of this plan, Artemis. First, a press release is not a high quality document to provide factual evidence regarding cumulative effects. Secondly, the THP states that the press release means "This is a very strong indication from state and federal agency biologists that chances for re-establishment of this species here are good due to the trending improvement of habitat conditions in the greater Battle Creek Watershed since the Ponderosa Fire and drought years 2012 through 2016". This statement avoids and misrepresents much of what the press release says though. E.g.:

--Nearly the entire in-river juvenile population was lost in 2014 and 2015 due to extreme drought.

--"Over the course of several decades, this reduced the number of winter-run Chinook salmon from four large populations numbering in the in the hundreds of thousands, to a single, imperiled population that is mostly comprised of hatchery fish."

--"Today, Sacramento River winter-run Chinook salmon are listed as an endangered species under both federal and state law. NOAA Fisheries also considers winter-run Chinook salmon among eight marine species most at risk of extinction…"

This press release adds no factual evidence to inform the analysis of SPI's cumulative effects. It doesn't address the SPI-chosen area for the cumulative impacts assessment included within the plan at all. SPI, and the plan, limits the area for cumulative impacts assessments to a planning watershed and a small percentage of their industrial timberland. This reductive system has been used for the multitude of logging plans in the Battle Creek watershed to avoid a factual watershed-scale cumulative impacts analysis. Here, SPI wants to suddenly include information from outside their chosen assessment area that they seem to believe supports them. Yet, nothing is included from the larger watershed area about their negative impacts. Impartial decision-making based on facts cannot allow SPI to have it both ways.

Although this plan includes the brief press release noted above, it does not include the 2019 USFWS report (Bottaro and Earley 2019) regarding fish monitoring that was conducted in Battle Creek in 2017.

<u>Example: 2011Task Force report, pages 219-220 and 439-508</u>

One of the few documents from Battle Creek (the larger logged area, not the planning watershed for this plan) cited by SPI in this plan again is the 2011 report from Cal Fire et al. (Interagency Task Force) "A Rapid Assessment of Sediment Delivery from Clearcut Timber Harvest Activities in the Battle Creek Watershed, Shasta and Tehama Counties, California".

One of the Task Force Report's recommendations was:

Recommendation 10:
Engage in a follow-up study to relate the results of the assessment to water column data (i.e., turbidity) and in-channel physical habitat characteristics (e.g., particle size, pool fining, etc). A follow-up study should also address the potential for timber harvest associated peak-flow induced increases to suspended sediment, turbidity, bedload transport, and/or channel alterations. (pg 53)
The Task Force was unable to evaluate the potential for indirect water quality impacts due to clearcut harvesting (for example, potential channel modifications

and increases in suspended sediment and turbidity associated with logging-induced increases in peak flows), but the issue of timber-harvest-induced changes in hydrology in ground-water dominated, young volcanic terranes such at Battle Creek watershed remains an open question. (pg 54)

In 2016, we received documents from a Public Records Act (PRA) request. These documents included emails written in 2013, including one from a member of the Task Force (Short 2013). On May 28th, 2013, staff member Bill Short wrote:
"As we have discussed previously, a significant hole in the 2011 BC task force assessment (which we acknowledged) was the timing of the field work (because the assessment was performed late in the season, it was recognized that there was a potential to miss subtle indicators of erosion and sediment delivery from the harvest units that may have been obscured over the time period between the last rainfall and the assessment). I believe that it is important for us to follow-up on this aspect of the assessment so that we can respond if any questions are asked in the future."

After receiving these emails, we questioned Assistant Secretary of Forest Resources Management Russ Henly. We asked if any Task Force follow up had been performed since 2013. On May 27th, 2016 he responded: *"No follow-up work was performed by the Task Force."* He also stated: *"Section 6.7 Assessment Limitations in the Battle Creek report acknowledges that the assessment area was not subject to significant stressing storm events for several seasons prior to September 2011,* [when the 5 days of field visits occurred] *when the then-recent harvest activity was assessed."* (Henly 2016.)

Hydrologist Tom Myers wrote a technical memorandum for us on August 4th, 2012 regarding another logging plan in Battle Creek. That plan also used the Task Force report as justification for SPI's practices (Myers 2012). Regarding the Task Force report Dr. Myers wrote:"*The Interagency Task Force [ITF] report, which the THP discusses, does not assess sediment conditions in the streams; it focuses only on conditions on harvest sites and found just one example of a low-magnitude sediment delivery. In contrast, during a brief tour from public roads in the watershed in April 2012, Myers (2012) saw several examples of sediment and turbidity moving along roadside drainages and from at least one harvest access road. This visit occurred during a minor rain event. The ITF visit occurred during September 2011, a time when many signs of erosion and sediment could have been obliterated due to four to six months of dry weather.*

> * *The ITF report should be relied on only sparingly until the work can be repeated during a wetter period so that sediment movement and erosion processes can actually be observed.*

The ITF report also does not assess sediment conditions in the streams. The statement that the ITF 'saw no significant direct water quality impact related to clearcut harvesting in the assessment area' ***is meaningless because the ITF did not assess stream conditions."***(Emphasis added.)

Hydrologist Jack Lewis also addressed the deficiencies of the Task Force report in 2014 (Lewis 2014). "The Interagency Task Force (ITF) report (CALFIRE et al., 2011) on Battle Creek has been cited in recent THPs to suggest that there are no significant direct water quality impacts in Battle Creek related to clearcut harvesting. **Such interpretations are inappropriate as a lack of evidence of impacts using the ITF rapid assessment methodology does not constitute evidence of no impacts.**"

The inclusion of the 2011 Task Force report again in this logging plan does not provide relevant factual evidence to prove that significant impacts are not occurring, and have not occurred since 2011. In fact, it provides evidence that significant effects are not being adequately followed up on. We have commented on the overlooked problems in this report many times before, yet it still keeps being used to support SPI's and Cal Fire's claims there are no significant effects being caused by SPI's large scale of landscape-changing logging. The report cannot be used to support this plan, and should contain full disclosure of the problems associated with it when it is referenced, the most important problem being that no additional search for impacts has ever occurred in the decade that has passed since the Task Force Report was produced.

Example: Page 221 and 535-569 regarding Tussing report "Battle Creek Watershed Stream Condition Monitoring 2012-2017"

Page 221 of plan: SPI takes one figure and paragraph out of the report, avoiding the many details that show downstream impacts, in an attempt to represent the report as demonstrating that there are no adverse impacts occurring.

page 540: Downstream impacts are detailed in the Tussing report: "Within the first two winters post-fire, increased rates of debris flows were initiated primarily in Digger Creek and Lower South Fork Battle Creek (Terraqua 2018). However, the most severe sediment inputs to perennial stream channels are observed in the third winter post-fire (2015 water year) which brought high intensity rainfall and flooding to the Battle Creek watershed. Stream flows from this storm event peaked at 15,300 cfs at the lower Battle Creek stream gauge (USGS station #11376550, online query). South Fork Battle Creek peaked at 7,700 cfs, while North Fork Battle Creek peaked at 3,258 cfs (DWR, BAS and BNF gauges respectively). Note that the South Fork gauge captures approximate half the drainage area as the North Fork gauge (Appendix 1, Figure 1). Observations during and after the flood events in the 2015 water year indicate that fish habitat and water quality are being affected by high sediment loads. There is evidence that anadromous habitats have experienced an increase in sediment deposition and the loss of important pool habitat (USFWS 2015a), public road segments have experienced failures (CVRWQCB 2015), and the Coleman National Fish Hatchery is being affected by high suspended sediment concentrations (USFWS 2015b)."

page 548: Note the report's own disclaimers regarding low sample sizes and lack of monitoring at all in 2015 and 2016: "With the exception of the mainstem, average CSCI scores in 2017 for all major sub-watersheds exceed 0.92 “likely intact”, though inferences at this scale suffer from low samples sizes (Table 4). The mainstem below the confluence of North and South Forks of Battle Creeks is in “likely altered” condition in 2017, represented by a single sample."

[Table 4 shows only 4 samples for Digger Creek. It also shows the Mainstem (downstream) as "likely altered".]

"Note that BMI monitoring was not performed in 2015 or 2016, after the watershed experienced a significant flood event and erosion of native surface roads (e.g. Ponderosa Way, South Fork watershed) in the 2015 water year. Therefore, the potential decrease in watershed average CSCI conditions related to this event are not captured."

page 554: "Trends. The long-term trend in stream bed surface d50 (median) particle size from all available probabilistic sampling sites within the Battle Creek watershed for years 2001 through 2017 illustrate a coarsening of stream beds in 2017 (Figure 14). The dramatic increase in d50 in 2017 is the result of 5 sites dominated by bedrock or boulders exceeding 625mm (Table 7). Two of these sites occur in the South Fork, and one each in the North Fork and Bailey and Digger Creeks (Table 7)."

page 555: Figure 15 plus "The percent embeddedness for cobble sized substrate shows some fairly consistent increase over time for all sub-watersheds."

page 556: Tables 8 and 9 show steadily increasing embeddedness from 2006-2017 in both north fork Battle Creek and Digger Creek; others are all higher percentages of embeddedness in 2017 than in 2006.

page 559: The report presents more disclaimers regarding the results: "Results of the BACI analysis for post fire effects are inconclusive, likely for several reasons. First, the sample size of this study is small with only four of both control and impact sites. Secondly, inter annual variability due to larger scale processes appear to be affecting both control and impact sites. For example, decreases in CSCI observed across all control and impact sites between 2013 and 2014 (Figures 10, 11), with 2014 being the 3rd year of a drought cycle and having the lowest average annual discharge of the last 18 years (Figure 1). Lastly, the most significant post-fire impacts to stream reaches downstream of the wildfire likely occurred during the 2015 water year (WY) as documented by USFWS (2015a). The effects of the atmospheric river precipitation events, flooding, and sediment inputs in the 2015 WY across all potentially affected tributaries went undocumented by BCWC stream monitoring due to a lack of funding."

Example: SPI 2015 Work Plan. Page 221 and 390-404 add SPI's Battle Creek Work Plan (2015) ostensibly written for the Central Valley Regional Water Quality Control Board (CV Water Board). We wrote about it in our comments for the previously submitted Artemis plan. Nothing has changed.

The Work Plan is a document similar to this logging plan, in that it is primarily generalized information with little specific factual evidence. We have spoken with CV Water Board staff to ascertain what follow up information they have received that the SPI Work Plan itemized. The staff mentioned that the work plan was not part of any regulatory requirement, so the work plan and the actions outlined in it are not enforceable by the Water Board.

The Work Plan document details many action items, including providing the CV Water Board with an annual report of SPI's follow up to the Work Plan items, beginning in 2016. As of 2020 staff at the CV Water Board have not received any reports for any of the action items (CV Water Board 2020).

The entire SPI Work Plan consists of statements on paper that have produced no subsequent reports or solid data with appropriate explanation of methodology to inform a reasonable analysis of SPI's impacts. The current logging plan again lacks the basic information to perform a reasonable analysis of its impacts. Consequently, this plan does not conform to the FPRs or the PRC laws.

On page 402 of the plan the Work Plan states: "the following map summarizes SPI Monitoring Activities in the Greater Battle Creek Watershed" but there is no map on the page or later. There was no map in the earlier Artemis version of this plan either, as we wrote in 2018. There was no map with the document in the Rio Gatito plan, as we wrote in 2020. This is either a purposeful omission of relevant information, or another example of the cutting and pasting of the same generic information in plan after plan. Either way, it does not meet the standards encoded in 14 CCR 897 that "the information in [THPs] shall also be sufficiently clear and detailed to permit adequate and effective review".

Example: Page 215 The Past Projects List abuses the planning watershed delineation again by listing only the acreages of past plans that fell inside of the small Upper Digger Creek planning watershed.

Following is the significant difference between what the "Past Projects" lists in this plan and how many acres the plans actually were:

2-04-166 TEH (Hazen) **22 acres** listed; the plan was **2,115 acres**

2-10-003 TEH (Dry Gulch) **5 acres** listed; the plan was **1,048 acres**

The list does not include the 2-03-158 TEH (Digger) plan at all, which was **993 acres**.

Figure 37 is a map constructed by BCA over the years of plans up until 2012. The map illustrates how the arbitrary planning watershed boundaries and the misleading Past Projects list have no correlation to the physical reality that all the plan units are continuously situated near one another.

The small geographic scope of the assessment area used by SPI in this, and past, logging plans, is precisely the type of truncated analysis that the cumulative impact assessment is meant to protect against. *See EPIC v. Cal. Dept. of Forestry & Fire Protection*, 44 Cal.4th at 525.

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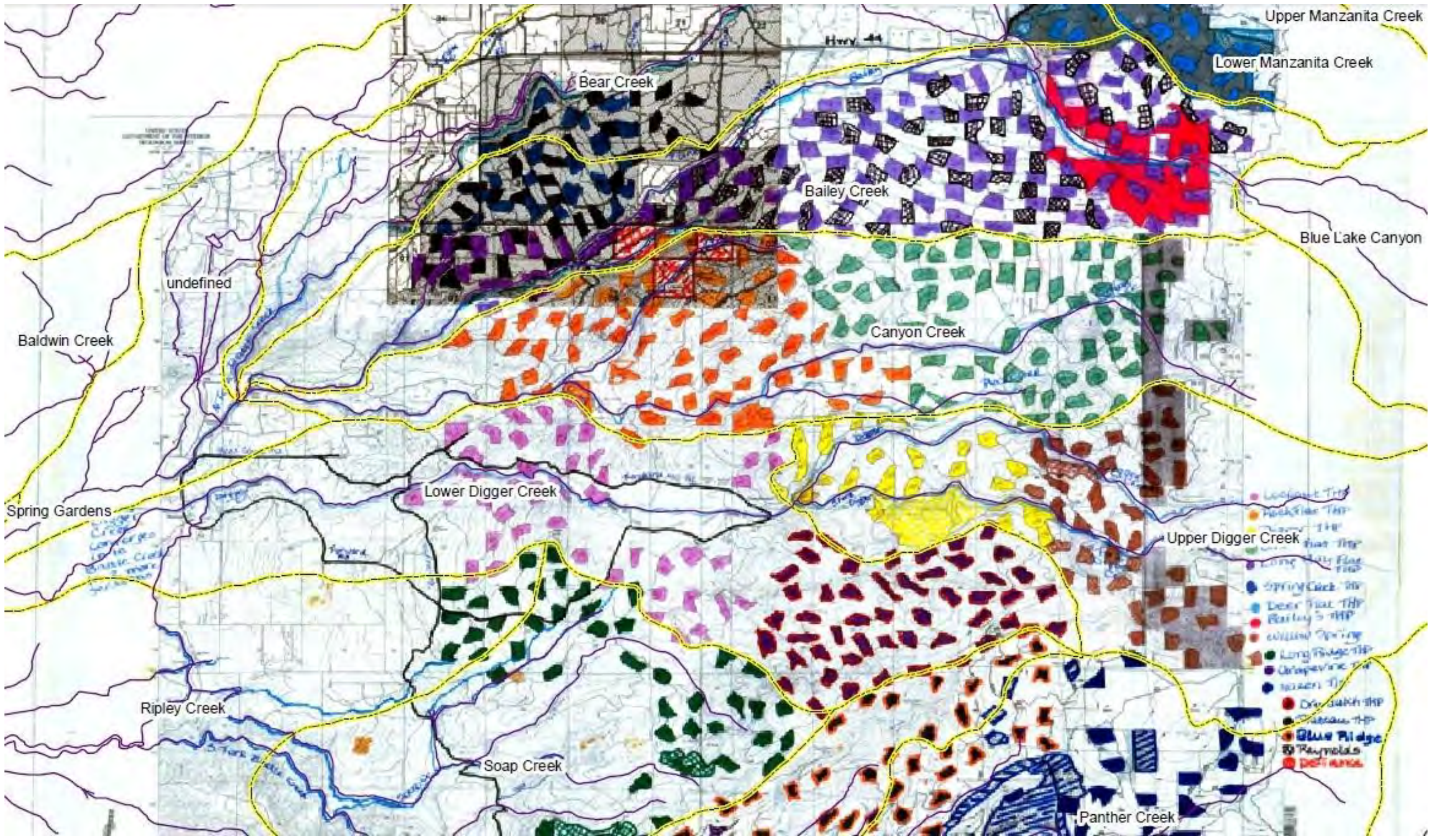


Figure 37. BCA map of some of the logging plans through 2012. Yellow dotted lines are planning watershed boundaries. The plans from the Past Projects List are: Hazen, 2,115 acres marked in blue in the lower right corner; Willow Spring, 942 acres marked in brown above Hazen; Dry Gulch, 1,048 acres marked in purple with red outlines to the left of Willow Spring. The Digger THP was not included in the Past Projects list, but is marked in yellow; it was 993 acres.

<u>Example: Page 216-217</u> SPI has inserted an erroneous paragraph into this plan on these pages regarding the Lewis et al. research paper that was published online in 2018 and in the scientific journal "Environmental Management" in 2019. This paper analyzed BCA's water quality data that began being collected in 2009. This is another in a long list of attempts by SPI to suppress factual evidence which demonstrates that their logging practices have significant adverse effects.

Mr. Lewis responded to the paragraph's claims in a letter we submitted to Cal Fire when we first knew of the paragraph in October 2020 (Battle Creek Alliance 2020 b). We provided evidence from Mr. Lewis and asked for the demonstrably false paragraph to be removed from this plan. Cal Fire refused.

As documented in our attachment "Battle Creek Alliance Intimidation and Suppression Timeline (2020 a)" SPI has made many attempts to stop our collection of water quality data, its publication, and its use to provide relevant evidence regarding their ongoing practices and plans. SPI's inclusion of the paragraph in this logging plan continues their attempt to suppress relevant evidence and is another factual misrepresentation in this plan.

These long-term suppression and intimidation attempts began in 2010 and have continued in the ensuing years as documented by the various emails and letters referred to in the following timeline. The timeline demonstrates the length of time that concerns regarding cumulative impacts have been ignored by SPI and Cal Fire practices.

Battle Creek Alliance (BCA) Timeline of Cal Fire and Sierra Pacific Industries (SPI) attempts to suppress our work/evidence

Supporting documents that have been submitted to Cal Fire are listed in parentheses.

2009 BCA begins Citizen's Water Monitoring Project, collecting samples using public roads in the Battle Creek watershed.

2010 March: SPI sends 1st threatening letter regarding BCA's data collection, attorney Rene Voss responds in June (Voss, Woodhouse letter 2010)

Oct.: Cal Fire releases an Official Response to the Plateau Flat logging plan (2-09-027SHA) in which it refers to BCA as "plagiarizing" a document that had been given to BCA by hydrologist Jon Rhodes, with his permission to use it. BCA asked Cal Fire to remove this insult and lie from its official, public record for several years. Cal Fire ignored the request every time and never removed it. (BCA 2010 Plateau plagiarist)

2011 SPI employee Cajun James makes baseless trespassing remarks at public meetings on 3/15/11 and 5/17/11

2012 Jan.: Attorney Rene Voss sends SPI employee "Cease and Desist" letter regarding libelous statements at public meetings in 2011. (Voss Jan 24, 2012)

Feb. 6: SPI sends another threatening letter to BCA director with baseless claims of criminal trespassing, copyright infringement; attorney Rene Voss responds in April. (Voss April 5, 2012)

Feb. 25th: SPI sends Shasta Co. Sheriff Deputy to BCA director's house to threaten her with arrest for criminal trespass. He says they have evidence; she asks what it is, he says he doesn't have to tell her. He tells her she can't get out of her vehicle to take samples on the public county road. She asks what law that is; he responds that he doesn't have to tell her.

April-June: Hydrologist Tom Myers, who is analyzing BCA data to write a report, and Justin Augustine from Center for Biological Diversity, visit Battle Creek sites on county roads in April. In June, they and BCA receive another threatening letter from SPI trying to stop BCA water data collection. (Myers and Augustine 2012)

In August, Ponderosa Fire burns on 27,000 acres of land, 2/3rds SPI ownership. It is logged under emergency exemptions with no environmental review required.

2013 Dec.: BCA director files complaint against Cal Fire Timber Harvest Review Team Chair and practices. (Battle Creek Alliance 2013)

2014 June: Brief, form letter from Cal Fire which offered no substantive response to BCA complaints, received by BCA. BCA asks for a list of who was interviewed; request is ignored, no interviewee list is provided. BCA director was not spoken to by investigator.

2015 April: BCA director and other women environmentalists begin to receive Cal Fire whistleblower emails, detailing the hidden practices at Cal Fire e.g. the Review Team Chair calling the women "fucking bitches" at agency meetings. (Cal Fire whistleblower emails)

Nov: Statistical hydrologist Jack Lewis started reviewing our data and producing reports in 2014. Cajun James/SPI contacted him a number of times to try to influence him against working for BCA. In Nov. 2015, as he was working to publish his analysis he wrote in an email to Cal Fire employee Pete Cafferata that James had called him to threaten "she would make sure that it did not get published". (Lewis Cafferata emails 2015)

2017 June: We discovered through emails we received from a Public Records Act request that Cal Fire employees had reviewed Jack Lewis' manuscript (submitted to a scientific journal) regarding significant effects occurring from logging in Battle Creek watershed. In these 2016 emails the Cal Fire employees wrote of their intent to get the paper rejected. Consequently, we filed a complaint with Cal Fire and the Natural Resources Department. (Cal Fire Complaint 6-2017)

On Aug. 18th we received a response from Russ Henly, Natural Resources, that dismissed all of our concerns. On Aug. 22nd, we wrote to Monte Manson, CDF Chief, Professional Standards Program (Cal Fire complaint 8-2017). We received a dismissive reply. On Sept. 20th we asked for a list of who he interviewed regarding our complaint and any other evidence he considered. There was no reply. On Nov. 3rd, we wrote again to say we received no list of interviewees or other evidence. Again, there was no reply. (BCA to Monte Manson 2017). The refusal to provide any evidence to us that was used in decisions or investigations has been the pattern throughout the years and has occurred many other times than are detailed here.

2018 At the public Board of Forestry March 2018 meeting SPI employee Cedric Twit presented disinformation and veiled slurs about our research paper and hydrologist Jack Lewis during the comment section of the meeting, including saying our paper was unpublishable. BCA wrote a letter to the BOF but received no reply. (BCA to BOF 3-19-18.) An audio recording of the meeting is here:
https://www.youtube.com/watch?v=hMpIVvioANA&feature=youtu.be
Our research paper was published in the scientific journal *Environmental Management* online in April 2018, and in the print version in 2019.

2019 From January to April BCA worked with Erick Burres, State Waterboard Monitoring Coordinator, to update our Quality Assurance Project Plan (QAPP) and to upload our data to the State CEDEN site (California Environmental Data Exchange Network). On April 29th, we received an email from Mr. Burres that SPI had contacted him to say BCA was trespassing to obtain water samples. (Burres 2019.) BCA director and Mr. Burres spoke on the phone afterwards. He informed her that SPI was demanding that BCA data not be allowed to be uploaded to the CEDEN site. BCA sent a letter to again answer the baseless accusations by SPI. (BCA to Burres 2019.)

2020 On October 18th, 2020 BCA found that SPI had inserted an erroneous paragraph into resubmitted plan 2-20-00159 SHA "Powerhouse" in an attempt to invalidate our research paper. We sent emails and evidence to Cal Fire between October 18th and 30th, asking for the paragraph to be removed. Cal Fire refused. (Cal Fire Ramaley 2020 erroneous paragraph emails and BCA Erroneous paragraph in THP letter 2020.)

G. Herbicide Data is Not Specific to Plan, Therefore Required Cumulative Impacts Analysis Cannot Be Made.

Page 178-185 states that SPI has collected 4,506 herbicide samples "from across our lands" (1.7 million acres) since 2000. There is no detail given if any samples were collected from the planning watershed in this plan, or what year(s) the samples were collected. As with other SPI self-reported results detailed throughout this comment, there is no basic methodology regarding their sample collection supplied. We spoke to the Central Valley Water Board to ask for any information they have been given by SPI regarding the data collection. The Water Board has no information or knowledge regarding how SPI collects its samples. Without knowing anything about the geographic location of where the samples were collected or if samples are collected upstream or downstream of logging and herbicide application, after rainfall or in dry periods, and the length of time since herbicide application, any self-reported results from SPI prove nothing about what effects are occurring, and are not the factual evidence the THP requires.

Additionally, CV Water Board staff informed us during the 2018 Artemis version of this plan: "I'm unaware of any herbicide sampling done by SPI, or their methods for when they do that type of sampling. We have learned that grab samples cannot gather enough water to detect pesticides, so if they do grab samples they probably will come back non-detect. To clarify, It's an issue that the pesticides are only detectable at very, very low concentrations. From a stream or river, a typical 1-liter bottle doesn't have enough of the chemical in it to be detectable, thus very special methods are needed to detect pesticides in aquatic environments. The USGS is working on a sampling methodology to detect these, but we currently don't have this sampling method, at least one that has been vetted." (CV Water Board 2018.)

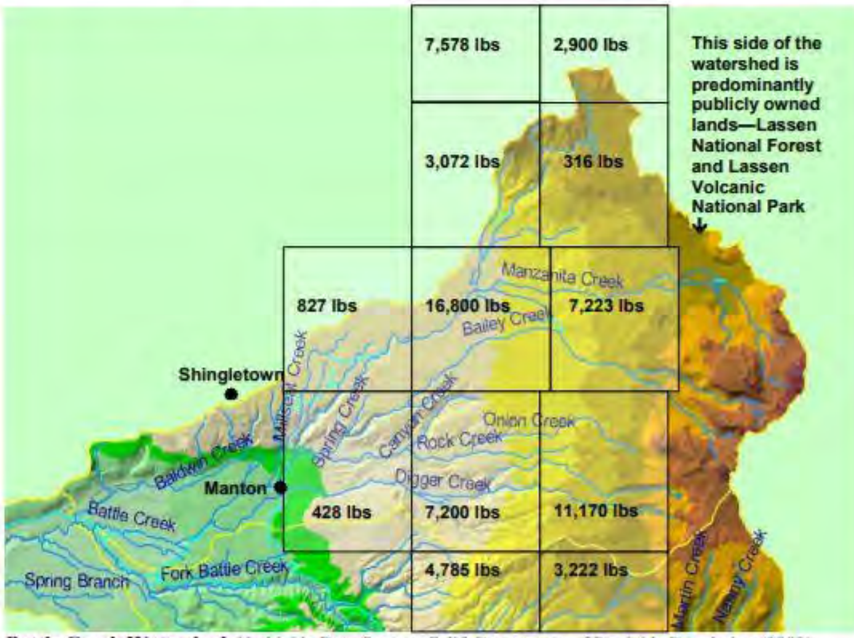
SPI's pages regarding herbicide testing are exactly the same in every THP we have seen, i.e. copied and pasted generalized information. SPI states that they collect grab samples. Therefore, the CV Water Board statement makes it clear that SPI's samples and results are invalid. This is the third comment we have included the CV Water Board's statement in, yet SPI continues to copy and paste the same misleading statements into their logging plans.

The lack of validity of SPI's herbicide sampling, along with the continuing use of large amounts of herbicides upstream of fish habitat and public water supplies, are more potentially adverse significant impacts that Cal Fire's current practices have allowed for decades with no analysis.

Page 184 of the plan states "...on any given acre of SPI's forestland, application of herbicides may occur once or twice every 60-80 years." This is a deceitful concealment of what really occurs on the land overall, and does not fulfill the requirements for analyzing significant cumulative impacts. Figure 38 is a map made in 2008 from Department of Pesticide Regulation data of herbicide use in the Battle Creek watershed between 1996 and 2006. We do not have the staff to update this map, but the regulatory agencies should be doing this work in order to complete an adequate cumulative impacts analysis. This map has been submitted in our past comments. What has happened in the 14 years since this data was assembled? No one knows because the amount of usage is not reported in the logging plan and there is no known, valid data from monitoring. As may be seen in the Figure, there have been many thousands of pounds of herbicides applied to the area of this plan and all the acres around it, and it has been much more frequently than "once or twice every 60-80 years".

BATTLE CREEK WATERSHED, SHASTA AND TEHAMA COUNTIES

Sierra Pacific Industries (SPI) Forestry Herbicide Applications



Battle Creek Watershed. Herbicide Data Source: Calif. Department of Pesticide Regulation (2008), Current data are available only to 2006.

Township & Range	Lbs. herbicides	Date range
T33NR3E	2,900 lbs	2000-2006
T33NR2E	7,578 lbs	2001-2006
T32NR3E	316 lbs	2005
T32NR2E	3,072 lbs	1998-2006
T31NR1E	827 lbs	1999-2005
T31NR2E	16,800 lbs	2000-2006
T31NR3E	7,223 lbs	1997-2006
T30NR1E	428 lbs	2004-2005
T30NR2E	7,200 lbs	1999-2006
T30NR3E	11,170 lbs	2001-2006
T29NR2E	4,785 lbs	1996-2006
T29NR3E	3,222 lbs	1998-2006

Chemicals used include atrazine, hexazinone, imazapyr, glyphosate, triclopyr BEE, 2,4-D, sulfometuron methyl, and a variety of additives and surfactants.

TOTAL: 62,621 pounds of herbicides were applied by Sierra Pacific Industries in the Battle Creek Watershed in the last decade. Of this, 17,834 pounds were applied aerially. This total does not include additional spraying in 2007 and 2008.

Battle Creek watershed is the site of a $43 million state and federal salmon and steelhead recovery project. The streams in this watershed are critical habitat for federally listed threatened and endangered salmon and steelhead.

Figure 38. Past SPI herbicide use in the Battle Creek watershed 1996-2006. This map/data demonstrates the length of time that SPI's practices have been approved by Cal Fire with no substantive analysis of the cumulative impacts on downstream fish habitat and public water supply.

Page 185 of this plan also cites a 1997 DiTomaso paper entitled "Post-fire herbicide sprays enhance native plant diversity". This is another reference which has been copied and pasted into every SPI THP for years. Again, its study areas were not in the Battle Creek watershed, or more specifically, not in the upper Digger Creek planning watershed. One of its study areas was in the Fountain Fire vicinity between Round Mountain and Burney, soon after the fire in 1992. Figure 39 is representative of what a plantation in the area of the Fountain Fire looked like by 2013. There is no plant diversity in it, contrary to the DiTomaso paper's claim that herbicides enhanced plant diversity.

Figure 39. A plantation in the Fountain Fire area, photographed in 2013. The Fountain Fire burned in 1992. There is no real plant diversity here, contrary to the 1997 paper the THP cites.

SPI has provided no recent relevant information regarding the dangers of herbicides and their effect on humans, wildlife, aquatic habitat, and water quality. Our references provide abundant information regarding the significant effects. See: Cox, 1996, Cox, 1998/2000, Doyle, 2004, Pimentel et al., 1992(b), Relyea, 2008, Richard et al., 2005, Sierra Club Canada, 2005, Zhang et al., 2019.

H. No Assurance in Plan that Plant Protection or Retention will Occur

Plan pages 246-249 The three brief, generic pages regarding plants in this plan use phrases such as "comprehensive review" "protection measures" "retention area to ensure no substantial reduction to the number". This is another instance where what the paper plan says has no correlation to what actually occurs on the ground.

We wrote extensive comments regarding the 2006 Lookout THP which is slightly west/downstream of this plan. Some of the units had occurrences of a rare plant, *fritillaria eastwoodiae,* as does this plan. Details of what occurred on the ground in that plan are representative of the factual practices that SPI uses, as opposed to the fiction their plans state.

The Lookout THP downstream of this proposed plan included the following information on page 21.4 (revised 4-2-07):

"Prior to timber operations, an additional survey for *Fritillaria eastwoodiae* will be conducted… Fritillaria spp were also observed in the vicinity of Units 17, 21, and 25…The Fritillaria in the vicinity of Units 22 and 23 shall be identified to species…The following are conservation measures: PPZs (Plant Protection Zones) shall be established in clearcut units where *Fritillaria eastwoodiae* is present…"

A botanist saw *fritallaria eastwoodiae* in Unit 25 in 2007. This is Unit 25 in 2007; the plants were near where the person in the blue shirt was standing:

Figure 40. *Fritallaria eastwoodiae* location in 2007 pre-logging, Unit 25.

Figure 41. Unit 25 post-clearcut in 2011, with no evidence of any attempt at a plant protection zone.

The other units the plant had occurred in:

Figure 42. Unit 17, post-logging 2011.

Figure 43. Unit 21, post-logging 2011.


Figure 44. Unit 22, post-logging 2011.


Figure 45. Unit 23, post-logging 2011.

There were no plant protection zones and no retention of the plants. We have no reason to believe that the practices would be any different on the ground during this plan.

Figure 46 is an example of *fritallaria eastwoodiae* growing near Digger Creek in an uncut area slightly west of this plan (T30 R2E Sec. 26). They grow in partially shaded areas with leaf litter and other plants, not in hot, open clearcut areas. SPI's practices are wiping out this plant's, and many other species', habitats.

"Ecosystems, species, wild populations, local varieties and breeds of domesticated plants and animals are shrinking, deteriorating or vanishing. The essential, interconnected web of life on Earth is getting smaller and increasingly frayed. This loss is a direct result of human activity and constitutes a direct threat to human well-being in all regions of the world," said Professor Josef Settele, co-chair IPBES Global Assessment Report on Biodiversity and Ecosystem Services (2019). https://www.unep.org/news-and-stories/press-release/natures-dangerous-decline-unprecedented-species-extinction-rates

Figure 46. *Fritallaria eastwoodiae* growing near Digger Creek in an uncut area, approximately 1 1/2 miles downstream of this plan. This is the habitat it grows in.

As is true for all the resources that have been adversely affected by past logging plans, there is no documentation or evidence provided in this plan that measure what trends have occurred in plant populations or how populations have changed. Therefore, the plan fails to measure the true cumulative impacts again, as have the past plans and approvals of them.

Zhang et al. (2016) writes that the "Extinction risk of North American seed plants [is] elevated by climate and land-use change". Part of their summary states "We show that

~2000 species may lose >80% of their suitable habitats under the A1b emission scenario for the 2080s, while ~100 species may experience >80% range expansions (a 20 : 1 ratio of loss to gain). When considering >50% range retraction and expansion, the ratio of loss to gain was 13 : 1. A greater loss of species diversity is expected at low latitudes, while larger gains are expected at high latitudes. Evolutionarily distinct species are predicted to have significantly higher extinction risks than extant species. This suggests a disproportionate future loss of phylogenetic diversity for the North American flora."

The importance of diversity to functioning ecosystems cannot be overstated, yet the ongoing logging practices have overlooked and ignored diversity for decades. Figure 47 shows the diversity in an uncut area directly downstream of the Powerhouse plan. Here there are numerous species and differing sizes of trees and understory plants. Plant diversity is also important to animal, bird, and insect species for shelter and food. Those species give back to the plant species in the form of organic material from both eating and dying in the timeless interconnections of life.

Figure 47. This 2021 photo shows diversity of species and sizes in an uncut area on the edge of the Powerhouse plan in T30 R2E Section 26. Ponderosa pines are just one species of many in the nearby area including: Douglas fir, white fir, incense cedar, sugar pine, black oak, alder, willow, big leaf maple, dogwood. This is what is being lost. This is what is irreplaceable in short timescales.

The water cycle (detailed in Section C. 2.), combined with soil health, also affects plant growth. This plan contains the standard generic responses that have been in past plans regarding soils, while providing no consideration of the conditions on the ground and how they are degrading.

The cumulative impacts of replacing so many acres of grown and diverse forest with plantations of small ponderosa pine trees has not been addressed at all by this plan or the practices it continues. There is no discussion of the fact that the original growth of climax forest was mostly cut by the 1930s. The forest that has been being cut for the past 20 years is mostly 2nd growth forest, ~80 years old. The plantations being planted now during climate change and more extreme weather conditions are the third rotation in approximately 100 years. As Pimentel (1998) observes regarding the effects of soil erosion on productivity: "For example, the loss of soil organic matter increases water runoff, which reduces water storage capacity. This diminishes nutrient levels in the soil and also reduces the natural biota biomass and the biodiversity of the entire ecosystem". (See also Pimental et al. 1992 (a) for many ecosystem impacts from forestry.) Many of the trees in plantations are showing unusual yellowish color (Figure 48). This could be related to lack of soil nutrients, higher temperatures, or low rainfall amounts, or a combination of all of those factors and more. Since apparently no one is discussing those effects or studying them, there is no effort to understand or address the ongoing cumulative impacts occurring to plants, soils, and climate occurring in the area of this plan.

Figure 48. Ponderosa pines showing yellow color on Forwards Mill Road (T30 R2E Section 22) in February 2021, downstream/west of the Powerhouse THP. This unhealthy discoloration is commonly occurring in the replanted, third rotation pine plantations in the logged areas of Battle Creek; the grown forests are also showing signs of stress with discoloration, and many dead needles/dead trees.

Nothing in this plan or SPI's practices meaningfully address the trends and threats occurring to plants and other biological resources. There is no evidence to support their practices, and no attempt to practice any kind of conservation of irreplaceable species. These practices are specifically contrary to CEQA laws.

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V. Climate change impacts ignored in the logging plan and SPI's Option A.

We wrote of some interconnected climate change impacts in the preceding sections C. 2. Water Cycle and D. Wildlife and Habitat. Section D also includes more details regarding SPI's Option A.

Ellison et al. (2017) writes: "Forest-driven water and energy cycles are poorly integrated into regional, national, continental and global decision-making on climate change adaptation, mitigation, land use and water management. This constrains humanity's ability to protect our planet's climate and life-sustaining functions. The substantial body of research we review reveals that forest, water and energy interactions provide the foundations for carbon storage, for cooling terrestrial surfaces and for distributing water resources. Forests and trees must be recognized as prime regulators within the water, energy and carbon cycles... The effects of tree cover on climate at local, regional and continental scales offer benefits that demand wider recognition."

There is no recognition of forests' impacts on climate in this plan. (See Ellison 2017, Vickers 2012, Pokorny 2010.)

There is no substantive evidence in the plan to prove that the mass removal of forest cover in the 75,000 acre block of industrial timberland, and the surrounding areas, is not a deleterious cumulative addition to climate change impacts in the local area.

None of the important aspects detailed in Ellison et al. and throughout literature have been accounted for in this plan or in SPI's Option A. These aspects are part of a large significant adverse impact occurring due to both SPI's logging practices, and Cal Fire's approval practices. These long-term practices have failed to uphold CEQA's rules that are meant to afford the fullest protection to the environment.

- SPI's Option A basis for their practices, and Cal Fire's approval of plans based on SPI's Option A, have no relevance to current or future conditions. The Option A is a purely speculative document with no facts or evidence to prove it is true in 2020 or will be true in future conditions.

Page 204 of this plan cites to another of SPI's documents "Carbon Sequestration in Californian Forests: Two Case Studies in Managed Watersheds". This SPI-produced document was found to have significant flaws in its methodology when reviewed by Peter Miller (2008). One of his conclusions is "A critical review of this study demonstrates that, contrary to the report's conclusions, replacing existing diverse forests with uniform tree plantations is unlikely to produce significant carbon benefits and will instead increase the risk of catastrophic fire and threaten the extensive range of benefits provided by existing forest ecosystems."

The only documents that support SPI's practices are the documents their own staff produces. The carbon sequestration document is another example of their self-produced findings that has been debunked. SPI continues to submit this and other fallacious documents in its plans and Cal Fire continues to accept them, despite the evidence that the reports are deeply flawed and unreliable.

Harmon (2010/2021) Zald et al. (2016) and DellaSalla (2018) have all reviewed Cal Fire's carbon calculator and found significant flaws in it. The flawed calculator continues to be used in this plan and others though, significantly ignoring the carbon stored in soils and dead wood. For just one example: DellaSalla (2018) writes "The report is also silent on carbon retention times even though long-term carbon stores (live and dead pools above and below ground) are critical to climate stabilization".

Vickers et al. (2012) studied the difference in carbon fluxes and water use efficiency between young ponderosa pine plantations and older (50-250 years) forests. Some of their findings were: "The mature forest with larger leaf area and wetter and cooler soils has a net uptake of carbon 3.3 times that of the young plantation… Patterns of photosynthesis, inherent water-use efficiency (IWUE) and tree transpiration indicate that the young plantation responds to the seasonal drought sooner and to a more severe degree." Nowhere does this plan even acknowledge these important adverse effects, nor does it offer any mitigations for the devastating loss of canopy cover in the large central block of industrial timberland in the Battle Creek watershed.

Figure 49 illustrates more logging/forest canopy reduction in 2020, adjacent to part of the large unrecovered area of the 2012 Ponderosa fire, west of this proposed plan. The plan does not disclose this additional logging because it is outside the narrowly limited area of the plan's assessment area. The limited assessment area in this plan combined with past plans has allowed the forest cover to be lost at a high rate in this crucial time in the world. There is no mitigation which repairs this loss, particularly in the short term.

As far as we know, no one is even attempting to understand what kind of impacts the higher heat and disrupted water cycle from the immense loss of canopy cover in the industrial timberland below it is having on the Lassen National Forest land to the east of this particular area. Certainly there is no evidence in this plan, past plans, or Official Responses that SPI or Cal Fire think about it at all.

Figure 49. The Reynolds Flat THP was filed in 2012, but all of its units were not cut; some of the units were interspersed with the area burned in the 2012 Ponderosa fire. In the summer of 2020, around the time fires were starting all over California, the Reynolds units were cut, adding more open, dry land to the watershed which fails to dissipate incoming solar radiation.

VI. Summary of SPI citations included in Powerhouse plan, which do not support SPI practices

In our years of submitting comments regarding logging plans, one of the common experiences we have had has been that no matter what kind of documentation we submit, Cal Fire's Official Responses deride, dismiss, or ignore our submissions (see ORs for 2-06-173 Lookout, 2-08-052 Bailey's, 2-08-097 Long Ridge, 2-09-027 Plateau Flat, 2-10-003 Dry Gulch, 2-10-034 Grace, 2-10-067 Blue Ridge, 2-12-026 Reynolds Flat, 2-12-031 Hendrickson-Defiance, 2-18-055 Graceland, 2-19-00180 Rio Gatito). Along with this practice, Cal Fire holds SPI to much lower standards and does not provide any evidence that they have analyzed SPI's references as exhaustively as they do ours.

We have reviewed some of SPI's references which are cited as support for this plan below, because Cal Fire practices during plan approvals present no evidence that they have done so. This review finds that most of the references are not from the specific area this plan has chosen as its assessment area, and that the ones we have had time to review do not support the generalized conclusions and speculations about future conditions the plan alleges.

There are dozens of citations in this plan's Section 4. Mostly all have been cut and pasted from SPI's previous plans. Mostly all are old and exclude recent research. Under scrutiny, these references do not support the THP's conclusions. The inclusion of many as supporting SPI's claims is false and misleading.

The 1981 Lisle paper regarding erosion and sediment transport listed in SPI's references is almost 40 years old and was performed in a north coast watershed regarding the impacts of a 1964 flood. If we submitted this paper, it would be dismissed as not relevant to the THP area by Cal Fire. Why is SPI allowed to reference it with no dismissal by the Review Team?

The study area of the 1993 Sakai paper regarding wood rats was also in northwestern California. If we submitted this paper, it would be dismissed as not relevant to the THP area by Cal Fire. Why is SPI allowed to reference it with no dismissal by the Review Team?

The study area of the 2008 Reno/SPI document was in Trinity County near Hayfork and northwestern Shasta County near Castle Crags. If we submitted this paper, it would be dismissed as not relevant to the THP area by Cal Fire. Why is SPI allowed to reference it with no dismissal by the Review Team?

The 2008 SPI/Murphy produced document regarding canopy regrowth in planted forests is only 6 pages long and has no description of where the plots were, except for an unlabeled map on page 6. Judging by using the position of Lake Almanor on the map it appears there were no plots measured in the block of Battle Creek timberland this THP is situated within. If we submitted this document, it would be dismissed as not relevant to the THP area by Cal Fire. Why is SPI allowed to reference it with no dismissal by the Review Team?

--Additionally, it takes more than low canopy cover of mostly a single species of tree to create and sustain biodiversity of plant, vertebrate and invertebrate species. Technical Rule Addendum No. 2 states in C. 4., the biological habitat condition section, "The RPF may also need to consider factors which are not listed below. Each set of ground conditions are unique and the assessment conducted must reflect those conditions...Upland multistoried canopies have a marked influence on the diversity and density of wildlife Species utilizing the area." The Powerhouse THP continues the pattern of past plans and contains no quantitative evidence regarding the diversity or density of wildlife, past and present.

The 1997 Bull et al. paper cited in the plan is about trees and logs important to wildlife in Washington, Oregon, and Idaho in the interior Columbia River Basin. Using the Cal Fire rationale applied to studies we submit, this report is not relevant to the Digger Creek planning watershed, The 2018 Forest Carbon Action Report cited by SPI was extensively reviewed by the Center for Biological Diversity (CBD) and found to be misleading in many ways (CBD 2017). It is more of a state-wide policy document which has nothing site-specific to the Digger Creek planning watershed and is not evidence to support this plan.

<u>Further SPI references which do not support their practices:</u>

Baldocchi 2008. "Breathing of the terrestrial biosphere: lessons learned from a global network of carbon dioxide flux measurement systems". Another paper on a broad scale which says nothing about any measurements from Battle Creek watershed or planning watersheds. Does say "ecosystems losing carbon were recently disturbed".

Brown 2004. "BASELINE GREENHOUSE GAS EMISSIONS FOR FOREST, RANGE, AND AGRICULTURAL LANDS IN CALIFORNIA". From 2004, no specific measurements to Battle Creek.

DOE 1605b. "Technical Guidelines for Voluntary Reporting of Greenhouse Gas Program" from 2006. Note 14 years old and voluntary. Measurement systems have been evolving ever since then. No specific measurements to Battle Creek.

Ferrell 1996 Sierra Nevada Ecosystem Project (SNEP) report "Influence of Insect Pests and Pathogens on Sierra Nevada Forests". Does not support SPI's practices and says nothing about any measurements from Battle Creek watershed or smaller planning watershed.

Franklin and Fites 1996. Another 1996 SNEP report "Assessment of late successional forests". Excerpt:

> vada and, in other SNEP exercises, constructing and evaluating al-ternative management scenarios. Forests with high LS/OG structural rankings are currently uncommon in the Sierra Nevada; only 8.2% of the mapped polygons had structural rankings of 4 or 5. Commercially important forest types—such as the mixed conifer and eastside pine forests—are particularly deficient relative to their potential as a result of past timber harvesting. Key structural features of LS/OG forests—such as large-diameter trees, snags, and logs—are generally at low levels. On the positive side, the forest cover in most areas is not highly fragmented by clear-cutting and stands have sufficient structural complexity to provide for at least low levels of LS/OG forest function. National parks provide the major concentrations

Note that even in 1996 there were LS/OG (late successional/old growth) deficiencies and low levels. And that was 25 years ago when they write "the forest cover...is not highly fragmenting by clear-cutting" which was true in 1996, but is clearly not true now in 2020.

Franklin et al 2000. Regarding fitness in northern spotted owl populations. Study area was near the north coast, nowhere in the Sierra or Cascades, much less in Battle Creek, since Battle Creek is out of their range.

Graber 1996. Another 1996 SNEP report "Status of Terrestrial Vertebrates" Nothing in this report is supportive of SPI/CDF practices. In fact, it clearly states 25 years ago that their types of practices are detrimental.

Haig et al. 2001 regarding geographic variations in spotted owls. Maps do not include the Sierra, much less Battle Creek. (There are California spotted owls in Lassen Forest.)

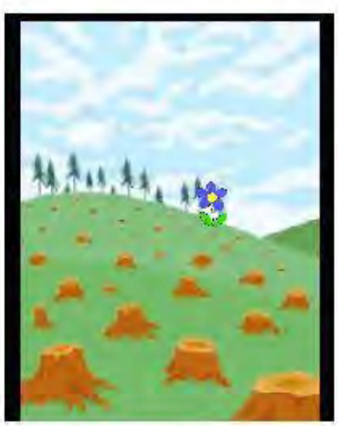
Helms 1996 SNEP report "Silviculture in the Sierra". An old, broad overview with no real pertinence to SPI's practices; most certainly no pertinence to cumulative impacts from 1998 to the present.

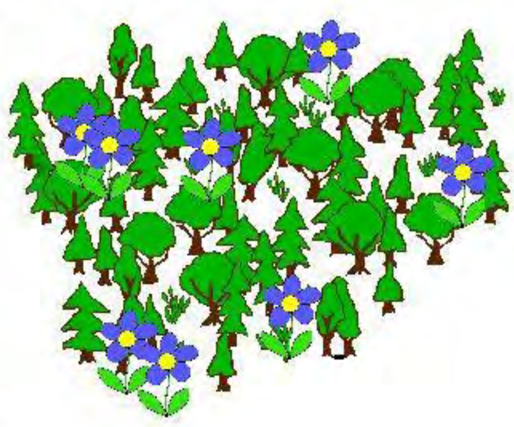
Howe 1989. Genetic Effects of even and uneven aged management, presented at some conference in Alaska in 1989. Dated (30+ years old) and unpublished, so no way to determine its validity or applicability to SPI methodology.

Hurteau 2009. "Fuel treatment effects on tree-based forest carbon storage and emissions under modeled wildfire scenarios" Note this was based on a "model" rather than on-the-ground data and it was modeled from data in the southern Sierra, east of Fresno.

Information Ventures 1995. Some brief sheets from 1995 regarding some of the herbicides SPI uses, produced by a consulting firm. Not up to date regarding herbicide effects.

James 2012. SPI's supposed comparison of floristic diversity, produced by SPI employees. This document is representative of what SPI does in all documents they produce-- they disguise the truth with different forms of manipulation. This study used "species richness" for the comparisons between cut and uncut forest. While that is an accepted way to do counts in some circumstances, for SPI it serves to really obscure the reality on the ground. That's because "richness" gives a numerical value to number of species, while ignoring the "abundance" or number of individuals within the species. The easiest way to explain this is with drawings:





Clearcut Plot ↑ **Uncut Plot ↑**

Figure 50.

Using "richness" both the plots in Figure 50 would be given the same rating of "1" because the species is in both areas. But with "abundance" added the rating would be 1 for the clearcut area vs. 8 for the uncut area. Here's another drawing for understanding:

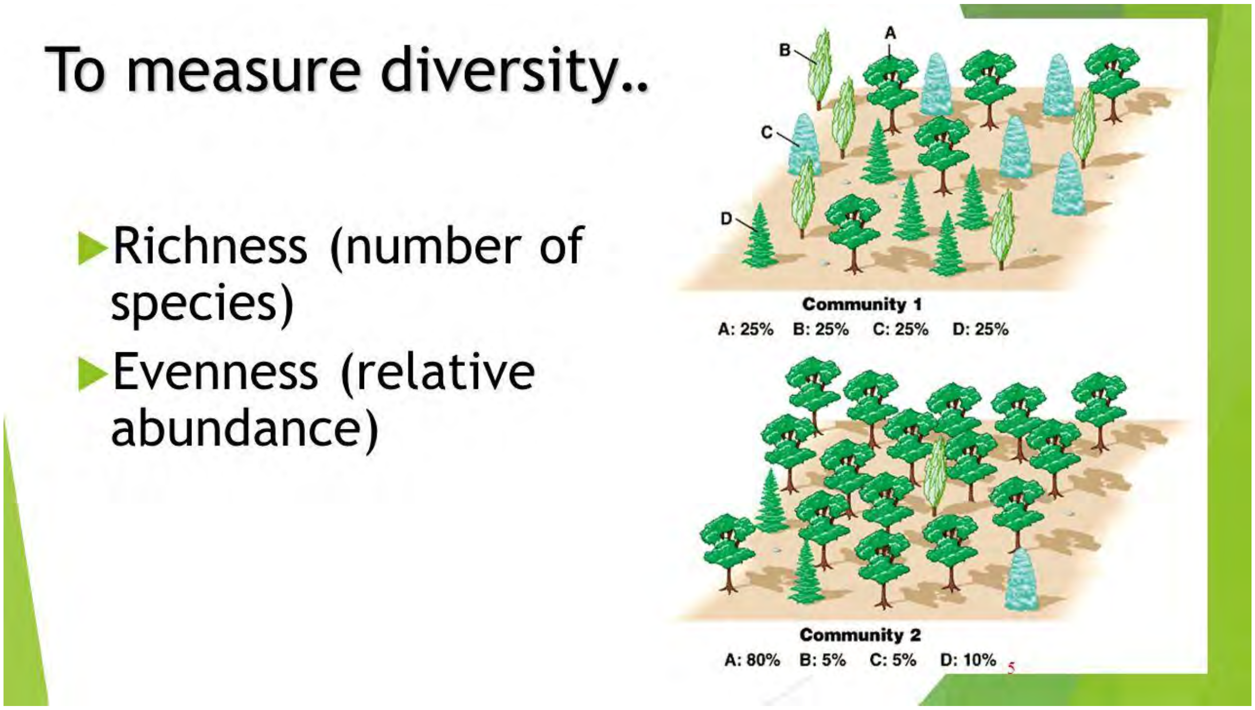


Figure 51. Clearly "Community 1" is more diverse. Using only richness as a parameter while ignoring abundance would give both communities the same rating.

Krohn 1995. Fishers and martens and how snow conditions affect them. Does talk about logging some but has no real relevance to Battle Creek, particularly since there are either no known fisher populations here.

Krohn 1997. 1989-1994 surveys of fishers and martens on Nat'l forest land. No relevance to SPI land, practices, or populations.

Lenihan 2006. "THE RESPONSE OF VEGETATION DISTRIBUTION, ECOSYSTEM PRODUCTIVITY, AND FIRE IN CALIFORNIA TO FUTURE CLIMATE SCENARIOS SIMULATED BY THE MC1 DYNAMIC VEGETATION MODEL" Another model based document from 2006 with no measurements specific to Battle Creek. It does state (14+ years ago): "Considerable uncertainty exists with respect to regional-scale impacts of global warming. Much of this uncertainty resides in the differences among the different GCM climate scenarios as illustrated in this study. In addition, models that translate climatic scenarios into projections of ecosystem impacts can always be improved through reexamination and improvement of model processes. Nevertheless, the results of this study underscore the potentially large impact of climate change on California ecosystems and the need for further use and development of dynamic vegetation models using various ensembles of climate change scenarios."

McDonald 1996. Another 1996 SNEP section "Silviculture-Ecology of Forest-Zone Hardwoods in the Sierra Nevada". Contains this, contrary to SPI practices:

Artificial regeneration in a conventional sunlit plantation is beset with problems, especially lack of consistent and reliable seedling growth. Partial shade appears to be mandatory, but how much and until when is unknown.

McKelvey 1992. "Historical Perspectives on Forests of the Sierra Nevada..." History of early 1900s logging of Plumas Co on south-- nothing about northern Sierra. Not pertinent to current logging, climate change, habitat fragmentation, water cycle disruption.

Oliver, SNEP 1996 "Density Mgmt of Sierra Nevada Forests". This is all about thinning forests--there is nothing that supports clearcutting, particularly of 60,000+ acres out of 75,000 acres as SPI has done in Battle Creek.

Olson 1996. Research from Blodgett Experimental Forest of growth between 1933-1995. Blodgett is near Georgetown in El Dorado County south of Battle Creek some hundreds of miles and the time period stops in 1995, before higher temperatures and less rain really started kicking in.

Powell 1994. An overview life history of fishers. Only pertinence to Battle Creek is that fishers were probably here in the past, but aren't anymore due to human actions.

Sakai 1993. Paper about dusky footed woodrats/northern spotted owls (NSO) in northwestern CA --the north coast, different conditions than inland. There are no NSOs in Battle Creek because it's outside of their range. There are CA spotted owls in Lassen Forest that likely move lower in the colder parts of the year.

Saspis 1996 SNEP Assessment of Fire Behavior in Sierra.:

When coupled with the information presented on risk here and in McKelvey and Busse (1996), these findings on hazard present a significant issue of concern for Sierra Nevada Ecosystems. Although findings on fire size and abundance indicate no trends in increasing amounts of fire in the Sierra (Erman and Jones 1996) what we may be seeing is an increase in fire severity resulting from stand and fuel condition changes resulting from harvesting and fire suppression. Further, with clear climate induced responses and an uncertain future in regard to incidence of severe fire weather, the prospects for fire related damage from extreme wildfire loom large. Fuel conditions in much of the Sierra Nevada support the potential for large fires exhibiting extreme fire behavior with likely undesirable effects. Future management of the region would be well served to understand this, and make hazard reduction an objective in any land management strategy.

Note: "what we may be seeing is an **increase in fire severity** resulting from stand and fuel condition changes **resulting from harvesting and fire suppression."** "Hazard reduction" is not obtained by adding tens of thousands of acres of highly-flammable tree plantations.

Skinner 1995, Klamath Mountains (north coast) Changes in spatial characteristics of forest openings. "Watersheds with minimal human disturbance were chosen for study." No relevance to this area or SPI practices.

Skinner SNEP 1996, Sierra Nevada Fire Regimes. A history of fire and its ecological importance. No discussion of logging practices and certainly no approval of SPI practices.

SPI "Option A" from 1999 (32 pages), tied to one THP from then, which is broadly about all their land and has never been updated to acknowledge changing or diverse conditions. This document is based on SPI's projections for the next 100 years (from 1999) yet has not one word about climate change in it. It's a delusional joke, yet every THP they submit uses the Option A as its basis.

SPI 2001 Snag Management Objectives. Another old document that SPI supposedly applies to their 1.7 million acres of land. What this document says, along with the THP, is completely divorced from their practices on the ground.

SPI 2008. Document regarding SPI's candidate conservation agreement for the release of fishers on their land in the Stirling area, Butte Co. south of Lassen Nat'l Forest. Nothing to do with Battle Creek, although one of the collared fishers released there booked up to Battle Creek, but carefully avoided clearcut areas (according to his collar locations) and then disappeared.

Truex 1998. CDFW draft report regarding fishers in the Klamath range, north coast, and southern Sierra. No relevance to Battle Creek.

US EPA GHG Emissions Inventory 2015. Broad scale, far beyond watershed or planning watershed size.

USCCSP 2008."Scientific Assessment of the Effects of Global Change on the United States" Another broad scale assessment without any fine-scale relevance to Battle Creek. Page 140 of doc writes though: "In a review of fire activity in the western United States from 1974 to 2004, Westerling et al. (2006) found that both the frequency of large wildfires and fire season length increased substantially after 1985, and that these changes were correlated with advances in the timing of spring snowmelt and increases in spring and summer air temperatures. They concluded that earlier spring snowmelt contributed to greater wildfire frequency by extending the period during which ignitions could potentially occur and by reducing water availability to ecosystems in midsummer, thus enhancing drying of vegetation and surface fuels (Westerling et al., 2006). These trends in increased fire size correspond with the increased cost of fire suppression (Calkin et al., 2005)." This is another example of SPI's own cited references disagreeing with both SPI's statements in plans and Cal Fire's determinations, approvals, and conclusions that there are no cumulative impacts occurring.

USFWS 2001 letter regarding "Formal Endangered Species Consultation...Sierra Nevada Forest Plan Amendment" An old biological opinion letter which only covers federal land, not private timberland. Species list is at least 20 years out of date.

Verner 1992. Assessment of the Current Status of the CA Spotted Owl. Well, it was current in 1992. Where's the data for the almost 30 years since then? However, the habitat concerns that were expressed then have become even more prevalent from SPI's practices.

> **Areas of Concern**
>
> Our over-riding concerns for spotted owls in the Sierra Nevada conifer zone involve potential impacts of logging practices on their habitat (details in Chapter 13) and the extent to which selective logging and aggressive fire suppression in this century have created incendiary conditions in a majority of the low- to mid-elevation conifer forests (details in Chapters 11 and 12). In addition, we have identified several conditions that will bear further study and evaluation (table 3G, fig. 3A). These involve bottlenecks in the distribution of habitat or owl populations, gaps in the known distribution of owls, locally isolated populations, fragmented habitats, and areas with low densities of owls.

Weatherspoon 1992, Fire and Fuels Management in Relation to Owl Habitat. Again, does not support cutting down grown forests to replace them with single-species plantations of small trees; indeed, it underscores the importance of closed canopy forests to maintain humidity, reduce heating and drying of surface fuels and reduce wind velocity.

> By comparison, success of initial attack on wildfires evidently is greater in areas of owl habitat within the Sierran mixed-conifer type. Countryman's (1955) description of fuel conditions within old-growth stands applies in large measure to fuel conditions within many mixed-conifer stands used by the California spotted owl. These stands are less flammable under most conditions, because the dense canopies maintain higher relative humidities within the stands and reduce heating and drying of surface fuels by solar radiation and wind. The reduction of wind velocity within closed stands discussed by Countryman is supported by wind reduction factors identified by Rothermel (1983) for stands with closed canopies. Windspeed at mid-flame height for fires burning in surface fuels is approximately one-tenth of the windspeed 20 feet above the stand canopy.

Weatherspoon SNEP 1996, Landscape-level Strategies for Forest Fuel Management. This is about fire primarily, nothing to do with logging or SPI/Cal Fire practices. The strategies suggested for landscape-level plans are as relevant today as they were 25 years ago, but have never been implemented.

Weatherspoon SNEP 1996: BCA quoted from this in our comment on page 40--it does not support SPI/Cal Fire practices at all.

Zielinski 1996, Southern Sierra Fisher and Marten Study. Like the title says "southern Sierra" as in Sequoia National Forest, Tulare County, far south of Battle Creek.

Zielinski 1997, Detection surveys from 1989-1994 for fishers and martens. 30 years old, no relevance to what has happened to population numbers and range since then.

VII. Endangered Salmonid Species, Battle Creek Restoration Project

Despite the fact that they are threatened and endangered, this plan barely mentions chinook or steelhead salmonids, never discusses how existing conditions created by past logging has affected the viability of these species' freshwater habitat in the watershed, and never discusses how the project-induced increases in sediment will interact with the existing conditions, and cumulatively with related past, present, and reasonably foreseeable projects. In short, for all the types of information necessary to assess this plan's cumulative impacts on salmonids, the plan provides none.

The Battle Creek Salmon and Steelhead Restoration Project was begun in 1999 and has not yet been completed. It is in the downstream reaches of the watershed below the industrial timberland block. This plan contains a brief update from 2020 regarding the project on pages 419-425. The update has nothing to do with cumulative impacts or this logging plan.

The ongoing 20 year Restoration Project, which has already cost $161 million dollars, is meant to restore the endangered salmonids that are downstream of SPI's land. One of the plan's few remarks about salmonid species is on page 209: "There is no known presence of anadromous salmonids or Rare, Threatened, or Endangered aquatic species in the plan area. Therefore, no Rare, Threatened, or Endangered species shall be affected by these operations". The only reason that statement could be construed as accurate is because of the wording that says "known" and "in the plan area". As we have explained in this, and past, comments SPI's practice of limiting effects considerations to a small area while ignoring downstream effects is misleading and does not conform to the laws and rules meant to safeguard the environment. There may be "no known presence" of the species in the small area of the planning watershed, but the species are present in the downstream planning watersheds that Digger Creek flows into.

Cal Fire states: "The Forest Practice Watershed Mapper allows users to identify the status of a specific planning watershed in accordance with the Anadromous Salmonid Protection (ASP) Rules, which require that every timber operation contribute to salmonid habitat restoration...The ASP Rules (2010) apply in planning watersheds with state or federally listed anadromous salmonids, and those that are restorable."https://frap.fire.ca.gov/frap-projects/forest-practice-watershed-mapper/

As may be seen in Figure 52, Digger Creek flows through this plan's Upper Digger Creek planning watershed. Its waters merge downstream with north fork Battle Creek to the west, which then merges with south fork Battle Creek. The Spring Gardens and Stillwater Plains planning watersheds downstream of this plan are listed as "Threatened and Impaired/ASP" which means Anadromous Salmonid Protections under 14 CCR 936.9 apply.

Figure 52. Some of the planning watersheds in the industrial timberland and west (downstream) of it. The names and numbers are marked in pale blue and outlined in blue. The red lines mark Digger Creek and the north and south forks of Battle Creek. Digger Creek joins with north fork Battle Creek which then joins with south fork Battle Creek, becoming the mainstem of Battle Creek.

There is no evidence provided that this plan will not have a significant cumulative impact on threatened and endangered salmonids. Given the failure to provide a fact-based assessment of the plan's cumulative water quality impacts, it is not surprising that the plan's assessment of cumulative salmonid impacts is also deficient. The plan contains no factual basis on which to determine that the addition of this plan, individually or cumulatively, will not adversely impact threatened salmonids and their aquatic habitat. The plan's entire discussion of baseline conditions, project impacts, and cumulative impacts on salmonids is lacking in any substance. SPI's two sentences in the plan contain none of the information required by CEQA to meaningfully understand the consequences of this plan on salmonids or their habitat. In place of the required project-level impact analysis, the plan relies on a short dismissal of the potential cumulative impacts on salmonids based on the small area of the planning watershed, while ignoring downstream populations and effects.

"State of the Salmonids II: Fish in Hot Water" (California Trout 2017) includes this: "At the current rate, California stands to lose 45% of its remaining native salmonids, including 11 of 21 anadromous species and 3 of 10 of its inland species, in the next 50 years unless significant actions are taken to stem the decline. (Figure 3). Under present conditions, 23 of the remaining 31 species (74%) are likely to be extinct in the next 100 years."

There is nothing in SPI's practices, or Cal Fire's ongoing approvals of those practices, that meaningfully address this, and the plethora of other adverse effects that the unending logging plans are contributing to.

VIII. Conclusion

This logging plan is not unique. All the plans submitted for logging projects in the Battle Creek watershed pay lip service to evaluating the proposed plans' cumulative impacts while failing to do so, as evidenced in this and other past comments from us.

SPI's present and past logging plans demonstrate that they have a pattern and practice of submitting the same shoddy and conclusory analyses of cumulative watershed impacts in all their plans in the Battle Creek watershed. Cal Fire has collaborated in these patterns and practices by approving the shoddy and conclusory analyses. Two of SPI's and Cal Fire's practices amount to a de facto policy, which has resulted in the ongoing water quality and aquatic, flora and fauna habitat impacts.

First, in each of the many Battle Creek logging plans, SPI has failed to submit quantitative, information-based assessments based on site- and project-specific information; Cal Fire has approved the deficient plans. SPI and Cal Fire adhere to a de facto policy that if a logging plan proposes to comply with the minimum required management practices identified in the Forest Practice Rules, the plan would by definition not contribute to any downstream cumulative water quality and aquatic habitat impacts.

The second practice is SPI's and Cal Fire's de facto policy to only address potential cumulative water quality and aquatic habitat impacts associated with a particular logging plan that are discernable within the planning watershed(s) in which the plan is located while not addressing downstream watercourses where relevant cumulative impacts are or would be present. The Rules say applicants and Cal Fire should **start** (not finish) by looking for cumulative watershed impacts at the planning watershed level, but that they also must consider whatever additional information or assessment area is required to fully assess cumulative watershed impacts (14 CCR § 898). But in practice, neither SPI nor Cal Fire ever look beyond the planning watersheds, even when presented with evidence of cumulative impacts occurring downstream, outside of the planning watershed.

Based on these operating procedures, SPI and Cal Fire have *never* concluded that a logging plan will result in a cumulative watershed impact. Yet there is substantial evidence that cumulative watershed impacts are occurring, and that logging is contributing.

The implementation of logging plans across the Battle Creek watershed have purposefully concealed and ignored the substantial alterations occurring to the environment. The addition of this plan will add to the heavy cumulative effects burden that already exists.

This plan must be denied.

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Battle Creek Alliance THP comments (folder on flashdrive)

2008. 2-06-173 Lookout

2008. 2-08-052 Bailey's

2008. 2-08-097 Long Ridge

2009. 2-09-027 Plateau Flat

2010. 2-10-003 Dry Gulch

2010. 2-10-034 Grace

2011. 2-10-067 Blue Ridge

2012. 2-12-026 Reynolds Flat

2012. 2-12-031 Hendrickson-Defiance

2018. 2-17-070 Artemis

2019. 2-18-055 Graceland

2020. 2-19-00180 Rio Gatito

Cal Fire Official Responses and Battle Creek Timber Harvest Plans (this is only partial number of plans submitted and approved) (folder on flashdrive)

2-03-158 TEH Digger

2-04-166 Hazen

2-04-181 Willow Spring

2-06-173 Lookout

2-08-052 Bailey's

2-08-097 Long Ridge

2-09-027 Plateau Flat

2-10-003 Dry Gulch

2-10-034 Grace

2-10-067 Blue Ridge

2-12-026 Reynolds Flat

2-12-031 Hendrickson-Defiance

2-17-070 Artemis

2-18-055 Graceland

2-19-00180 Rio Gatito

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March 4, 2021
Comment on THP 2-20-00159 SHA "Powerhouse"

#27

As a forest and fire ecologist, I am submitting these comments on the proposed Powerhouse logging project.

Logging Does Not Stop Wildfires and Often Makes Them Burn Faster or More Intensely-Sometimes Toward Communities: There is a substantial body of scientific evidence, including by some Forest Service scientists, finding that logging, including commercial thinning and even-aged logging, does not tend to reduce future fire intensity and, more often than not, increases fire intensity and rate of fire spread by altering the local microclimate, creating hotter, drier, windier conditions, and by spreading invasive combustible grasses like cheatgrass (Hanson and Odion 2006, Cruz et al. 2008, Cruz and Alexander 2010, Cruz et al. 2014, Bradley et al. 2016). Tree removal activities in general, including removal of live and dead trees, is typically associated with higher fire intensity (Donato et al. 2006, Thompson et al. 2007, Bradley et al. 2016, Zald and Dunn 2018), as we saw tragically in the Camp fire of 2018, which burned fastest and most intensely through thousands of acres that had been heavily post-fire logged and thinned in previous years before devastating the town of Paradise in northern California. Current climate science indicates that weather and climate factors and variables, and therefore climate change, primarily govern and drive wildland fire spread and behavior, as opposed to the density of forests or the abundance of dead trees and downed logs (Bradley et al. 2016, Zald and Dunn 2018, Preston and Hart 2020), but thinning and other tree removal activities tend to exacerbate climate-driven wildfire effects, as discussed above. Scientifically, it has been known and understood for decades that logging increases fire intensity. The 1996 Sierra Nevada Ecosystem Project Report, commissioned by Congress, concluded:

> "Timber harvest, through its effects on forest structure, local microclimate, and fuel accumulation, has increased fire severity more than any other recent human activity."

Moreover, the most current science shows that logging, conducted as "thinning" for "fuel reduction", results in a large overall net reduction in forest carbon storage and a large net increase in carbon emissions relative to fire alone and no thinning (Campbell et al. 2012, Hudiberg et al. 2013), which is just another way of saying that thinning kills far more trees than it prevents from being killed, regardless of whether some subset of thinned areas later burn at somewhat lower intensities (which they often do not).

The Weight of Scientific Evidence Concludes that Denser Forests, Forests with More Dead Trees, and Long-Unburned Forests Do Not Typically Burn More Intensely: There is a common assumption that denser forests and long-unburned forests burn significantly more intensely, ostensibly due to a higher "fuel-load" of live trees, snags, and downed logs. However, the weight of scientific evidence indicates that denser forests, including forests with the highest environmental protections and little or no removal of trees, do not burn more intensely and tend to burn less intensely (Bradley et al. 2016, Zald and Dunn 2018). The strong weight of scientific evidence also concludes that the most long-unburned forests (which are often the densest) burn mostly at lower-intensities, do not burn more intensely than most other forests, and often burn less intensely (Odion et al. 2004, Odion and Hanson 2006, Odion and Hanson 2008, Odion et al. 2010, Miller et al. 2012, van Wagtendonk et al. 2012). Further, the most comprehensive and spatially extensive scientific analyses find that forests with more dead trees and downed logs do not burn more intensely and may burn less intensely than other forests (Bond et al. 2009, Hart et al. 2015, Meigs et al. 2016, Preston and Hart 2020). Denser forests with more biomass, including forests with higher levels of snags and downed logs, have a cooler, shadier, and moister microclimate.

Deep Body of Scientific Evidence Finding that No Tree or Shrub Removal is Needed Prior to Prescribed Burning: Prescribed burning includes prescribed natural fire ("managed wildfire") and controlled burns set by agencies (prescribed natural fire is a much better option, ecologically). Where it is conducted, there is no need to remove any trees or shrubs prior to prescribed burning; where low-intensity fire effects are desired, burning is simply allowed/conducted in low fire weather in late spring or early summer (Keifer 1998, Stephens and Finney 2002, Fule et al. 2004, Schwilk et al. 2006, van Mantgem et al. 2011, van Mantgem et al. 2013, van Mantgem et al. 2016).

The Need to Focus on Home Protection: The best available science concludes that the only effective way to protect homes from wildfires is to make homes themselves more fire-safe and fire- resistant ("home hardening") and to conduct annual defensible space pruning of vegetation within 100 feet of homes (Syphard et al. 2014, 2017). Vegetation management activities beyond 100 feet from homes provide no additional benefit in terms of protecting homes from wildfires (Syphard et al. 2014). Any focus on vegetation management and removal in wildlands to protect homes is inconsistent with this science.

Sincerely,

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Appendix B

CAL FIRE Watershed Protection Evaluation of South Fork Battle Creek Data (2/3/2021)

Table 1: The number of days with temperature data available by water year and month. Yellow indicates a month with only partial days present, and gray indicates no data due to technical issues or the gage being taken off-line.

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
WY2001	31	30	30	31	28	31	30	31	28	30	31	30
WY2002	31	30	31	31	28	31	30	31	30	31	31	30
WY2003	31	30	31	31	28	31	30	31	30	31	31	30
WY2004	31	30	31	31	29	31	30	31	30	31	31	30
WY2005	31	30	31	31	28	31	30	31	30	31	31	30
WY2006	31	30	31	31	28	25	30	31	30	31	31	30
WY2007	31	30	31	31	28	31	30	31	30	31	31	30
WY2008	31	23	28	26	29	31	30	22	18	28	31	30
WY2009	31	30	31	31	28	22	19	26	30	31	31	30
WY2010	31	20	31	31	28	31	30	31	30	31	31	30
WY2011	31	30	31	31	28	31	30	31	30	31	31	30
WY2012	28	30	31	31	29	31	10	0	0	0	0	0
WY2013	0	0	0	0	0	0	0	0	0	0	0	5
WY2014	31	30	31	31	28	31	30	31	30	31	31	30
WY2015	31	30	31	31	28	31	30	31	30	31	31	30
WY2016	1	0	0	0	0	0	0	0	0	0	0	0
WY2017	0	0	0	25	28	31	30	31	30	31	31	30
WY2018	31	30	31	31	28	31	30	31	30	31	31	30
WY2019	31	30	31	31	28	31	30	31	30	31	31	30
WY2020	31	30	31	31	29	31	30	31	30	29	0	0

Data for each water year was processed to remove any erroneous data (i.e., 10F change in a 15 minute recording interval). WY2001 through part of WY2008 (November 20, 2007) used hourly data from the CDEC BAS temperature gage (https://cdec.water.ca.gov/dynamicapp/staMeta?station_id=BAS). Starting November 21, 2007, in WY2008, to the end of the active period of the gage, July 29, 2020 (WY2020), the data was event with 15-minute recording intervals. Due to missing data or erroneous data, some months did not have complete records (Table 1). Five months were missing from May through September for WY2012, and effectively the entirety of WY2013 was missing due to the gage going offline. WY2016 also was missing for the entirety, and October through December WY2017 was absent. WY2020 did not include August and September, as the gage was taken offline.

For each day with data present, the average stream temperature (T_{avg}) and maximum temperature (T_{max}) were calculated from either the hourly or 15-minute data points. The 7 Day Mean (T_{Avg7}) and 7 Day Mean Max (T_{Max7}) were calculated as seven day moving average of T_{avg} and T_{max}. T_{avg} and T_{max} were calculated as long as five or more consecutive days were present, otherwise left as N/A.

Daily mean air temperature was retrieved using the PRISM dataset (https://prism.oregonstate.edu/explorer/), which uses interpolated data from nearby weather stations to provide time series data for a location.

Table 2 indicates by water year and month, the number of days where the average daily stream temperature, T_{Avg}, met or exceeded 65F (yellow highlights). In parts of June and all or most of July, WY2001 (October 1 2000 to September 30 2001) and WY2002 (October 1 2001 to September 30 2002) showed daily average stream temperatures in excess of 65F. During WY2003 through WY2011, these occurrences are minimized to only a few days a month, while starting in WY2014, half of July had stream temps ≥65F. WY2015 had a majority of days in both June and July with daily averages ≥65F, continuing into WY2017 and WY2018 (WY2016 did not have any data). WY2019 there were no recorded daily average stream temperatures of ≥65F, while WY2020, which had data through the end of July 2020, recorded 29 days at ≥65F.

When considering the *maximum* instant daily stream temperature, based on either 1-hour or 15-minute intervals, Table 3 shows the much more prevalent occurrences of ≥65F during the June, July, August, and sometimes September and May months. Trends are somewhat similar for the 7-Day mean daily average (T_{Avg7}) (Table 4) and 7-Day mean daily maximum (T_{Max7}) (Table 5) stream temperatures. That is, WY2001 and WY2002 showed elevated summer daily average stream temperatures, while WY2003 to WY2011 did not, with nearly continuous maximum instant daily and weekly temperatures recorded at the BAS station. WY2014 signifies the start of more prevalent increased temperatures again, with the exception of WY 2019.

Table 6 shows that WY2001 and WY2002 had very low relative discharge readings at the station, for both minimum and average CFS during the June 01 to September 30 periods, with average flows of 7 and 16 CFS, respectively. While air mean and maximum 7-Day mean daily average air temperatures remain in the upper 80F's and low 90F's from WY2003 through WY2011, the June 01 to September 30 mean discharge ranged from 43 to 229 CFS during this time, reflecting cooler stream temperatures (Figure 3, Figure 4, Figure 5). Starting in WY2014, there is a warming trend to the stream temperatures at the BAS station; while CFS in WY2014 and

WY2015 was substantially higher than WY2001 and WY2002, mean daily and maximum 7-Day average air temperatures were indicated as slightly warmer, with an maximum 7-Day average air temperature increase of 1.7F in WY2014/15 over WY2001/02. In later water years, stream discharges, both minimum and average in the June 01 to September 30 periods, decrease, with the exception of WY2019, where discharge was higher (mean of 166 CFS). WY2019 also recorded the lowest mean daily average and maximum 7-Day average air temperatures of WY2017 to WY2020, reflecting the lower stream temperatures.

Assessing the entirety of individual stream temperature data points, the percent exceedance of 65F ranged from 1% (WY2011) to 15.6% (WY2001) (Figure 4). Percent exceedances have seemingly increased when stream discharge has decreased, air temperatures increase, or when discharge decreases and air temperature increase concurrently. Stream temperature at the BAS station is therefore, acknowledging the large drainage area upstream and multiple land uses, influenced strongly by air temperature trends, and runoff and stream discharge volume trends.

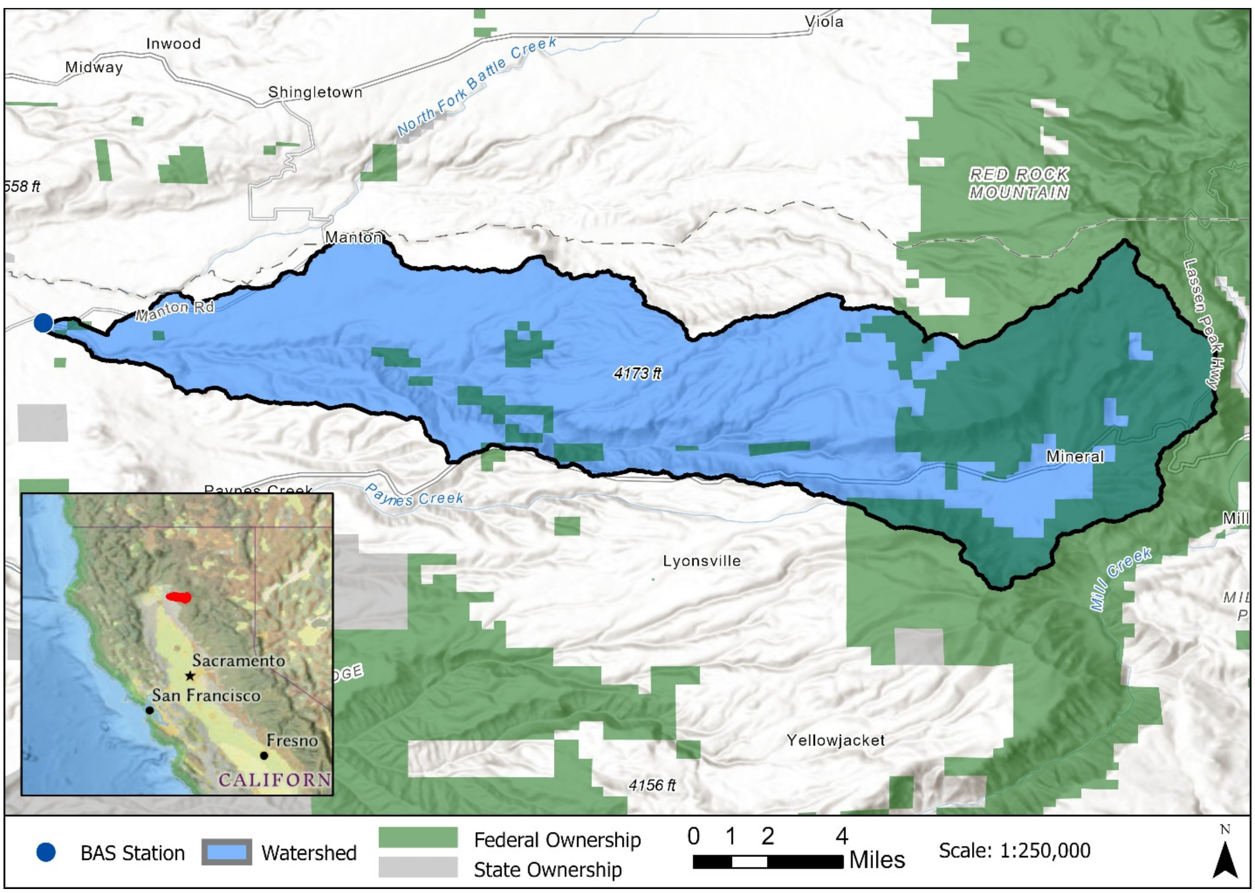


Figure 1: Map of the BAS station, contributing watershed, relative location in the state, and associated non-private ownerships in the area.

Table 2: Number of days each month, by water year, that the daily average temperature equaled or exceeded 65F. Months with at least one day are highlighted in yellow.

$T_{avg} \geq 65$	WY 2001	WY 2002	WY 2003	WY 2004	WY 2005	WY 2006	WY 2007	WY 2008	WY 2009	WY 2010	WY 2011	WY 2012	WY 2013	WY 2014	WY 2015	WY 2016	WY 2017	WY 2018	WY 2019	WY 2020
Oct	0	0	0	0	0	0	0	0	0	0	0	0		0	0		0	0	0	0
Nov	0	0	0	0	0	0	0	0	0	0	0	0		0	0		0	0	0	0
Dec	0	0	0	0	0	0	0	0	0	0	0	0		0	0		0	0	0	0
Jan	0	0	0	0	0	0	0	0	0	0	0	0		0	0		0	0	0	0
Feb	0	0	0	0	0	0	0	0	0	0	0	0		0	0		0	0	0	0
Mar	0	0	0	0	0	0	0	0	0	0	0	0		0	0		0	0	0	0
Apr	0	0	0	0	0	0	0	0	0	0	0	0		0	0		0	0	0	0
May	1	0	0	0	0	0	0	0	0	0	0			0	0		0	0	0	0
Jun	16	19	0	0	0	0	0	0	0	0	0			1	23		13	10	0	14
Jul	30	24	4	1	5	0	3	0	6	3	0			16	22		26	23	0	29
Aug	28	2	0	0	0	0	0	0	1	0	0			1	4		5	2	0	
Sep	2	0	0	0	0	0	0	0	0	0	0			0	8		1	0	0	

Table 3: Number of days each month, by water year, that the daily maximum temperature equaled or exceeded 65F. Months with at least one day are highlighted in yellow.

$T_{max} \geq 65$	WY 2001	WY 2002	WY 2003	WY 2004	WY 2005	WY 2006	WY 2007	WY 2008	WY 2009	WY 2010	WY 2011	WY 2012	WY 2013	WY 2014	WY 2015	WY 2016	WY 2017	WY 2018	WY 2019	WY 2020
Oct	0	3	0	0	0	0	0	0	0	0	0	0		0	0		0	0	0	0
Nov	0	0	0	0	0	0	0	0	0	0	0	0		0	0		0	0	0	0
Dec	0	0	0	0	0	0	0	0	0	0	0	0		0	0		0	0	0	0
Jan	0	0	0	0	0	0	0	0	0	0	0	0		0	0		0	0	0	0
Feb	0	0	0	0	0	0	0	0	0	0	0	0		0	0		0	0	0	0
Mar	0	0	0	0	0	0	0	0	0	0	0	0		0	0		0	0	0	0
Apr	0	0	0	0	0	0	0	0	0	0	0	0		0	1		0	0	0	0
May	12	5	0	0	0	0	1	0	4	0	0			2	20		0	8	0	5
Jun	26	30	9	17	3	7	14	5	10	5	0			19	30		16	27	17	26
Jul	30	31	28	29	31	19	28	26	26	27	18			31	31		31	30	30	29
Aug	31	31	4	9	17	0	13	26	19	21	4			25	16		31	22	24	
Sep	22	6	2	0	0	0	1	0	0	0	0			2	14		10	4	0	

Table 4: Number of days each month, by water year, that the seven-day mean of daily average temperature equaled or exceeded 65F. Months with at least one day are highlighted in yellow.

$T_{Avg7} \geq 65$	WY 2001	WY 2002	WY 2003	WY 2004	WY 2005	WY 2006	WY 2007	WY 2008	WY 2009	WY 2010	WY 2011	WY 2012	WY 2013	WY 2014	WY 2015	WY 2016	WY 2017	WY 2018	WY 2019	WY 2020
Oct	0	0	0	0	0	0	0	0	0	0	0	0		0	0		0	0	0	0
Nov	0	0	0	0	0	0	0	0	0	0	0	0		0	0		0	0	0	0
Dec	0	0	0	0	0	0	0	0	0	0	0	0		0	0		0	0	0	0
Jan	0	0	0	0	0	0	0	0	0	0	0	0		0	0		0	0	0	0
Feb	0	0	0	0	0	0	0	0	0	0	0	0		0	0		0	0	0	0
Mar	0	0	0	0	0	0	0	0	0	0	0	0		0	0		0	0	0	0
Apr	0	0	0	0	0	0	0	0	0	0	0	0		0	0		0	0	0	0
May	0	0	0	0	0	0	0	0	0	0	0			0	0		0	0	0	0
Jun	9	13	0	0	0	0	0	0	0	0	0			0	21		10	6	0	8
Jul	28	27	0	0	3	0	0	0	2	0	0			10	27		27	22	0	29
Aug	31	0	0	0	0	0	0	0	3	0	0			3	3		10	4	0	
Sep	5	0	0	0	0	0	0	0	0	0	0			0	8		0	0	0	

Table 5: Number of days each month, by water year, that the seven-day mean of daily maximum temperature equaled or exceeded 65F. Months with at least one day are highlighted in yellow.

$T_{Max7} \geq 65$	WY 2001	WY 2002	WY 2003	WY 2004	WY 2005	WY 2006	WY 2007	WY 2008	WY 2009	WY 2010	WY 2011	WY 2012	WY 2013	WY 2014	WY 2015	WY 2016	WY 2017	WY 2018	WY 2019	WY 2020
Oct	0	2	0	0	0	0	0	0	0	0	0	0		0	0		0	0	0	0
Nov	0	0	0	0	0	0	0	0	0	0	0	0		0	0		0	0	0	0
Dec	0	0	0	0	0	0	0	0	0	0	0	0		0	0		0	0	0	0
Jan	0	0	0	0	0	0	0	0	0	0	0	0		0	0		0	0	0	0
Feb	0	0	0	0	0	0	0	0	0	0	0	0		0	0		0	0	0	0
Mar	0	0	0	0	0	0	0	0	0	0	0	0		0	0		0	0	0	0
Apr	0	0	0	0	0	0	0	0	0	0	0	0		0	0		0	0	0	0
May	9	0	0	0	0	0	0	0	0	0	0			0	16		0	5	0	4
Jun	28	28	3	14	2	6	9	0	4	0	0			19	30		13	30	16	30
Jul	30	31	31	31	31	19	31	20	29	27	15			31	31		31	31	31	29
Aug	31	31	5	8	16	0	10	31	21	26	6			31	17		31	24	26	
Sep	27	7	0	0	0	0	3	0	0	0	0			3	20		13	4	2	

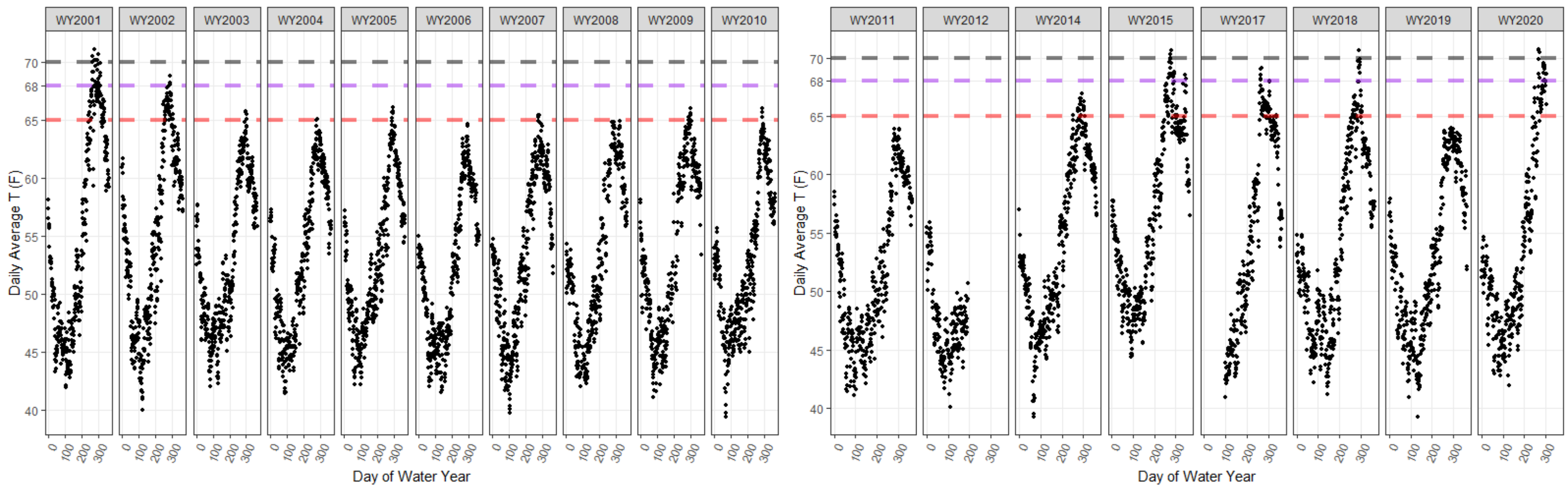


Figure 3: T_{avg} stream temperature by day of water year. The red dashed line indicates 65F, the purple dashed line 68F, and the black dashed line 70F.

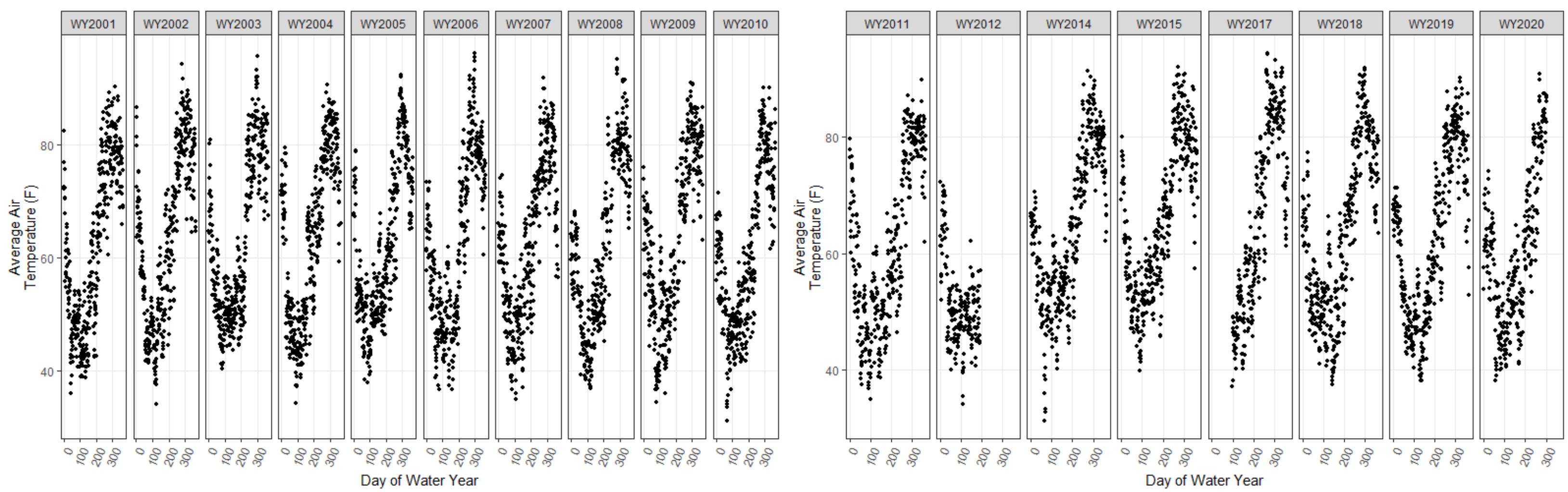


Figure 2: The PRISM daily average air temperature for the stream gage location, by day of water year.

Table 6: By water year, the number of individual (1-hour and 15-minute intervals) that instantaneous stream temperature met or exceeded 65F, the maximum daily average stream temperature, maximum mean 7-Day average daily stream temperature (T_{Avg7}), and the maximum mean 7-Day average daily maximum stream temperature (T_{Max7}). Also, the minimum and mean discharge in CFS for June 01 to September 30 of each water year, the mean PRISM air temperature at the rain gage from June 01 to September 30 of each water year, and the annual maximum PRISM 7-Day mean air temperature.

	Stream Temp. Points ≥65F (%)	Maximum T_{avg} Stream Temp	Maximum T_{Avg7} Stream Temp	Maximum T_{Max7} Stream Temp	June 01-Sept 30 Min / Mean CFS	June 01-Sept 30 Mean Air Temp	Maximum 7-Day Mean Air Temp
WY2001	15.6%	71.1	69.6	77.2	2 / 7	77.7	84.7
WY2002	10.8%	68.8	67.6	73.9	9 / 16	79.1	87.7
WY2003	2.8%	65.8	64.6	68.0	31 / 78	80.0	90.9
WY2004	2.7%	65.1	64.1	68.0	28 / 43	79.0	86.2
WY2005	3.3%	66.1	65.4	68.8	25 / 76	77.0	90.3
WY2006	1.3%	64.7	63.7	67.0	35 / 229	79.3	93.0
WY2007	2.9%	65.4	64.9	69.0	33 / 71	76.9	87.6
WY2008	4.1%	64.9	64.3	67.4	35 / 51	79.5	89.5
WY2009	4.7%	66.0	65.4	69.0	36 / 52	78.5	87.8
WY2010	3.6%	66.0	65.0	68.5	35 / 100	77.1	87.2
WY2011	1.0%	63.9	63.0	66.4	35 / 94	77.2	84.4
WY2012	-	-	-	-	-	-	-
WY2013	-	-	-	-	-	-	-
WY2014	6.5%	66.9	66.0	69.7	41 / 63	79.1	87.4
WY2015	14.2%	70.6	69.7	75.0	36 / 65	79.8	88.4
WY2016	-	-	-	-	-	-	-
WY2017	15.2%	69.1	68.3	73.0	33 / 54	80.5	91.7
WY2018	9.9%	70.6	69.2	73.2	32 / 43	78.7	89.0
WY2019	4.4%	64.0	63.6	67.8	52 / 166	78.3	85.2
WY2020	11.8%	70.7	69.9	74.5	45 / 46	78.8	86.2

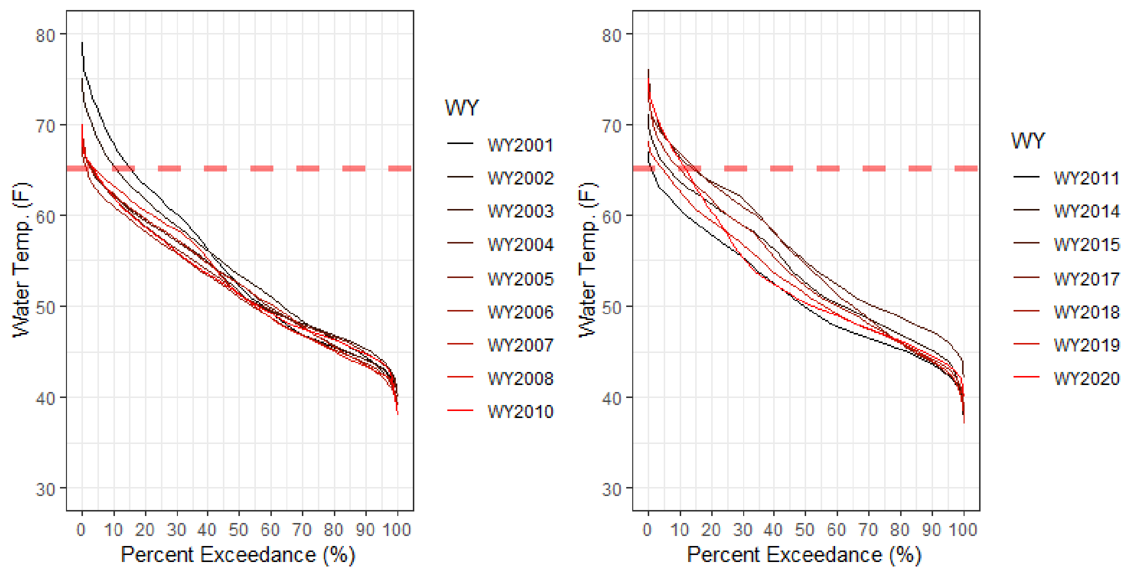


Figure 4: Percent exceedance by water year for individual instantaneous stream temperature data points, shown on left from WY2001 to WY2010, and WY2011 to WY2020 on the right.

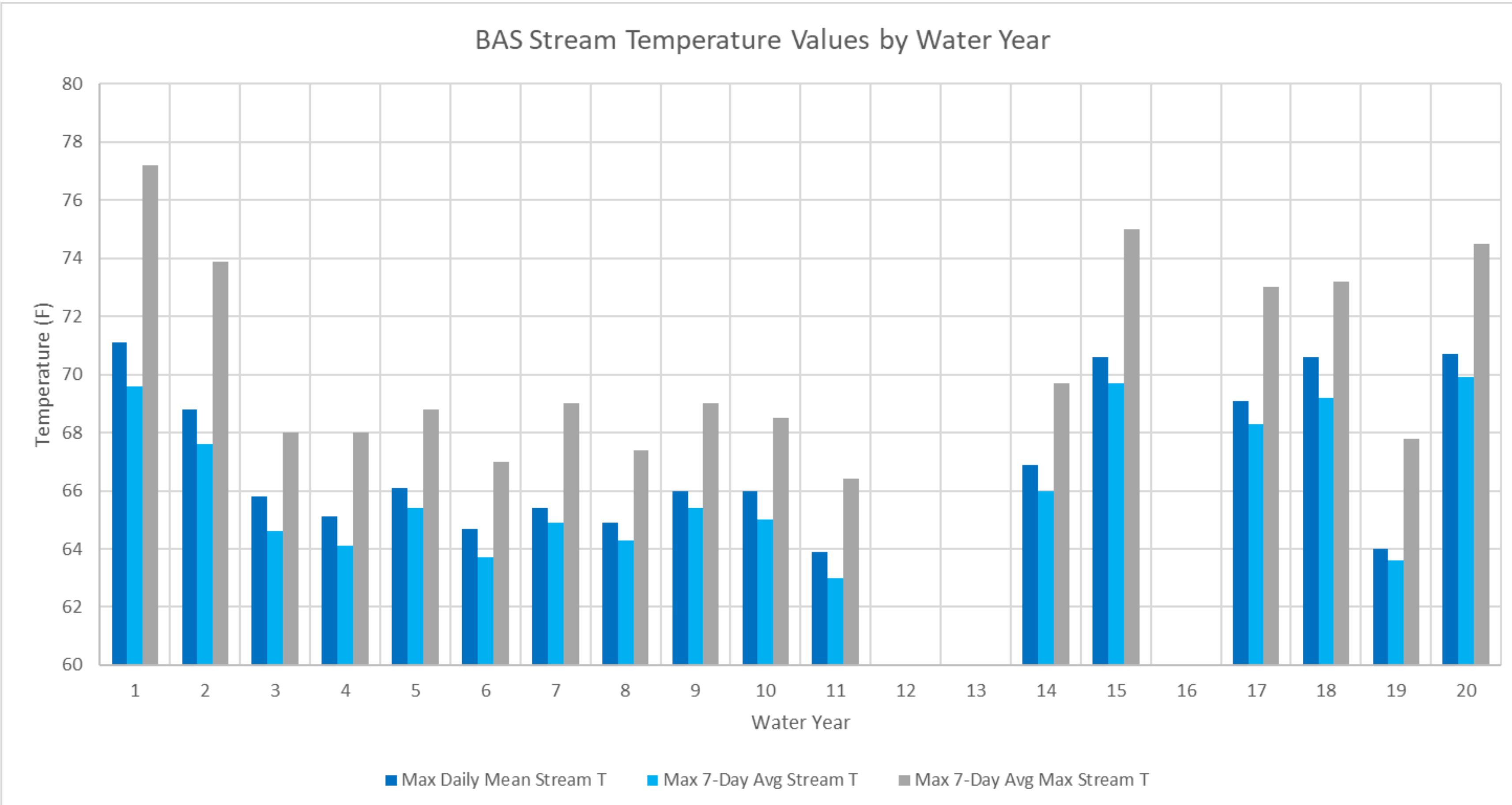


Figure 5: By water year, where 1 = WY2001, 2 = WY2002, and so on, the maximum daily mean stream temperature (dark blue), the maximum mean 7-Day average daily stream temperature (T_{Avg7}) (light blue), and the maximum mean 7-Day average daily maximum stream temperature (T_{Max7}) (gray).

State of California • Natural Resources Agency
Department of Conservation
California Geological Survey
6105 Airport Road
Redding, CA 96002-9422

Edmund G. Brown Jr., *Governor*
John G. Parrish, Ph.D., *State Geologist*

MEMORANDUM

DATE: November 20, 2017

TO: Helge Eng
Deputy Director for Resource Management
California Department of Forestry and Fire Protection

FROM: Christopher Gryszan
Engineering Geologist
California Geological Survey

SUBJECT: Engineering Geologic Review – Timber Harvesting Plan (THP) for THP 2-17-070-SHA [Artemis THP]

Timber/Timberland Owner:
Sierra Pacific Industries

County: Shasta

Quadrangle:
Grays Peak and Lassen Peak
7.5' USGS Quadrangles

CALWATER 2.2 Planning Watershed:
Upper Digger Creek (5507.120402)

Silviculture:
Clearcutting (942 ac.)
Road Right of Way (6 ac.)

Logging Method: Tractor, including end/long lining; rubber-tired skidder, Forwarder and Fellerbuncher.

EHR: Low and Moderate

Date of Inspection: November 13, 2017

Participants-Affiliation:
Ted James, SPI
Dennis Garrison, RPF
Dawn Pedersen, CAL FIRE
Jaime Galos, CDFW
Ronna Bowers, CVRWQCB
Christopher Gryszan, CGS

Legal Description:
Sections 13, 24 and 25 T30N, R02E, 15, 16, 17, 18, 19, 20, 21, 22, 27, 28, 29, 33, 34 and 35 T30N, R03E; MD B&M.

Slope: Ranges from horizontal to as much as 75 percent, with most slopes between 25 percent and 35 percent.

Area: 948 acres

Geologic Concerns: Proposed timber-harvest operations that include reductions in canopy, ground-based yarding, and road construction may increase rates of sediment delivery to local Class I watercourses.

References:

Lydon, P.A., Gay, T.E., and Jennings, C.W. (compilers), 1960, Geologic map of California: Westwood Sheet: California Division of Mines and Geology, scale 1:250,000.

Pedersen, Dawn, 2017, *Preharvest Inspection Report for Timber Harvest Plan 2-17-070-SHA (Artemis THP):* Unpublished Inspection memorandum prepared for California Department of Forestry and Fire Protection, submitted on November 14, 2017.

USDA, 2017, Natural Resources Conservation Service, Web Soil Survey, National Cooperative Soil Survey, accessed November 2017, and available at http://websoilsurvey.nrcs.usda.gov/app/WebSoilSurvey.aspx.

Aerial Photographs Reviewed:

40°26'20.60"N and 121°41'06.19"W. **Google Earth.** July 29, 1993; September 12, 1998; July 2, 2017. Accessed November 10, 2017.

Geologic Conditions:

The THP area occupies gentle to steep (up to about 75%) ground in the vicinity of Rock Spring, approximately 6.0 air miles southwest of Viola, California (Figure 1). Elevations within the THP area range from about 3,800 feet above mean sea level (amsl) in Section 24 to about 5,800 feet amsl in Section 34.

Surface water within the THP area is generally concentrated and conveyed through a network of subtle swales and Class II and III watercourses that drain into either Digger Creek or South Fork Digger Creek, southwesterly flowing Class I watercourses that flow through the THP area (Figure 1).

Published geologic maps (Lydon et. al, 1960) indicate that the THP area resides near the southern boundary of the Cascade Range physiographic province and is primarily underlain by bedrock comprised of Pleistocene-age andesite (Qpv^a), basalt (Qpv^b), rhyolite (Qpv^r) and pyroclastic (Qpv^p) rocks. With minor areas underlain by Quaternary-age glacial deposits (Qg). No landslides are mapped within the THP area on published geological maps of the region (Figure 2).

The prominent soil types mapped in the THP area are listed in the following table (USDA, 2017).

Table No. 1, Prominent Soil Types in the THP Area	
Soil Name	**Soil Type**
Cohasset stony loam, 0 to 30 percent slopes	Stony clay loam
Cohasset stony loam, 10 to 50 percent slopes	Stony clay loam

Review-team Questions:

B. The THP proposes the construction of one permanent bridge crossing over South Fork Digger Creek, a Class I watercourse (see crossing 48, in the table on THP page 30). CGS wishes to attend the PHI to evaluate the appropriateness of the proposed bridge design.

CAL FIRE Inspector: Please evaluate the appropriateness of the proposed bridge design.

CGS Response: The proposed bridge crossing was evaluated during the PHI and is discussed further as CGS-1 under Specific Observations below.

C. The THP has proposed to install numerous rock armored crossings, see THP pages 27 through 32. According to the THP, the rock armor would generally consist of 12- to 36-inch diameter rock.

CAL FIRE Inspector: For all permanent crossings, please evaluated if they appear to be adequately designed to accommodate the expected 100-year flood flow plus associated sediment and debris. Moreover, please evaluate if the size and thickness of the proposed rock armor is adequate to resist substantial scour during the expected 100-year flood.

CGS Response: A representative sample of the proposed rock armored crossings was evaluated during the PHI. Where observed, the channels are approximately 2 to 8 feet wide, incised 2 to 4 feet, with gentle to moderate gradients. In addition, most of the crossings consist of either under-sized and/or damaged culverts or native surface fords that have scoured the existing road surface.

According to the THP, the new culverts will be sized to accommodate the 100-year flood flow and the rock armor will consist of 36-inch diameter rock. In addition, the native surface fords will be upgraded to rocked fords composed of a 2-inch diameter rocked running surface, and the outfalls will be armored with 12-inch diameter rock. Based on observations during the PHI, the majority of the proposed crossings appear appropriately designed to accommodate the expected 100-year flood flow plus associated sediment and no specific recommendations were made. However, during the PHI, excessive scour was observed within the outfalls of several existing fords. Therefore, it was discussed between the RPF and agency staff to increase the size of the rock armor at several crossings to 12 -to 36-inch diameter rock. These locations are discussed further in CAL FIRE PHI report (Pedersen, 2017).

General Observations:

A review of the local geology and soils in the field agreed with available published information (see References). Bedrock observed within the THP area is primarily composed of competent volcanic rocks (Qvp^{a}), (Qvp^{b}), (Qvp^{r}) and (Qpv^{p}). Soils in the THP area are primarily thin (less than 2 feet thick) in higher elevations to moderately thick (2 to 5 feet thick) in the lower elevations and are composed of mostly low-plastic clays with varying amounts of sand, gravel and cobble.

Slopes within the THP area range from horizontal to about 75 percent in gradient, with the majority of slopes between 25 and 35 percent, and are vegetated with a mixed stand of conifer trees ranging in size from 12 to 36 inches in diameter at breast height (DBH). Where not previously altered by ground disturbance associated with road building and skid trail construction, most of the slopes exhibit smooth rounded topography without significant geomorphic evidence, such as abrupt irregular to hummocky slope morphology, indicative of slope instability.

Based on our field review, the THP generally appears to adequately describe the existing slope stability and soil erosion conditions in the THP area and, unless specifically addressed below, the proposed silvicultural activities appear suitable for the site conditions. The proposed timber harvest operations are not anticipated to adversely impact regional slope stability.

Specific Observations:

CGS-1 / THP Crossings 48 (Figure 3): CGS-1 refers to a proposed 40-foot long engineered bridge to span across Digger Creek, a Class I watercourse that flows through Section 28 of the THP area (Figure 3).

Based on our observations in the vicinity of the crossing, the active channel is approximately 10 to 20 feet wide, incised 4 to 6 feet, with a gentle gradient (i.e. less than 4 percent). The substrate generally consists of gravelly sands (SP), with cobbles and boulders. A generally open to moderately dense vegetative cover of conifers was observed growing adjacent to the watercourse and terrace deposits were not observed. In addition, evidence of recent high flows (i.e. woody debris) was not observed. However, minor slumping (i.e. less than 2 feet) was observed along the eastern bank of the watercourse in the vicinity of the proposed bridge.

Hydrology and hydraulic calculations for the proposed bridge crossing and a scaled cross section showing the anticipated 100-year flood elevation relative to the proposed channel cross-section is provided in the THP. Based on observations in the field, the information provided appears to be an accurate depiction of the existing site conditions and no additional recommendations were made. However, based on the observed slumping along the eastern channel bank, a recommendation was made to excavate the material and armor the channel bank, see CGS-1 under Specific Recommendations below.

General Recommendations:

None.

Specific Recommendations:

CGS-1: As part of the proposed bridge construction, the RPF shall excavate the unconsolidated material along the eastern channel bank to a slope inclination of (1H:1V) (Horizontal:Vertical). In addition, the slope shall be armored with 12- to 36-inch diameter rock that shall be keyed into the toe of the slope.

Original signed by:

PROFESSIONAL GEOLOGIST
C. J. Gryszan
No. 2640
CERTIFIED ENGINEERING GEOLOGIST
STATE OF CALIFORNIA

Christopher J. Gryszan, CEG 2640
Engineering Geologist
Redding, California

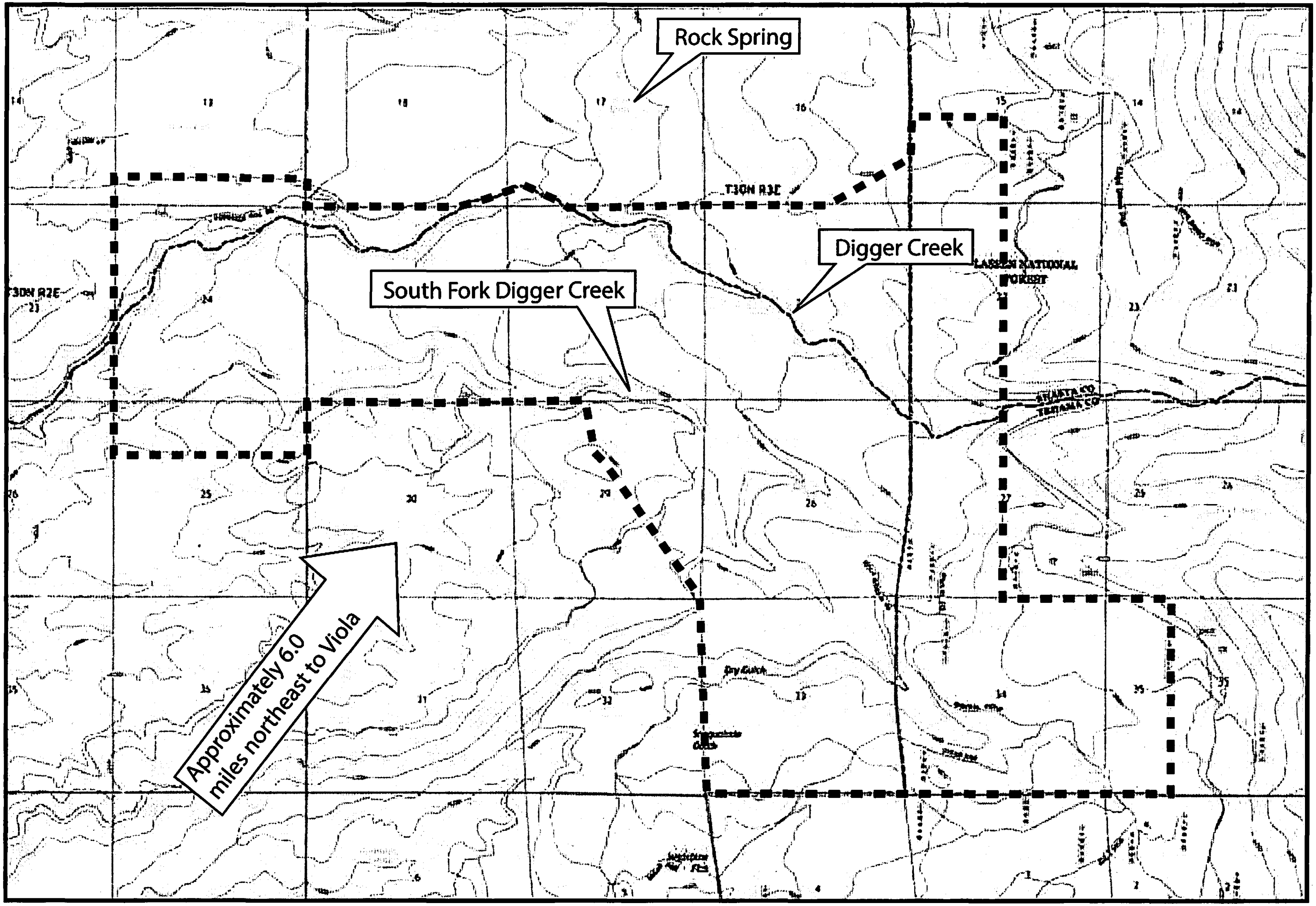
Concur:

November 20, 2017   Original Signed by:

PROFESSIONAL GEOLOGIST
D. N. Lindsay
No. 2323
CERTIFIED ENGINEERING GEOLOGIST
STATE OF CALIFORNIA

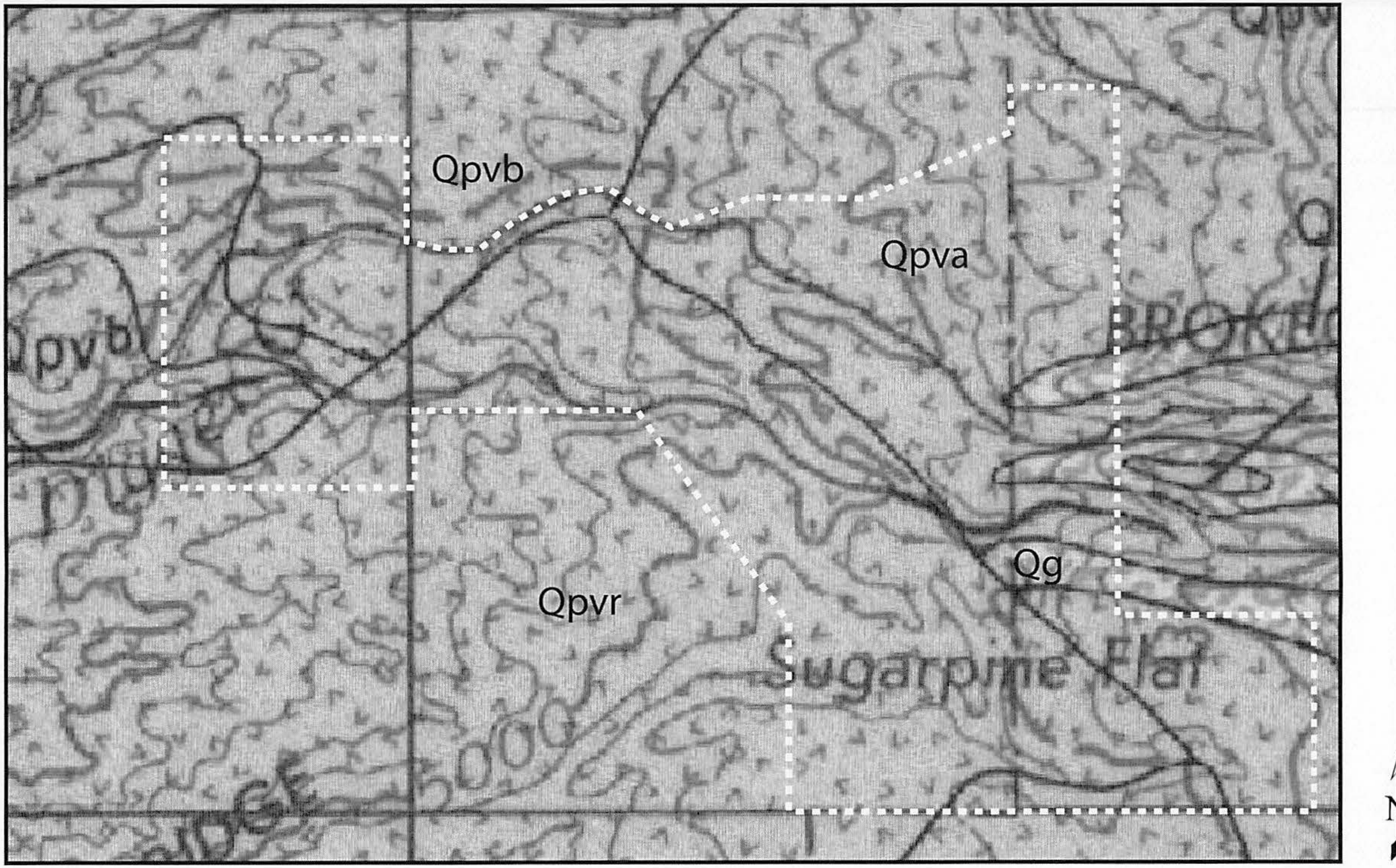
Date   Donald N. Lindsay, CEG 2323
Senior Engineering Geologist
Redding, California

Attachment:
Figure 1: Vicinity Map
Figure 2: Regional Geologic Map
Figure 3: CGS Reference Point Map



Date: 11/20/2017	Vicinity Map To Accompany Engineering Geologic Review of THP 2-17-070-SHA	Figure: 1	Approximate THP Area
Scale: 1" = 3,771'			
Approved By: Chris Gryszan, CGS			Base Map: Modified from USGS, 2015, Topographic Map of the Grays Peak and Lassen Peak 7.5' Quadrangles, 1:24,000, downloaded from www.NationalMap.gov.

N



Explanation

Approximate THP area

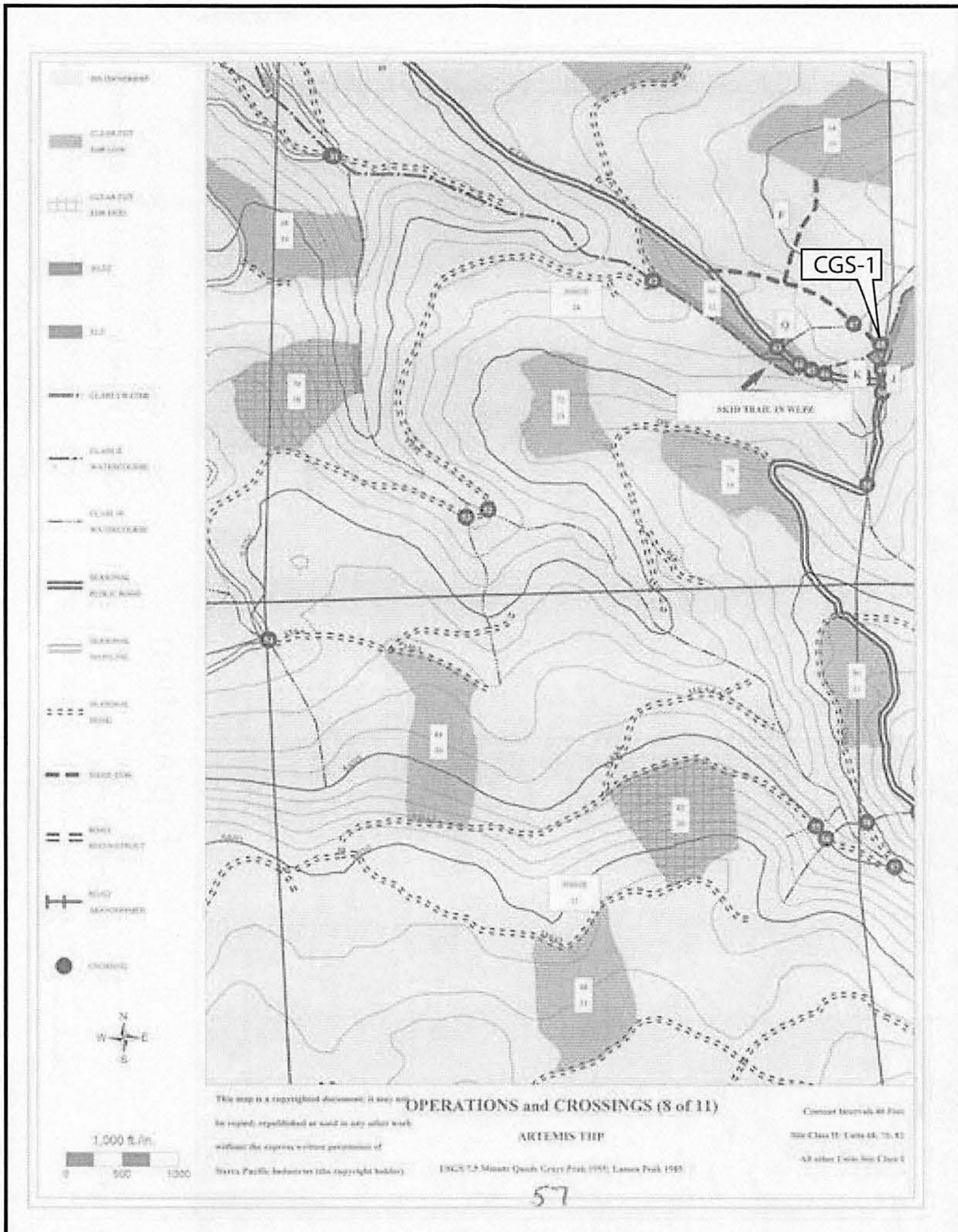
Geologic contact, dashed where approximately located

Fault; dotted where concealed; teeth on upper plate where thrust

Qg	Glacial deposits (Quaternary)
Qpva	Volcanic rock, andesite (Pleistocene)
Qpvb	Volcanic rock, basalt (Pleistocene)
Qpvr	Volcanic rock, rhyolite (Pleistocene)

Date: 11/20/2017	Regional Geologic Map To Accompany Engineering Geologic Review of THP 2-17-070-SHA	Figure: 2
Scale: 1" = 3,520'		
Approved By: Chris Gryszan, CGS		

Base Map: Modified from Lydon, P.A., Gay, T.E., and Jennings, C.W. (compilers), 1960 Geologic map of California: Westwood Sheet: California Division of Mines and Geology, scale 1:250,000.



Explanation

CGS-1 CGS Reference Point

Date:11/20/2017	CGS Reference Point Map	Figure:
Scale: 1" = 1,280'	To Accompany	3
Approved By:	Engineering Geologic Review of	
C. Gryszan, CGS	THP 2-17-070-SHA	

COMMENTS AND CORRECTIONS ON: UNIVERSITY OF CALIFORNIA WILDLAND RESOURCE CENTER REPORT NO. 46 "A SCIENTIFIC BASIS FOR THE PREDICTION OF CUMULATIVE WATERSHED EFFECTS"

California Department of Forestry and Fire Protection
Forest Practice Program

April 2003

Table of Contents

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Overview

Members of the UC Committee should be commended for their willingness to contribute time and expertise to the difficult question of how to assess cumulative impacts of forestry activities. However, with constraints on time and funding, the Committee did not have the benefit of background information about California's Forest Practice Program that could have prevented misconceptions and allowed a more thorough consideration of recommendations.

The recommended use of modeling to evaluate the risk of cumulative effects from different scenarios of timber operations and climatic stress could be very helpful in identifying differences between various watershed-wide timber harvesting alternatives. Unfortunately, the Committee's Report does not recognize many of the past and on-going efforts by the Department of Forestry and Fire Protection (CDF) to address cumulative watershed effects (CWEs), and the proposed use of modeling overlooks many serious deficiencies that have prevented agencies from using this approach in regulatory programs. The Report's criticism of current agency efforts also fails to recognize cases where modeling could complement or be integrated into existing programs.

The only reasonable conclusion that can be drawn from information and examples cited in the Report's Appendix is that currently available models are not adequate for prediction of cumulative watershed effects. As a result, the Committee's proposed approach cannot be substituted for current timber harvesting plan (THP) assessments. This does not mean that we should not investigate the modeling approach for future applications or conduct pilot studies. But it does clearly indicate that we should not rely on current models to make land use decisions.

It is also possible that there is a philosophical difference in approach that leads academic reviewers to favor new, but unverified, methods of decision making, while agencies place more reliance on tangible research results to guide the development of practices that are used to regulate the activities of private landowners. In contrast to the UC Committee's description of CDF's past efforts, the Department has actively promoted and supported research related to the potential on-site and cumulative impacts of timber operations in California (Dodge et al 1976, Peters and Litwin 1983, Durgin et al 1988, Lewis and Rice 1989, Euphrat 1992, Hawkins and Dobrowolski 1994, Rice 1996, Ziemer 1998, and MacDonald and Coe 2001, to name a few) and has been open to the development and application of workable cumulative impacts assessment methods. These and other studies of erosion sources and causes of large erosion events have been used to improve California's Forest Practice Rules. The Department's studies of cumulative effects have not found major impacts related to modern harvesting practices (Hawkins and Dobrowolski 1994, Bottorff and Knight 1996, Dahlgren 1998, Ziemer 1998, Holloway et al. 1998). However, data developed as part of the Caspar Creek watershed studies has shown that there can be downstream effects on both base and peak flows. Past research and reviews have not provided workable CWE models (Reid 1993), and the UC Committee's proposal is an approach to analyzing cumulative effects, rather than a currently available method, with an expectation that operational models can be developed after more research.

Some of the Committee's criticisms and concerns appear to have come from lack of information about the Forest Practice Rules, the THP review process, and the role of the California Environmental Quality Act (CEQA) in setting standards for cumulative impacts assessment. It is unfortunate that the UC Committee did not interview CDF's watershed staff or the California Geologic Survey (CGS) THP review staff, who have been major contributors to the Department's efforts in dealing with cumulative impacts. CDF and CGS staff could have provided background information and answered questions that might have avoided misconceptions and errors in the Report's findings and conclusions. This lack of communication has led to a one-sided view of forest practice regulation, and the Committee has also strayed far from the task of assessing cumulative impacts with poorly informed comments about agency abilities and behavior.

The following observations on the UC Committee's Report are lengthy because there are numerous inconsistencies and points of concern. Comments on similar topics from throughout the Report have been grouped together as shown in the Table of Contents. Specific items of concern are referenced using the chapter number, appendix section (where appropriate), page number and the paragraph number to identify the location of the statement or issue in the hardcopy version of the Report. This gives a reference with the following parts:

(Chapter # - Appendix section - Page # - Paragraph #).

It is hoped that this review will answer some of the questions raised in the UC Committee's Report and will contribute toward greater focus on realistic improvements in cumulative impact assessment that meet both statutory requirements and the need for environmental protection.

CEQA Process

The Committee's suggestion that CWE analysis for policy making be separated from CWE analysis for THP approval or that the responsibility for review of CWE assessments be taken out of CDF and the Forest Practice Program (ES-1-1, C5- 52-2, C7-61-#1, C7-61-#2) needs to be considered in relation to the purpose for conducting these assessments. The requirement for including CWE assessments in THPs is based on legislative and judicial direction that discretionary approval by CDF makes these projects subject to provisions of the California Environmental Quality Act (CEQA), with CDF designated as the lead agency for project review. The required standards, and limitations, for cumulative impacts analysis are contained in both the California Public Resources Code and the CEQA Guidelines (CELSOC 2002). Section 15130(b) of the CEQA Guidelines states that:

> "The discussion of cumulative impacts shall reflect the severity of the impacts and their likelihood of occurrence, but the discussion need not provide as great detail as is provided of the effects attributable to the project alone. The discussion should be guided by the standards of practicality and reasonableness."

Section 15130(b) also specifies the elements that "are necessary to an adequate discussion of cumulative impacts." These include:

> "(1)(A) A list of past, present, and reasonably anticipated future projects producing related or cumulative impacts, including those projects outside the control of the agency, …
> "(2) A summary of the expected environmental effects to be produced by those projects with specific reference to additional information stating where that information is available, and
> "(3) A reasonable analysis of the cumulative impacts of the relevant projects. …"

The standards for adequacy of the EIR, which includes its cumulative impacts analysis, are given in CEQA Guidelines Section 15151 as follows:

> "An EIR should be prepared with a sufficient degree of analysis to provide decision makers with information which enables them to make a decision which intelligently takes account of environmental consequences. An evaluation of the environmental effects of a proposed project need not be exhaustive, but the sufficiency of an EIR is to be reviewed in the light of what is reasonably feasible. Disagreement among experts does not make an EIR inadequate, but the EIR should summarize the main points of disagreement among the experts. The courts have looked not for perfection but for adequacy, completeness, and a good faith effort at full disclosure."

In addition, Section 15149(b) of the Guidelines states that:

> "In its intended usage, an EIR is not a technical document that can be prepared only by a registered professional. The EIR serves as a public disclosure document explaining the effects of the proposed project on the environment, alternatives to the project, and ways to minimize adverse effects and to increase beneficial effects. …"

In other words, CEQA requires:

- Identification of past, present and reasonably anticipated projects related to the environmental effects being considered.
- Identification of other information used in the analysis.
- A summary of expected effects.
- A reasonable analysis that 1) does not require the same level of detail as project specific impacts, 2) is guided by the standards of practicality and reasonableness for the project under review, and (3) provides information that allows a decision that intelligently accounts for environmental consequences.

CDF's authority to require a specific cumulative impacts analysis under current Forest Practice Rules is further constrained by the court ruling in East Bay Municipal Utilities District (EBMUD) vs. CDF (1993), which found that the Department had created an underground regulation when it used the CDF Guidelines for Cumulative Impacts as a standard of comparison to judge the adequacy cumulative impacts assessments included in submitted THPs.

This discussion illustrates that the scope and purpose of the project level analysis required under CEQA is different than the separate, watershed wide program proposed in Recommendation #1 of the UC Committee's Report. Therefore, the state needs to decide if it wants to establish a new program to analyze cumulative watershed effects that is not required for CEQA project review – keeping in mind that other legislation may require more protection for resources affected by timber harvesting than is specified in CEQA.

THP Process

The UC Committee Report includes several misconceptions about the THP Process, including the statement that neither applicants nor CDF regulators recognize that any significantly adverse, cumulative effects are likely to result from timber harvest (C4-21-3). The THP development and review process is intended to produce harvesting plans with few impacts, and these plans are revised during both preparation and review to prevent or reduce potentially significant effects; so it should not be surprising that plan submitters and CDF do not report the presence of significant impacts in proposed and approved plans, respectively.

In addition, the UC Committee has stated that the Department is responsible for arguing on behalf of plan submitters when a THP is challenged by the public or in court (C4-18-

1, C4-21-4). This is not correct. In disputes about THPs with other agencies and in court, the Department supports its own decisions about plan approval and the decision making process, rather than advocating on behalf of the plan or plan submitter. In reaching a decision, however, CDF must often chose between positions taken by plan submitters in support of their proposed activities and the positions of agencies who are advocates for other resource values. As the lead agency for approving THPs, CDF has the responsibility for identifying potentially significant impacts, deciding on what mitigations to require, and supporting these decisions. This frequently results in changes to submitted THPs. In contrast, other agencies are free to criticize without the responsibility of demonstrating the need for or the feasibility of their recommendations – including the need for complex CWE analyses in light of less stringent regulatory requirements.

A related comment by the UC Committee refers to the defense of THPs by CDF and CGS against public challenge (C6-55-3). It is not clear what this means, but if it is a reference to the Department’s response to comments that is prepared for each THP, CDF is required by law and legal precedent to respond to significant issues raised by the public in comments on a given THP. This is not a post-approval defense of the THP, and THPs are frequently revised to address significant concerns raised by CDF, other agencies, and the public prior to plan approval and preparation of the Department’s official response.

The UC Committee is also recommending that the Department’s decisions about impact significance be based on an analysis of risk (C5-31-1 and C5-32-4). This suggestion makes sense because the interaction between landscape and the climatic events that drive watershed events are best described in terms of probability. However, the regulatory criteria for assessing environmental conditions are generally expressed in terms of quantitative limits rather than the risk that the criteria will be exceeded.

CWE Regulatory Requirements

The UC Committee members have not had the benefit of experience with preparing timber harvesting plans, so it is not surprising that they are not familiar with Forest Practice Rule requirements for preparing CWE assessments or how the THP process works. Therefore, it is unfortunate that the Committee did not interview or otherwise discuss CDF’s cumulative impacts assessment process with members of the Department’s watershed staff, which could have allowed misconceptions and errors to be addressed prior to publication of the Report.

Two minor corrections to the Committee’s findings are that the requirement for including CWE assessments in THPs was established by a court decision in 1985, rather than 1974 (C1-6-4), and it is not true that “other rules do not mention cumulative effects directly …” (C3-10-3). There are several references to cumulative impacts in the Rules, including an entire section describing the requirements for cumulative impacts assessment, which the Committee does cite in other sections of its Report.

The Committee is correct that Technical Rule Addendum No. 2 does not include a methodology (C6-55-4). They miss the point, however, that this was done on purpose by the State Board of Forestry and Fire Protection (BOF), because the only off-the-shelf method available when these rules were adopted was the USFS Equivalent Roaded Area method, which is not well correlated with instream conditions (Roby 1991). It is also inaccurate to state that "CDF and resource agencies in other states have been unable to promulgate any defensible methodology for defining the presence and source of any CWE, even when they have consulted the scientific community" (C3-14-1). Although the methods used in THPs apparently do not measure up to the standards of the UC Committee, they have been found to meet the CEQA standards for which these assessments are conducted (East Bay Municipal Utilities District v. CDF 1993). This does not mean that improvements are not needed, but the UC Committee's proposal is a hypothetical approach that does not provide a workable method for conducting CWE analyses. Even a quick reading of the Report's Appendix shows that models are not currently available to implement the recommended approach (see additional comments under "Modeling Limitations"), which means that the Committee has left the development of models and procedures needed to implement its recommendations to the future efforts of others.

The UC Committee's statement that THP preparers are simply asked if they recognize the possibility of CWEs is not accurate, and their characterization of the required assessment area and use of mitigation is also incorrect (C1-5-3). Each THP must include an affirmative statement that the proposed timber operations will not create or add to significant impacts. The assessment area for making this determination is required to be an area where cumulative impacts are most likely to be significant, and mitigation is specified to eliminate or reduce those impacts that could create or contribute to significant cumulative impacts. In addition, the statement that "virtually no one filing a THP admits to the presence of any CWE" (C314-1) does not recognize that many THPs identify the presence of potential cumulative impacts and provide mitigations to prevent or offset any significant increase related to the proposed timber operations.

The UC Committee also incorrectly states that the terms "significant" and "adverse" are not defined (C6-55-2). These terms are defined in CEQA and the CEQA Guidelines through the phrase "significant effect on the environment," which is described as "a substantial, or potentially substantial, adverse change in the environment." This definition is admittedly not very helpful, but it not under the jurisdiction of the BOF or CDF, and legislation would be required to change it. However, the UC Committee's subsequent statement that "This often makes prevention of negative CWEs unenforceable" is wrong. CWE requirements are made enforceable by language incorporated into THPs requiring specific mitigation measures or other actions to prevent or reduce problems that were determined to be significant in the plan approval process.

The UC Committee's description of the connection between the Regional Water Quality Control Boards' waste discharge permit process and the THP process (C6-54-Legal Impediments) is also not correct. Agencies are not granted waivers. Instead, CDF and the State Water Resources Control Board have entered into a Management Agency Agreement that authorizes the Department to oversee state non-point pollution requirements, with Regional Boards retaining the ability to require waste discharge permits.

The Committee comment that requiring release of pesticides from two or more locations as a criteria for identifying CWEs in Technical Rule Addendum No. 2 "appears to be an example of misdirected complexity that could overlook direct effects of these contaminants originating from a single location" (A-VIII-100-2) shows a lack of understanding of state pesticide regulations and misses the point of cumulative impacts. The direct impacts of pesticide application are regulated by the California Environmental Protection Agency under a separate permitting process, which is administered by County Agricultural Commissioners and is not controlled by CDF. TRA No. 2 focuses on release of contaminants from two or more locations to address the potential cumulative, as opposed to direct, impacts of contaminant releases.

The UC Committee concludes its comments about pesticides with the following paragraph (A-VIII-100-3):

> "However, the application of forest herbicides is rarely addressed in THPs. Application rates are not well documented and effects on biota are generally unknown except in laboratory situations. There is a lack of monitoring data, except for the few studies conducted that have shown little or no evidence of transfer of pesticide residues to aquatic ecosystems or animals. There is also no predictive modeling capability. It is suspected that fat-soluble pesticide constituents may be transferred by runoff from roads that are sealed with oil, but there are few of these in the north coast of California and no experiments have yet been conducted to measure biological responses to this potential source. Even consistent and credible, qualitative predictions of watershed-scale effects of pesticide application await resolution of some of these technical issues, but the CWE modeling efforts of runoff and sediment transfer into aquatic habitat outlined above could provide a framework for field studies that might yield some predictive capacity."

This is a convoluted criticism of the Department's process for analysis of cumulative impacts that does not account for the label requirements for applying herbicides and pesticides, monitoring requirements for aerial applications, and the County Commissioner's role in the permit process. The concern about lack of information about potential pesticide impacts in current CWE assessments is contradicted by the statement that available studies "have shown little or no evidence of transfer of pesticide residues to aquatic ecosystems or animals" and, at the same time, this analysis is found to be infeasible since "There is also no predictive modeling capability." Then the Committee goes on to criticize the current CWE analysis process for not providing the framework for a research project to test a hypothesis that road oil might mobilize fat soluble pesticides. At best, this seems to have slipped off the topic of CWE assessments for THPs.

Forest Practice Rule Requirements

The UC Committee conclusion that the Forest Practice Rules are not backed by empirical studies (C6-55-4) either ignores or dismisses the work of many well qualified experts in forestry, hydrology, geology, soils, and other fields related to natural resource management over a period of more than 25 years. These scientists and agency specialists have relied on the best available published literature to guide the development of Forest Practice Rules, and CDF has both directly sponsored and participated as a cooperator in many studies that have led to a better understanding of landscape responses to timber harvesting. However, research is not available to answer all questions, and science often does not provide clear thresholds to make decisions about limits and cut-off points, which must then be based on the best judgment of the BOF and RPFs applying the Rules.

The date and details of changes to WLPZ widths described by the UC Committee (A-II-80-4 and A-II-83-1) are incorrect. And although the Report's description of potential reductions in riparian zone composition with multiple operations is mathematically accurate, CDF does not interpreted the Rules to allow such progressive reductions, and the Department's Hillslope Monitoring Project (Cafferata and Munn 2002) has not found the large decreases in WLPZ canopy that would accompany reductions in basal areas from "100% to 25% to 6%" for Class I watercourses, as listed by the UC Committee. In fact, this serves as a good example of how even simple modeling outcomes can be driven to false conclusions by incorrect assumptions.

The follow-up comments that the effectiveness of the watercourse and lake protection zone rules has never been established (A-II-80-4, and A-II-83-2) are also incorrect. Rule compliance and the effectiveness of Class I and II WLPZs in maintaining required canopy levels and the frequency of disturbance features such as gullies and bare areas is being determined as part of CDF's Hillslope Monitoring Project (Cafferata and Munn 2002). Measurement of Class III watercourse conditions has begun more recently, but the UC Committee statement that "the effectiveness of current regulations for ensuring woody debris recruitment is certainly very low" (A-II-80-4) both presumes an outcome and assumes that woody debris requirements for these non-fish bearing and ephemeral channels are well established when, in fact, this is still being determined.

The UC Committee comments that "There is an escape from every rule" (C3-14-1) and "virtually all rules are written with escape clauses" (C4-21-3) show a lack of understanding of both the requirements and application of the Forest Practice Rules. In fact, relatively few rules allow exceptions or in-lieu practices, and these require equal or better protection along with explanation and justification in the THP. Additionally, the requirements for proposing and justifying alternatives to the standard watercourse and lake protection rules, as specified in 14CCR Section 916.6, are very difficult to meet; and alternatives to the harvesting practices rules (14 CCR Section 914.9) must be approved by all agencies involved in the THP review process. It is worth noting at this point that the Rules are also frequently criticized as lacking flexibility to meet site specific conditions.

The Report section on “Conceptual impediments” (C6-55-4) includes many criticisms that are addressed elsewhere in this review. However, the part titled “Excessive reliance on rule-making rather than problem solving” (C6-55-4) needs to be specifically addressed. CDF cannot impose requirements on property owners that fall outside of authorities contained in state law and the Forest Practice Rules, which are developed by the BOF under authority included in the Forest Practice Act and must follow requirements for promulgating regulations specified in the state Administrative Procedures Act. One of the tenets of representative democracy is that government is supposed to follow the law, as laid down by the voter’s elected representatives, despite the inconvenience that this may cause agencies and other interested parties.

CWE Assessment

The need for larger CWE assessment areas is a central theme of the UC Committee’s report (C4-24-1). However, the Report does not account for the scope of the project under review. The assessment area used for THPs is constrained by both the scale of the project and the potential to detect impacts from one or more projects. It is, of course, true that sediment from a THP will travel downstream. But at some point, the connection between upstream sources and downstream impacts, whether measured or modeled, becomes so tenuous in large watersheds that it can no longer provide a reasonable basis for decisions about plan approval.

For example, the analysis area of 40-80 square miles (25,000 to 50,000 acres) recommended by the UC Committee (C5-43-4) does not recognize many situations where smaller watersheds drain into large rivers where it makes more sense to concentrate on the smaller watershed while also considering the downstream condition of the receiving channel.

Relieving THP submitters from the responsibility for “basin-wide” analysis (C5-29-1) does make sense, because this is beyond the scope of reasonable review for individual THP projects. However, the presence of a watershed wide assessment, by itself, does not relieve plan submitters from the CEQA requirement for CWE assessment. In addition, the UC Committee at this point recognizes that a separate process is needed for these larger scale inventories and assessments, but is still critical of THP assessments for not accomplishing what they are not designed or required to do (C4-23-8). This criticism is, at best, disingenuous. And a state-sponsored program of multi-disciplinary watershed analysis for CWEs (C3-17-2) could easily turn into an extremely large and low utility undertaking if it isn’t preceded by some recognition of overall landscape sensitivity that would direct more intensive analyses to areas where the “risk” of cumulative impacts justifies such an effort.

The results of basin-wide assessments are usually constrained by the level of detail of inventory information available for resources that need to be considered. This is why assessments covering large areas, such as Sustained Yield Plans (SYPs), do not usually include CWE analyses that can be used with individual THPs. Faced with local analyses that do not adequately deal with big picture issues, and basin-wide analyses that are too general to evaluate local impacts, the best approach would be to use basin wide analyses to identify potential impacts on downstream resources and to incorporate information from these smaller scale analyses into plan-specific assessments that can be used to determine how proposed activities will or will not contribute to cumulative impacts.

Assembling a digital database on “the spatial pattern of physical, chemical, biological and socio-economic properties of California landscapes” along with “Digital maps of topography, stream channel networks, lithology, landslides (from CGS or other sources), roads and skid trail, fish distribution, vegetative cover, and THP submissions” and then combining these into “a common geographic framework” (A-IX-100-4) would not be a trivial or simple task. In effect, the UC Committee is asking for a complete, digital landscape description. This data is going to vary in availability, quality, formats, scale, registration, and a myriad of other ways that make putting it together in a useful way extremely difficult. It should be recognized that going through the time and expense of developing this digital watershed database is not necessary to make generalized interpretations about potential salmonid habitat. And the suggestion of using computerized tools to generate interpretations to make region-wide comparisons of watersheds (C5-51-3) would require assembling a database for the entire North Coast.

The state may chose to implement a program to “correctly formulate predictions of how land use affects water quality, biodiversity, and other resources at a whole-watershed scale” as recommended by the UC Committee (C7-61-#2), but this would be well beyond the scope of CEQA compliance. However, the Department must also meet conditions mandated by the Endangered Species Act and water quality standards that can go beyond CEQA requirements. But it should be recognized at the outset that a new program established in response to this recommendation would be primarily involved with research and development activities that may or may not lead to useful products and that this should build on the work of existing efforts, such as North Coast Watershed Assessment Program.

A program requiring 3 PhD employees, 5 Masters Degree employees, some field technicians, and several GIS specialists (C5-43-2) along with analysts, clerical staff, a significant computing environment, office space, and vehicles would easily cost more than $1,500,000 per year, not counting start-up costs. Before asking for new or redirected fees to finance this new CWE technical unit and related research activities

(C7-63-#8), a specific plan of action should be prepared in addition to the recommended plan for funding.

With the body of the report focusing on cumulative watershed effects, which was the purpose of the undertaking, it is surprising that the first and very lengthy description of modeling methods deals with terrestrial wildlife (A-I-76-2). If the recommended Scientific Committee and CWE modeling effort are expected to deal with terrestrial wildlife in addition to water-related issues, it will greatly expand the number of Committee members and data needed to implement the proposed program.

Including the effect of roads and skid trails on increasing large flood flows as a component of CWE analysis (C3-15-3) is hypothetically possible, but has yet to be demonstrated or quantified. And the UC Committee's discussion of the effect of timber harvesting on flood runoff (C3-15-4 through 16-1) seems to be saying that we can't measure this effect, so we will predict it, then establish risk based on what we think is happening but can't actually determine. This level of certainty does not create much confidence for making decisions about land use.

The UC Committee is also proposing the use of generalized models to "assign" specific timber harvesting prescriptions before the watershed analysis work is done (A-IX-101-4). This leap from cumulative effects analysis to developing site specific prescriptions is hard to justify considering the Committee's listing of problems with the available models.

CDF agrees with the UC Committee's conclusion about the inadvisability of relying on threshold values in CWE analysis (C5-36-2, C6-56-2). It is not clear how the UC Committee concluded that CDF has a different view.

The UC Committee conclusion that THPs use mitigation to avoid acknowledging cumulative effects (C6-56-3) is incorrect. Many THPs conclude that the potential for creating or adding to existing CWEs is "no with mitigation". This clearly acknowledges that CWEs are possible and indicates that something has been done about them. Whether the UC Committee agrees that on-site and off-setting mitigation works or not, it should at least recognize that the issue was identified.

Modeling Limitations

The UC Committee's statement that "The process of constructing conceptual models should not be seen as a complicated or exclusive process" (C5-47-2) would seem to indicate that constructing the models needed to implement their recommendations is a simple task. But after further discussion, the task becomes more complicated, with "a tremendous amount of work to be done just to implement a number of these linked models to predict CWEs for a single watershed" and "In the appendix, we will also refer to issues for which modeling is still in a crude state, employing statistical and other empirical rules transferred to the site from elsewhere. These are subjects requiring research …" (C5-50-3). In fact, information in the Appendix clearly indicates that few, if any, of the recommended models are capable of even stand-alone application. The take-home message from this seems to be that conceiving the model is easy, but developing working models is hard and will require research. In other words, the UC Committee is recommending a research project from which useful models may someday emerge. This is clearly beyond the CEQA requirements for CWE assessment.

The UC Committee concept of matching model complexity to "the sophistication of our understanding and data available for calibration or testing" (C5-49-2) creates a situation where models would be relying on currently available data of questionable accuracy, with gaps in data availability for key resources. This is certain to result in unreliable outcomes, while obtaining data of adequate scope and better quality would be very time consuming and expensive.

The discussion about using spatial databases and remote sensing tools (C5-44-1) recognizes the difficulty of acquiring data for analysis and that there will be gaps in data, but still concludes that models of unknown reliability combined with low resolution remotely sensed data can be used to assess risk and restrict land use. The effort and expense of any such program needs to be considered with the understanding that the resulting "predictions of models will not be precise" (C5-50-2). And it is not clear what is achieved by expressing communal understanding through "computing their best estimate of the consequences of that belief" (C5-50-2)?

The UC Committee seems unwilling to accept qualitative evaluations of physical watershed conditions and impacts, as are used in CDF's CWE Guidelines (CDF 1994), but then finds similarly qualitative assessments as being adequate for making "generalizations" about the effects of watershed conditions on aquatic populations (A-VII-93-3). This means that after the time, effort, and expense of model creation, data collection, and model running, final interpretations would still be based on professional judgment. But in this case, it would be the judgment those developing and using models, rather than experienced RPFs who are familiar with the project site. And the implication of this section is that these judgments will not include the effects of downstream conditions on fish populations, which defeats a primary objective of conducting more quantitative analysis.

The UC Committee's recognition that models can be used imperfectly as well as responsibly (C5-Modeling-35-4) points out the influence of both model developers and users on predicted outcomes. The Committee describes the model parameterization process as "estimating coefficients that represent the average behavior of various small-scale mechanisms that are too fine-grained for the model to represent explicitly" (A-III-84-2), which comes down to assigning values to model coefficients that cause the model to give expected outputs. Even with the best of intentions, the assignment of coefficients and parameters will reflect the judgment of the model developers about how the world should work and the consequences of management activities. And the transference of model coefficients (A-III-85-3) based on the skill, experience, and viewpoints of the modeler would simply replace the judgment of field personnel with the judgment of model developers and users.

More specifically, the UC Committee is proposing that models be used to determine the "spatially registered calculation of risk to resources such as biodiversity, ecosystem functioning, and water quality" to "distill policies about allowable rates of cutting, differential requirements for BMPS … and other guidelines, depending on the risk they are willing to accommodate" (C5-29-3). In each of these cases (biodiversity, ecosystem function, and water quality), predictions will require linking separate models that represent different ecosystem and watershed functions, and then comparing outputs to criteria establishing risk. This approach may provide useful information about how the world might work for a given set of assumptions, but it has serious limitations as a predictive tool for land management. Each of the assumptions and relationships built into a model has its own range of uncertainty and potential errors, and the accumulation of this uncertainty for all of the model components leads to much greater potential prediction errors. And when model predictions exceed our quantitative experience with the variable being predicted, or the range of data on which component relationships have been established, the determination of whether predicted outcomes are reasonable must be based on individual judgments that are not backed up by data or experience. The UC Committee confirms these problems when it states that "Unfortunately, the technical state of the art of environmental prediction is, and for the foreseeable future will be, unable to avoid large uncertainties" (C5-30-3), and the discussion of model misuse (C5-36-2) describes further difficulties in assigning values to variables and parameters (C5-36-3). As a result, watershed models can be useful for investigating relationships and refining questions, but they do not, as yet, provide good decision making tools.

The scenario described by the UC Committee for predicting harvesting and road effects on flood peaks and sediment transport (A-III-85-1) serves as an example of the complications faced even in those situations where individual processes (such as evaporation, compaction, and infiltration) are well understood. The question of runoff generation from harvest units may be answered with some confidence by available models, but adding the effects of roads on runoff generation adds much uncertainty to model results because of large differences in road system configurations and because the relationship between roads and runoff is not well established. Using these modeled flows to predict sediment production and transport adds more uncertainty because sediment inputs are very difficult to predict, the point at which bedload transport is initiated varies with the changes in channel characteristics along the length of the stream, and channel transport capacity varies with flow, channel characteristics, and the nature of the load being carried. In addition, the relationship between flow and risk is not easy to establish for these processes. Return periods for flows are known for some streams and can be modeled based on anticipated or assumed rainfall characteristics for others. But data from which to extrapolate sediment production return periods or other criteria for expressing the risk are much harder to come by.

The UC Committee's risk based decision making approach (C5-31-1) also suffers from the problem that the large errors in model outcomes, as described above, are translated directly into the prediction of risk. And the recognized unreliability of numeric predictions (C5-36-2) combined with limitations on information available for assigning risk to extreme climatic events and to effects on individual species (C5-36-3 and A-VII-93-3) make it even more difficult for models generate trustworthy estimates of risk for decision making. In addition, this uncertainty increases as the geographic area shrinks toward a determination of the risk at any particular site (e.g., we may be certain that landslides will occur every year in a large area, but we don't know where for any given year). So predicting quantitative differences in risk, which requires a comparison of numeric outcomes, becomes problematic. In other words, one cannot reliably base a decision on differences in risk if there is no confidence in the predictions. Instead, we end up with risk evaluations that are no better than the current practice of avoiding or modifying practices on potential problem sites. However, modeling based on relationships established from data can provide a valuable tool for identifying those site characteristics and combinations of characteristics where avoidance or modification of practices should be applied, which links modeled risk to the site specific application of Forest Practice Rules and THP mitigations.

The statement that "The whole watershed view of the CWE problem requires that broad patterns of risk be computable" (C5-50-1) captures the main difficulty in relying on the Report recommendations. If this were easy or clearly feasible, it would have already been done. In fact, the Committee is recommending an expensive experiment to see if such an approach will work. This is clearly beyond the scope of what is envisioned in CEQA and the Forest Practice Act.

While the UC Committee's concerns about the effects of time lags and the difficulty of measuring downstream impacts (A-X-103-2) are certainly true, this serves an example of the problems involved in verifying results of CWE modeling. The Team's basic recommendation is to use process based models to predict CWEs in large watersheds. Therefore, it is the modeled CWE projections, rather than individual processes, that need to be verified by monitoring. However, the UC Committee indicates that such monitoring could take decades (A-X-103-2) and is even more pessimistic in its statement that "It is impossible to analyze and predict the long-term consequences of land use on erosion, sedimentation, ecosystem structure and function, or aquatic habitat through experiments or other empirical approach because to do so would require monitoring large, complex watersheds during land use of varying nature and intensity for many decades of variable weather" (C5-33-4). This begs the question of how we can successfully develop and verify CWE models if it is not possible to measure the effects that we would be modeling.

The Report section on Cumulative Effects of Watershed Changes on Sediment Sources (A-IV-86-3 through 88-3) gets to the heart of problems associated with modeling of land use effects. Here we find that spatially registered modeling of sediment loading is in its infancy, and that "models would not be able to match short-term measurements … nor meet the standards of replication established in the laboratory sciences." We are also informed that such models “should be physically based yet parameter-poor such that it can be calibrated, however crudely …” which means that those variables that we can’t calibrate will be left out, along with their influence on sediment production. And it is pointed out that models of the effects of root reinforcement “are difficult to calibrate due to the large number of parameters and the large spatial (and temporal) variation in those parameters.” The same could be said of most other landscape processes related to sediment production. But this constraint is ignored in order to make predictions of “general magnitudes of sediment loads” (that are not tested or validated) for assigning risks that become the basis for regulating timber operations. In addition, we are informed that current models are likely to overestimate the intensity of shallow landsliding unless data on soil depth is available, which is almost never the case at the scale needed to make these predictions, while deep seated landsliding “is more of a challenge to modelers.” In addition, we are informed that aerial photos can be used to estimate mean flow rates of large landslides, but not quantitatively, to analyze the approximate magnitude of changes resulting from land use, although it is not clear how quantitative differences are derived from non-quantitative flow rates. Then we are supposed to estimate the frequency of gullies related to land use and destabilizing of channels, for which no models are available. This is clearly the realm of research and pilot projects, rather than an operational approach to land use regulation.

Following are more specific comments on the Committee’s proposed use of modeling:

- The statement that “in a landscape which contains a large amount of spatial variability of topographic form and material properties, including transient properties such as evolving tree-root reinforcement of hillside soils, or aquatic primary production, all of which may be sufficiently variable that it is impractical to measure or map them with foreseeable resources in a particular application” (C5-39-Item a) points out that watershed scale modeling will not be able to account for some of the basic, site specific factors that control erosion resistance and susceptibility.

- The proposal to use the empirically based ESI model (A-IV-90-2) seems inconsistent with the recommendation to use physically based modeling. Also, the UC Committee appears to be placing great reliance on an unpublished model for surface erosion without commenting on currently available approaches, such as WEPP and SEDMODL.

- The translation of the paragraph about the state of the art in sediment routing (A-V-91-3) seems to say that we understand the process of sediment transport, but the physically based models don’t work very well in quantifying downstream sediment transport, and the state could help overcome the problems with current models by paying for more research on sediment routing (A-VI-92-3). This does not sound like an operational approach to land use regulation.

- The discussion of modeling sediment from roads (A-IV-89-3) acknowledges the lack of information about actual quantities of sediment from roads in California, which reinforces the argument against using such modeling without verification. But the

Report fails to mention that use of best management practices, such as outsloping, can greatly reduce the noted concerns about road sediment without resorting to the uncertainties of modeling sediment production.

- The use of empirical rating curves for estimating turbidity is not as easy or straight forward as is implied by the UC Committee (A-VIII-99-4). There are large differences related to time of year, rising and falling limbs of individual storms, instantaneous sediment inputs that vary by both antecedent watershed conditions and storm size, and other factors. Also, no model is cited, and the Report is silent about where the sediment budgets and suspended sediment samples that are required for calibrating turbidity to both suspended sediment and flow will come from.

- Modeling of stream water temperature should be more straightforward than flow, sediment, habitat, and populations. However, documentation for the Stillwater Sciences model cited by the UC Committee needs to be provided (A-VIII-99-3).

- The Appendix section on Riparian Biota (A-II-79-4 through 83-3) seems to have much to say about the Forest Practice Rules, but contains little in the way of useful information about modeling the impacts of timber operations on riparian resources.

- The Report contains a good discussion of the dilemma faced when trying to establish criteria for large woody debris and for many other natural features (A-II-81-1). One approach that is not mentioned is to identify a desired habitat condition, and then estimate the amount of woody debris that would be needed to provide it.

- The discussion of large woody debris source areas (A-II-81-6) does not address the likelihood and importance of providing larger diameter woody debris as distance from the stream increases within the length of a site potential tree. This larger diameter wood is much more likely to come from trees falling at the bank or very near the stream, with the proportions varying by topography, tree type, and degree of bank undercutting (Benda et al. 2002). The other significant source of larger diameter wood is from landslides that directly enter the stream system (A-II-81-6), which means that risk assessment models should also distinguish the benefits of LWD from the consequences of sediment.

- The UC Committee's statement implying that larger streams don't need wider buffer strips because the larger wood that is important for these streams is produced closer to the stream bank (A-II-82-1) should be qualified to recognize that buffers provide benefits for resources other than large woody debris. For example, buffers are intended to help minimize sediment inputs, prevent streamside landsliding, and provide wildlife habitat.

- It also seems inconsistent for the UC Committee to state that the empirical record of large floods is too short to define land use effects on risk, and then argue that we should evaluate the impacts of how such changes in flow frequencies would affect scour of gravels and large woody debris (A-III-85-2).

- The statement that "… the prediction of morphological change in aquatic habitat remains difficult, or at least undeveloped" (A-VI-91-4) means that despite much effort in modeling effects on the physical state of the watershed, the tools for linking this to impacts on habitat have not been developed. And the step from habitat to actual impacts on stream biology would be even more tenuous.

- The discussion of gradient effects on channel characteristics (A-VI-92-2) provides a description of generally expected conditions, but gives no guidance on how or what models would be used to predict changes to these characteristics and makes no linkage to aquatic habitat, which is the subject of this section of the Report.

- The idea of using digital elevation as a surrogate for "guiding, interpreting, and extrapolating field work … as a foundation for a general model linking ecological and geomorphic processes" (A-VI-91-5) stretches the limits of correlation past the breaking point. This puts the UC Committee in the position of first rejecting the use of studies based on statistical correlation, and then proposing to use guesses based on an assumed relationship to channel gradient to represent complex processes.

- Combining the statement that there is no mechanistic modeling capability available for changes in aquatic habitat characteristics caused by logging of headwater streams (A-VII-94-1) with the proposal to use available censuses from sample environments to make quantitative statements in probabilistic terms integrated over entire watersheds (A-VII-94-1) is substituting assumptions about transference of inventory results in place of the previously recommended process modeling, and then somehow extending the result across an entire watershed. This is followed by another statement that methods for predicting mainstream habitat changes from fundamental mechanics are not well developed, while proposing to predict habitat changes based on empirical evidence that is "extended to yield some credible predictive capability" (A-VII-96-1). The Report goes on to say that that the capability to predict changes in rearing habitat is "seriously limited by the lack of population models that contain information on habitat quality" (A-VII-96-3). And after stating that the lack of predictive population models is a serious limitation, the Committee suggests using an approach for prediction that is heavily reliant on the estimation of many parameters (A-VII-98-4). With this level of confidence in model capabilities, it is hard to imagine how combining highly uncertain predictions of sediment, wood, and habitat impacts could be used to make operational decisions about THP prescriptions and mitigations.

- Considering the limitations on use of models described above, the UC Committee's statement that "CWE prediction needs to … establish causal linkages between land use and ecosystem condition" (C5-38-item 1) indicates that there is still a major disconnect between what is needed for cumulative impacts analysis and the available models.

- The UC Committee's proposal for using landslide susceptibility interpretations to identify habitats at risk of excessive sedimentation (A-IX-101-3) oversimplifies a much more complex problem that often includes other sediment sources and would require linkage to habitat conditions that other sections of the report clearly state are not available. The difficulty of doing this has already been described earlier in the Report's Appendix.

- It is not encouraging that the Report does not recommend using the example models given in Appendix A (C5-49-2). If the best examples are not good enough, where are the models required to implement the Report's recommendations going to come from? And if research is needed on quantitative model development, linkage analysis, methods for field quantification, and monitoring methods (A-X-101-5), what is left that is ready for application?

CDF Guidelines

The CDF cumulative watershed effects assessment Guidelines (CDF 1994) critiqued by the UC Committee (C4-18-3) were designed to work in concert with Forest Practice Rule and CEQA requirements. This procedure is intended to walk the THP preparer though the gathering of information on field conditions, consideration of information available from other sources, applying professional experience, and the integration of this information in a way that leads to a conclusion about the potential impacts of the proposed activities. It is not clear whether the Committee members were provided access to Appendix A of the Guidelines, which includes instructions and definitions of terms that answer several of their comments, and the Committee also appears to have criticized the Guidelines without any effort to see if they provide reasonable conclusions. Following are responses to the Committee's specific "editorial comments" (C4-18-3 through C4-20-3):

1) What an RPF will be "aware" of in conducting a watershed assessment under the Forest Practice Rules is based on the requirements of Technical Rule Addendum No. 2 and other sections of the rules that require information development. These include:

    - The use of information that is "… reasonably available before submission of the THP."
    - Specific information sources listed in the Addendum to TRA#2 that must be identified in the THP.
    - Information about past and future projects, where:
        - project is defined as "… an activity which has the potential to cause a physical change in the environment, directly or ultimately, and that is: 1) undertaken by a public agency, or 2) undertaken with public agency support, or 3) requires the applicant to obtain a lease, permit, license or entitlement from one or more public agencies [including THPs].

  - Past projects are defined as "… previously approved, on-going, or completed projects which may add to or lessen impact(s) s created by the THP under consideration. These generally include, but may not be limited to, projects completed within the last ten years."
  - And "reasonably foreseeable probable future projects" can be summarized as "projects with activities that may add to or lessen impacts(s) of the proposed THP", such as another THP under control of the current THP submitter and expected to commence in 5 years, THPs on other ownerships where the plan has been submitted or on-the-ground work has materially commenced, non-THP projects requiring a permit that are under review by a public agency, or a project that has been announced by a public agency.
- Information about past and future activities obtained from "… plan submitters (timberland or timber owner), and from appropriate agencies, landowners, and individuals …".
- Other information or conditions that the RPF may have personal knowledge of based on current and previous work in the assessment area or downstream.

For the most part, these requirements are based on the CEQA Guidelines, which form the legal basis for cumulative impacts assessment. By the time the task of assembling and reviewing this information has been completed, an RPF will have amassed a substantial amount of background data on which to base judgments about what has happened in the watershed.

Conducting an on-site review of channels is required by the Rules and, as used in the CDF Guidelines, is intended to provide the RPF with both an understanding of current conditions and a context in which to consider how past projects have interacted with the landscape. Riparian zone protections are also specified in the rules. The Committee's implication that channel and riparian zone conditions are not considered is simply not correct and shows a lack of understanding of both the rules and the THP development process.

As part of Technical Rule Addendum No. 2, an RPF is required to determine the beneficial uses of water that exist on the plan site and downstream. These beneficial uses establish which water quality parameters must be protected. Consideration of effects on peak flow (including flooding) is specified in TRA # 2. And assessing the effects of timber operations on slope stability is also required by the rules.

2) Assessment area instructions in Appendix A of the CDF Guidelines specify using an area where cumulative impacts of the project may be significant. The Guidelines also include specific instructions for considering downstream effects.

3) Instructions for the qualitative evaluation of channel condition features and for assigning ratings are given in Guidelines Appendix A. The rating of these channel features is based on observed presence and relative frequency. Criteria

for whether gravels are buried in sediment, pools are filled, the channel is downcutting, and the requested characteristics of other listed features are based on field observations that foresters can determine.

4) See no. 1 above regarding how RPF is aware.

5) See no. 1 above regarding how RPF is aware.

6) The interpretation of whether practices used in the past have resulted in particular impacts is to be based on the RPFs observations in the field, information available for the THP, and the RPFs experience in the plan area.

7) The criteria for determining whether the potential for an impact is “High, Medium, or Low” is contained in Appendix A of the Guidelines.

8) Identification and evaluation of potential impacts from future projects is a requirement of CEQA. Types of projects to be included are described in the Forest Practice Rule definition of “reasonably foreseeable probable future projects.”

9) The criteria for determining the potential for cumulative impacts are given in Appendix A of the Guidelines.

10) The criteria for determining the potential for cumulative impacts after mitigation are given in Appendix A of the Guidelines. Whether it is realistic to give a one word answer or not, a statement of whether the project will result in significant cumulative impacts (which comes down to yes or no) is required by CEQA.

THP Mitigations

The Report does note in passing that THP level identification of problem sites and implementation of mitigation measures is helpful and is complementary to the recommended, larger effort (C5-50-1).

The BMP “leaks” described by the UC Committee (C3- 13-1) may be widely identified by some environmental scientists, although this is not documented, but are rarely measured. And when carefully measured, the overall effects of these “leaks” are usually found to be small (Bottorff and Knight 1996, Dahlgren 1998, Holloway et al. 1998, Lewis et al. 2001, Cafferata and Munn 2002).

The UC Committee recommendation that modeling and gaming strategy be used to overcome deficiencies in the THP process and application of site-scale BMPs (C5-53-1) would substitute generalized and highly uncertain predictions in place of the site specific field information that is presently used to prescribe BMP mitigations.

The report recognizes that loss of downstream rearing habitat has had a major effect on fish populations, which is then used to justify restricting upstream activities to preserve remaining small pockets of rearing habitat (A-VII-96-2). However, preventing habitat loss is already a focus of the WLPZ Rules, and working to restore the original, downstream habitat that is important to outward migration would seem to be a more productive solution to the problem of forcing under-developed fish into the ocean.

The UC Committee's criticism of using mitigation to reduce or offset potential cumulative impacts (C6-56-3) is disingenuous and inconsistent with the Report's earlier recognition of the potential for "positive CWEs resulting from rehabilitation projects" (C3-13-3). While the Report's authors conclude that cumulative effects are not quantifiable and recommend that these impacts be addressed in terms of risk through the use of unverified models, the UC Committee would then require that the benefits of practices aimed at offsetting CWEs be quantitatively substantiated. In effect, the Committee is requiring that non-quantified impacts be compared to quantified mitigations, from which no conclusion can be reached, and they are not willing to accept the basic premise that fixing clearly evident problem sites and known sources of sediment can be used to off-set unknown and un-measurable impacts. Before CDF adopts this viewpoint, there needs to be at least some documentation of why we would be better off by not fixing existing problems.

The UC Committee observation that CDF rarely considers mitigations outside of the plan area (C3-12-4) is the result of ownership constraints and because plan submitters have not proposed that outside activities be used to mitigate project area impacts. There have been exceptions – primarily through the use of road system mitigations within an assessment area, such as PALCO and Georgia Pacific in the Mokelumne River Watershed. In addition, the Committee's concern over lack of mitigation outside of the plan area seems to be inconsistent with the Report's criticism of using mitigation to off-set potential CWEs in general (C6-56-3).

The UC Committee has also incorrectly concluded that CDF expects impacts to be "mitigated out of existence by application of a Best Management Practice" (C4-21-3). Instead, THP mitigations for cumulative effects, whether included in the rules or required during the THP review process to meet a specific problem, are viewed as reducing a plan's contributions to CWEs to a point where they no longer meet the definition of a significant adverse effect.

Past Studies

It is not clear what the UC Committee considers to be a "short-term empirical study" (ES-3-1), but the results of past studies should provide the best information for forming a "communal understanding", and the results of these studies, such as the work at Caspar Creek (Ziemer 1998), should not be dismissed in the absence of better information. For example, the work reported by Hawkins and Dobrowolski (1994) on the cumulative impacts of watershed management on stream biota is dismissed by the UC

Committee as a region-wide statistical analysis of watershed conditions (C1-6-3), presumably because it did not find widespread adverse effects resulting from cumulative impacts, when this study had, in fact, specifically tried to identify impacts at the watershed scale that the UC Committee now recommends we use modeling to predict.

The UC Committee's discussion about prediction and its criticism of statistical studies in the section about "Spatially Registered Simulation Models and Gaming" (C5-39-Item 4) can be paraphrased as – an educated guess is better than results of a study that identifies significant factors. This is equivalent to looking at the world with blinders that prevent seeing or considering how or why statistically identified watershed factors are important in controlling or correlated with watershed responses. Statistical studies can show us preferred methods of expressing environmental variables that can actually be measured. And the best of both worlds is to use statistical methods to identify and quantify coefficients and parameters used in mechanistic models.

Statistics provides a systematic approach for interpreting data, which may or may not start with variables that have been selected or structured to represent expected processes. At one extreme, variables can be entered into a statistical model based solely on their ability to improve correlation and significance. At the other extreme, statistical methods can be used to determine best fit values for coefficients for process based models in which variables have been pre-selected and structured to represent a hypothesis of how the world works. In either case, the accuracy of such models is likely to be greater than models created from un-calibrated assumptions about natural systems, which are actually hypothesis waiting to be tested.

After criticizing the use of empirical studies and promoting processes based models, the Committee states on page 96 of the Appendix that "The lack of predictive population models, even of the coarse-grained, conceptual type … remains a serious limitation for resource managers and policy makers …" and that we will need to rely on formalized judgments and empirical statistical relationships (A-VII-96-4).

Although the data and tools available now are likely to have improved, it is worth mentioning that an extensive ranking of watershed sensitivity as suggested by the UC Committee (C5-51-3) has already been completed under a contract sponsored by the BOF's Monitoring Study Group (McKittrick 1994). This work was conducted by CGS based on available geology, slope, and precipitation data. The application of satellite imagery to analyze changes in land cover has also been used in the past by CDF's Fire and Resources Assessment Program with results that should encourage further investigation. And more recent work on watershed level analysis and sensitivity has been conducted by several of the state's resource agencies, including CDF, as part of the North Coast Watershed Assessment Program.

In addition, it is unclear what studies the UC Committee is referring to in its comments about nutrient losses related to timber harvesting in California that have raised concerns about the potential for eutrophication of lowland and estuarine habitats (A-VIII-99-5).

Water quality effects of harvesting have been measured in the Caspar Creek Watershed by Dahlgren (1998), who found only minor increases in nutrient flux, while Bottorff and Knight (1996) found no significant adverse effects on stream biology. Another water quality study in the Mokelumne River Watershed found that nutrient concentration increases occurred below the timber management zone in areas of residential and commercial development and, unexpectedly, as a result of leaching from one, specific rock formation (Holloway et al. 1998). Each of these studies was supported by CDF, and one reason that more work has not been done is that the magnitude of observed impacts has been small.

Agency Efforts

An uncritical or uninformed reading of the UC Committee's Report, and Chapter 4 in particular, would lead one to believe that modeling can accurately predict where and when to limit timber harvesting, can establish the risk of in-unit landslides, can monitor channel effects, and can determine the long-term impacts of timber harvesting on landsliding and aquatic habitat, among other things. This, however, ignores the limitations of available information and models that are described later in the Report's Appendix and pointed out in this review. The Committee would also lead readers to believe that CDF, with the complicity of CGS, has been accepting without question plan submitter denials of landslide potential and that CDF uses best management practices to avoid analysis of timber harvesting impacts. In addition, the Committee has determined that there is no monitoring despite pre-harvest inspections, active inspections, post-harvest inspections, systematic follow-up studies of hillslope and WLPZ impacts, periodic reviews of mitigations to prevent landslides, studies of instream impacts, and CDF sponsored watershed research projects (Ice et al., in press). In fact, the UC Committee has ignored the ongoing efforts by hundreds of scientists and agency "technical specialists" over the past 20 years that have resulted in radical changes in the way that timber operations are conducted and the impacts of these operations on the landscape.

Agency scientists and "specialists" who have been working on problems related to timber operations know that, in reality, timber harvesting rates and the magnitude of even-aged treatments have been effectively reduced by adjacency requirements, smaller unit sizes, and restrictions placed on both unit locations and type of harvesting as a result of land stability and other concerns identified during THP development and review. A Hillslope Monitoring Program and complementary Modified Completion Report Monitoring Program have been established as an additional check on compliance and to determine long-term effectiveness of the Forest Practice Rules as best management practices. These programs are focused on roads, skid trails, landings, and watercourse crossings because previous studies sponsored by CDF and others (Rice and Datzman 1981, Rice and Pillsbury 1982, McCashion and Rice 1983, Peters and Litwin 1983) have shown that these disturbance features produced much more erosion and sediment than in-unit erosion. Watercourse and lake protection zones are also included because of concerns about canopy and riparian impacts, and a

Class III watercourse survey has recently been added to the Hillslope Monitoring Program (Cafferata and Munn 2002). Much work has also been done to try to characterize instream impacts and to determine instream monitoring methods (Rae 1995, Barber 1999, CDF and NCRWQCB 2002), but these efforts are hampered by real world problems of access, high study costs, long time frames (especially for determining trends related to larger flows), and the recognition that large flow events often reset channel conditions and interrupt shorter-term trends.

Agency Expertise

The UC Committee has concluded that "The personnel currently in charge of recognizing and regulating CWEs could not provide the conceptual leadership and guidance with methods for CWE prediction described in this report and its 'tool-box' Appendix." (C6-57-3). This conclusion does not come as a surprise since the UC Committee has not found anything done by CDF sufficient for addressing cumulative effects. However, it is worth noting that the Committee made this determination without meeting with or otherwise interviewing CDF's watershed staff and that the Report Appendix does not provide a tool box, since the described models are not operational. In fact, the only possible conclusion that can come from reading the Appendix is that the proposed modeling approach to CWE analysis cannot be implemented with currently available watershed models. In contrast, CDF is constrained by a requirement for using feasible measures and cannot impose untested hypothesis on private landowners.

The UC Committee's further statements about "agency personnel" being unaware of developments in the technical literature, having an "insular view of what constitutes the best scientific information on a subject", and "hiring consultants to make quick, 'policy relevant' surveys as a basis for short-term decision-making" (C6-58-5) are highly critical CDF and other state agency staff. To provide some substance to support these findings, it would be helpful to know more specifically what agencies being criticized, in what way views of the scientific literature are insular, and in what situations quick policy-relevant studies are being misused.

In comments about available data, (C5-48-2 through 48-4), the Report makes some optimistic projections about data availability, followed by a pessimistic view of the usefulness of available data, then acknowledges the probable need for field inventories, while minimizing the difficulty of conducting such inventories by assuming that the people who have done this work in the past were not sufficiently experienced. In other words, the UC Committee would be able to more efficiently acquire the necessary data than hydrologists and fisheries biologists conducting stream surveys, geologists conducting mass wasting inventories, soil scientists conducting soil surveys, and other professionals engaged in inventorying the resources in their areas of expertise However, the outcome of "an analysis" based on low quality data and using, as described in the Report Appendix, inadequate models should not be expected to yield results from which land management decisions can be made.

The purpose of the UC Committee's recommendation that "the State needs to recruit appropriate professionals (working for Industry, State agencies, or other groups) with documented ability and knowledge of management to become involved in CWE analysis" (C7-63-#5) is not clear because there is no apparent reference in the Report about how these management skills would be used in conducting or implementing CWE assessments. In light of the Team's criticisms of the preparation and review of CWE analyses, it would seem more helpful for the Department to 1) provide better training about cumulative impacts for RPFs and agency Review Team personnel, 2) provide direction to take a closer look at submitted CWE assessments, and 3) to hire at least one additional staff member with a background in watershed processes to work directly with Review Teams on improving the quality of approved CWE assessments.

Adversarial Relationships

After describing agency personnel as unable to provide conceptual leadership and guidance, being unaware of developments in the technical literature, and having an insular view of what constitutes the best scientific information, the Committee also criticizes the state and industry for creating an adversarial relationship with scientists (C6-60-2 through 60-4). In addition, the Committee has determined that agency personnel are "perverse" based on events where they have heard only one point of view. At this point, it might have been useful for the Committee members to have given their recommended use of skepticism (C6-60-4) a trial run.

Having aired their opinions and complaints, the Committee then makes a preemptive strike on the possibility of disagreement by stating that "The inability of many people in the resource industries and associated State agencies to use skepticism constructively places serious constraints on transparent investigations of issues such as prediction of cumulative watershed effects. They see all questioning as judgmental, rather than as an approach for improvement of a product, technique, approach, and ultimately of sustainable development of the resource they profess to value" (C6-60-4). In other words, pointing out where scientists are wrong is bad, but criticism by poorly informed scientists is okay. What would be more helpful is for peer review of new research results and proposed models to occur within the scope of scientific publications instead of during the public review process of state and federal permitting agencies that require response to comment.

The Committee's final recommendation to support public debate on CWEs while denouncing "attacks" on participants (C7-64-#9) does not recognize the freedom of expression that is involved in the project review process, and the expectation that scientists who become advocates will be given special status in debates over controversial issues is a viewpoint that agencies can't enforce. Greater perspective on this issue could have been gained by reviewing comments about agency personnel that are received in the course of making decisions on controversial projects.

Consensus

The UC Committee's recommended analysis process assumes that there will be "multi-stakeholder accord on conceptual models" (ES-1-2). However, the process for reaching such agreement on models, data, and decision making depends on a willingness by those involved to reach consensus that past experience would indicate is often hard to find among interest groups with differing and firmly entrenched beliefs. Requiring agreement among people with conflicting interests as a condition of a cumulative impacts assessment (C5-45-1) would turn this analysis into a political exercise. And if the Committee really thinks that global warming is an example of how a modeling based approach will provide consensus (C5-34-4), then the polarized and politicized viewpoints on this topic should serve as a warning about the potential for modeling to reduce controversy in the THP review process.

Without the requirement for consensus, most of the community input that the UC Committee recognizes as necessary for identifying significant issues (C5-45-All, C5-46-3 and 4) can be provided by the CEQA process, where concerns are identified at the start of analysis and their disposition described in the agency's response to comment. However, this should not be expected to result in agreement on the part of individuals who may remain unconvinced.

The UC Committee also anticipates that the recommended CWE Committee would be able to mediate the concerns of various interest groups to determine issues that would be included in the CWE analysis for a given watershed, with assumption that technical knowledge and reputation will allow the Committee to bring the different parties to consensus (C5-47-1). This has been done before, and the result has been the labeling of participants as being for or against the interests of one or the other of the participating groups, which created similar adversarial circumstances of which the UC Committee is so critical.

Research Support

The limitations of current models cited in the Report and pointed out in the comments in this review clearly indicate that the use of models to predict CWEs is a research effort. The UC Committee also emphasizes the need for research as a part of their recommended modeling effort (C7-63-#6). An issue that would come up immediately in any current discussion of new research is the availability of funding at a time when state budgets are being cut. However, CDF could re-evaluate its priorities for coordinating and supporting research activities and seek funds from a variety of state and federal sources.

Documentation and Background Information

The Report states that environmental scientists agree that timber harvesting continues to cause “radical” alterations in water quality, habitat conditions, and flood risk (C1-6-4). However, there is no documentation offered to support this opinion. And it is ironic to note that research underlying current estimates of the effects of timber operations on flood risk in rain-dominated environments came from the CDF supported Caspar Creek study that is discounted by the Committee.

The UC Committee’s statement that there is “almost a complete lack of data on water quality, streamflow, terrestrial biota, aquatic populations, the physical condition of streams, components of the water balance, and the degree to which they are altered by timber harvest in the region” (C6-57-1) either shows a lack of familiarity with or disregards the large amount of information that is available. CDF has been conducting hillslope monitoring, which includes evaluation of watercourse and lake protection zones, for 6 years and has accumulated information on 300 THPs statewide, with the largest proportion from the North Coast (Cafferata and Munn 2002). The Department of Fish and Game has been collecting information about fish populations and channel conditions for decades, and this is now being brought together as part of the North Coast Watershed Assessment Program and other efforts. The forest industry has an extensive program for measuring stream temperatures (Lewis et al. 2000), and individual companies have on-going stream monitoring programs. Studies have been done to evaluate watershed impacts across a range of conditions, including the work described in both the Cited and Related References listed at the end of this review, among others. In particular, CDF has been cooperating with the PSW Research Station on studies of the impacts of timber operations on sediment production and channel conditions in the Caspar Creek watershed since the 1960’s, along with ancillary studies of water quality, stream biology, fish habitat, and others that would require a reference list too long to include here (see list of Caspar Creek references summarized by the Pacific Southwest Research Station at http://www.rsl.psw.fs.fed.us/projects/water/caspubs.html).

The Committee’s finds fault with a lack of “yes” answers in the Pape and CGS surveys to the question of whether a proposed plan would cause significant adverse impacts or contribute to existing impacts (C4-21-5 through 23-3). However, review of Report Table 1 (C4-22-2) shows that about half of the THPs in each of these surveys reported that there were continuing, significant adverse impacts from past projects in the assessment areas of the proposed THPs, about a third stated that significant cumulative impacts would not occur following mitigation, and two-thirds found that there were no significant cumulative impacts without additional mitigation. The absence of “yes” responses has already been explained in the earlier discussion of the THP Process, and the Committee does not present any information demonstrating that the conclusions reported in these THPs are not correct. The presence of features in the Redwood Creek watershed that were not included in THPs covering this area may point to a need for follow-up, but this does not demonstrate that the operations conducted under these plans have contributed to significant adverse cumulative impacts.

In addition, the UC Committee does not present any data or other evidence to support its contention that exceptions and in lieu practices, which must be explained and justified in the THP review process, have resulted in additional impacts (C6-55-4). And this point does not seem to have been related to the issue of cumulative impacts.

The comments of a CDF "reviewer" about mass wasting (C6-58-2) are presented by the Committee without providing any context for these observations, and they do not appear to have evaluated the THPs in question to see if these comments were addressed in the final product. In addition, the question of whether the referenced landowner's map of landslides was used to address the Team's concerns in the actual review of plans was not answered. On most North Coast THPs, and especially where mass wasting is a concern, interpretation of landslide hazards is done by licensed geologists who are employed by the California Geologic Survey, rather than by CDF staff.

Similar criticism of the THP review process, based on a state employee's comment about lack of forestry related landsliding that was not consistent with a map observed by the Committee showing numerous mass failures, (C6-58-3) lacks documentation that the mapped slides were actually related to timber operations, and there is not sufficient description in the Report to check the accuracy of this assumption. Simply put, more information is needed to support the Committee's conclusions.

There is also no foundation for the UC Committee's criticism of cumulative impacts analyses in SYPs (C4-25-3, C6-55-4). Cumulative impact assessment for use with individual THPs is not a required element in SYPs, and CDF determined that the Pacific Lumber Company SYP did not provide an adequate analysis to substitute for plan specific assessments. The only other SYP that had been approved at the time the UC Committee was preparing its Report was the Surdna plan in northeastern California, which had only three miles of class I waters on the entire 70,000 acre plan area.

In addition, CDF is not aware of any studies or other documentation that would support the UC Committee's conclusion that Forest Practice Rules pertaining to landsliding, road wash, skid trails, and non-fish bearing channels have not been based on scientific evidence (C6-56-1). Actually, CDF staff and others involved in the development of Forest Practice Rules have relied heavily on the best available research and have considered the "communal understanding" of both problems and solutions related to the impacts of timber operations, as described in more detail in the comments on "Forest Practice Rule Requirements." The Committee's implication that CDF staff have not responded to concerns about harvesting in the Freshwater Creek watershed because "logging does not cause flooding" (C6-58-1) is also not correct. In fact, CDF has limited the annual harvest in this watershed specifically to address the flooding issue, as described below.

The UC Committee comment that "Other rules, such as limitations on the size of areas that can be harvested within a short period of time, are easily circumvented" (C6-56-1) is both inflammatory and wrong. Circumventing the Rules results in violations or a citation. If this comment by the UC Committee is supposed to be a judgment about the adequacy of the Rules, then the authors should chose their words to say so. And even the example used by the Committee is misleading. The reference to clearcutting 15 percent in the Freshwater watershed during the same decade that 35 percent has been harvested with alternative (non-clearcut) prescriptions is supposed to somehow justify a comment about circumventing harvest unit size rules. But there is no analysis or discussion about how this circumvented or was an inappropriate application of the Rules. A quick review data available for harvesting on the Pacific Lumber Company's 19,600 acres of timberland in the Freshwater watershed shows that the various types of harvesting removed approximately 3 percent of the canopy per year from 1988 through 1997, which is significantly less that the 5 percent average that the UC Committee numbers imply, and CDF has subsequently reduced this to about 2 percent per year based on more recent information on potential peak flow effects (Munn 2001).

The UC Committee has apparently decided that the rules for Class II and III watercourses are ineffective (A-II-80-4) without feeling the need for any data to support this conclusion. And the UC Committee's statement that the effects of partially harvested buffers on stream temperatures is unknown (A-II-83-2) is surprising since the effects of streamside vegetation removal on stream temperature have been studied for many years and is one of the more easily modeled impacts of timber harvesting (McGurk 1989). In fact, information that was available in CDF's Interim Hillslope Monitoring Report (BOF 1999) showed that high levels of canopy are being retained in Class I or Class II WLPZs under the current Forest Practice Rules, and an additional two years of data collection has provided nearly identical results (Cafferata and Munn 2002). In addition, the Committee makes no case for their concern about Class III watercourses, which only carry water in direct response to storm events. This points out a discrepancy in the Committee's approach to criticism, where not having quantitative data to prove the Forest Practice Rules work is bad, but it is okay to say the Rules don't work without the benefit of supporting data.

The UC Committee also does not provide any indication of the information it is relying on to claim that state agency personnel have adopted a view that prevention of negative CWEs can be accomplished just through enforcement of the existing Rules (C6-56-1 and C6-56-3). CDF watershed staff, in particular, have not made this claim. But it would be correct to say that the Rules have substantially reduced sediment production from roads, landings, and harvested areas; that potential increases in water temperature have been minimized by restricting streamside canopy removal; and that reducing inputs of sediment and heat related to a project will also lessen the potential cumulative impacts of project activities. Where additional measures are needed, the Rules allow the Department to require mitigation measures that are not specifically included in Rule language, and it is on this point that improved CWE assessment would be most useful.

The UC Committee does not provide any indication of what information it is using to support a conclusion that CDF and others are relying on the concept of "threshold of concern" (C6-56-2). One of the major concerns expressed by CDF staff regarding use of the USFS equivalent roaded area (ERA) procedure is the use of a threshold value, and CDF Sacramento staff have been clear that there is no single threshold that can be used to define what is significant in all watersheds (CDF 1987).

In addition, it is not clear how the UC Committee arrives at the conclusion that mitigation measures used to off-set cumulative impacts have not been tested (C6-56-3). Examples of such “testing” would include literature showing that rocking roads reduces sediment (Coe and MacDonald 2002), and reports from work in Redwood Park describing the benefits of removing unstable crossings and fills (Madej 2001). This list could be continued to include most of the mitigation measures for water quality protection that are included in the Rules and THPs.

Finally, the UC Committee recommendation about monitoring (C7-63-#7) does not appear to recognize the many on-going monitoring efforts related to timber harvesting activities, including the activities of the BOF’s Monitoring Study Group, the Hillslope Monitoring Program, Modified Completion Reporting Program, CDF sponsored research projects, and many timber industry sponsored efforts. If they had been asked, Department staff would have been glad to describe and discuss these, and other, monitoring projects. Before embarking on another monitoring project or program, existing efforts should be evaluated to see what additional work is really needed.

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APPENDIX I Board of Forestry Technical Rule Addendum No. 1

CALIFORNIA STATE BOARD OF FORESTRY

TECHNICAL RULE ADDENDUM NUMBER 1

Revised
February 1, 1990

Procedure for Estimating Surface Soil Erosion Hazard Rating

Note: The procedure noted in this addendum is to be used in application of rules 14 CCR 912.5, 932.5 and 952.5.

Introduction

The purpose of this addendum is to guide calculation of the surface soil erosion hazard rating.

Determination of the Surface Soil Erosion Hazard Rating

The proposed rating system form [form is attached to addendum] for use in making the Erosion Hazard Rating has been prepared in a manner to allow the RPF to make an assessment of each of the erosion factors. These factors which are significant determinats in erosion hazard include:

(1) The inherent characteristics of the soil, including soil texture, depth to restrictive layer or bedrock, and percent of coarse surface fragments.

(2) Slope of the land surface.

(3) Protective vegetative cover.

(4) Precipitation characteristics.

Each of the factors has been weighed in relation to: (1) the within-factor range; and (2) the relative importance between factors. These relative weights have been field tested, checked against various soil series of generally known erosion hazard, and compared to the accepted theoretical basis of the erosional process.

In order to complete the hazard rating form, the user shall estimate the level for each factor and sum the ratings. This sum is then used to determine the proper adjective. As an aid to the user in selecting the proper level for each factor, the discussions and descriptions have been provided in Appendix I.

APPENDIX I

I. Soil Factors: Soil factors are rated individually.

A. Soil Textures

1. Detachability

Detachability refers to the ease or difficulty with which soil materials are dispersed or detached by rain-drop impacts and/or overland flow water. Soil detachability and texture are closely related.

Soil texture refers to a range, percentage by weight, of soil fractional particle sizes of sand, silt, and clay which make up the natural soil material. Various specific size range percentages have been established for the existing soil textural classes. For example, sandy loams, loams, or clay textural classes.

(a) Field Determination of Soil Texture Class

Soil material used for textural determinations is that material which passes 2mm sieve. Field sample should be spread out in palm of hand and all course fragments over 2mm in size (approximately 1/10 of an inch) separated from the 2mm size material. Ocularly estimate percent of coarse fragment material. Also estimate total percent of surface occupied by stones, boulders, and rock fragments; add this percent to the total percentage of coarse fragments. Make soil textural determination on material estimated to pass the 2mm sieve.

The determination of soil class is made mainly by feeling the soil with the fingers, sometimes supplemented by examination under the hand lens. Moist soil feels different to the fingers than dry soil.

The following descriptions can be used when making such textural determinations by feel.

<u>Sand</u>: Sand is loose and single grained. The individual grains can readily be seen or felt. Squeezed in the hand when dry, it will fall apart when the pressure is released. Squeezed when moist, it will form a cast, but will crumble when touched.

<u>Sandy Loam</u>: A sandy loam is a soil containing much sand, but which has enough silt and clay to make it somewhat coherent. The individual sand grains can readily be seen and felt. Squeezed when dry, it will form a cast which will readily fall apart, but if squeezed when moist, a cast can be formed and will bear careful handling without breaking.

Loam: A loam is a soil having a relatively even mixture of different grades of sand and of silt and clay. It is fairly smooth and slightly plastic, with a somewhat gritty feel. Squeezed when dry, it will form a cast that will bear careful handling, while the cast formed by squeezing the moist soil can be handled quite freely without breaking.

Silt Loam: A silt loam is a soil having a moderate amount of fine grades of sand and only a small amount of clay, over half of the particles being of a size called "silt". When dry, it may appear cloddy, but the lumps can be readily broken, and when pulverized it feels soft and floury. When wet the soil readily puddles. Either dry or moist, it will form casts that can be freely handled without breaking, but when moistened and squeezed between thumb and finger, it will not "ribbon", but will give a broken appearance.

Clay Loam: A clay loam is a fine-textured soil which usually breaks into clods or lumps that are hard when dry. When the moist soil is pinched between the thumb and finger, it will form a thin "ribbon" which will break readily, barely sustaining its own weight. The moist soil is plastic and will form a cast that will bear much handling. When kneaded in the hand it does not crumble readily, but tends to work into a compact mass.

Clay: A clay is a fine-textured soil that usually forms very hard lumps or clods when dry and is quite plastic and usually sticky when wet. When the moist soil is pinched out between the thumb and fingers, it will form a long flexible "ribbon".

(b) Rating Factor Determination

As indicated previously, there is a strong correlation between soil texture and detachability. For example, the coarse sandy loams, etc. are, for the most part, single grained and normally easily detached. The fine clayey-textured soils on the other hand, are detached with difficulty. Using these relationships, rather than requiring an empirical field test for determining detachability, the following subjective Table 1 relating soil texture classes to detachability values is provided as part of the rating system. The common soil textural classes found in each of the broad texture groups have been assigned values. The user can select the detachability which best fit the surface soil textural class.

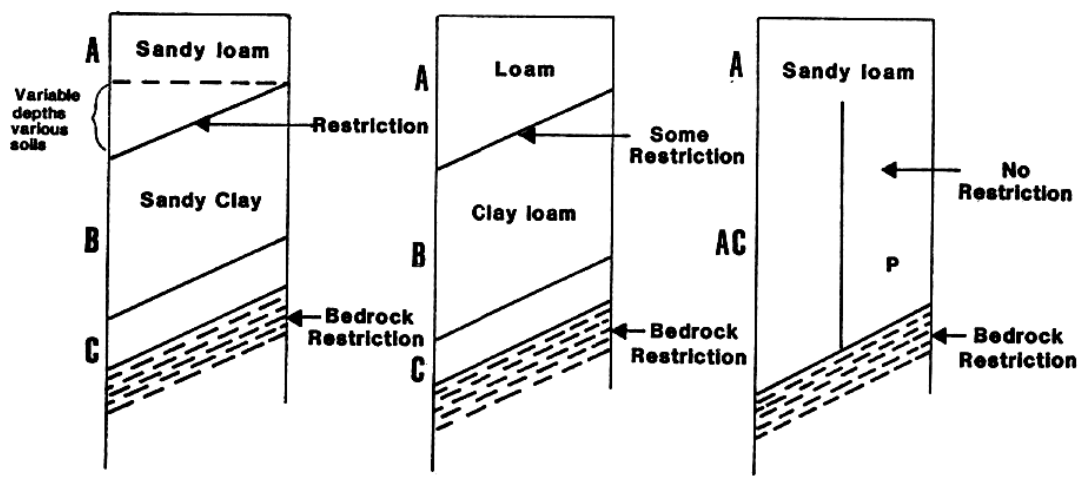
B. Depth to Restrictive Layer or Bedrock

This is related to the changes in soil permeability as well as to the depth of bedrock. For example, a soil profile having a sandy loam surface layer and a sandy clay subsoil would have restriction to water movement through the profile at the upper section of the sandy clay layer (Figure 1.).

Figure 1.

Examples of Various Soil Profile Configurations

Soil Profile Diagramatic Sketches.



A soil profile having a loam-textured surface soil underlain by a clay loam or clay subsoil would also be restrictive to water movement at the upper section of the clay loam or clay subsoil.

Should there be no obvious soil textural difference between the surface of the soil to the underlying bedrock, then the depth to the bedrock would be the restrictive difference.

Existing soil survey maps and report information, as well as close examination of existing road cuts of the area in question or an actual excavated soil pit will reveal the information required.

C. Surface Coarse Fragments Including Rocks or Surface Stones

The degree of surface coarse fragments or surface rockiness or stoniness has a pronounced effect on surface erosion in reducing rain-drop impact as well as reducing the erosion potential of overland flow.

II. Slope Factor

Other than the inherent properties of soil, the slope factor is one of the most important of the erosion factors. The kinetic energy attributed to overland water is direct relation to velocity and volume. For the purpose of EHR determinations, general slope characteristics are considered in making slope measurements. For example, a generally smooth mountainside slope is measured by taking the predominant slope and length condition.

III. Vegetative Cover

- This refers to all organic material both living and dead which protects soils from rain-drop impact and/or overland flow, e.g., overstory vegetation, the understory of younger and smaller trees and shrubs, the ground cover of forbs, and grasses, and the litter, duff, slash and stumps. The vegetative factor is an estimate of the residual organic material likely to exist in the area immediately after timber operations. All roads, landings and skid trails are included as part of the disturbed area. Where a Timber Harvesting Plan includes a Site Preparation Addendum, the vegetative cover used in calculating the erosion hazard rating shall be based on the amount of vegetative cover reasonably expected to be present immediately following completion of site preparation activities.

IV. Rainfall

This refers to rainfall intensity based on a two-year return period. Attached is a rainfall intensity map of California. The information was taken from Technical Paper No. 28, U.S. Weather Bureau. This presented only as a guide. Should more localized information be available for a specific area, it should be used, especially to adjust for snowfall conditions.

TABLE 1

Soil Textural classes and Associated Suggested Ratings [1,2,3]

Broad Class	Texture	Rating
Coarse	Sands	30
	Loamy Sands	27
	Sandy Loams	23
	Fine Sandy Loams	20
Medium	Loams	17
	Silt Loams	14
	Silty Clay Loams	11
Fine	Clay Loams	8
	Clays	5
	Extremely Fine Clays	1

1 The amount of organic matter incorporated with the soil mass has an effect on the ease or difficulty of soil particle detachment.

2 Also, nonwettable or difficult to wet soils will resist detachment. This phenomenon is lessened with continual wetting.

3 It is not unusual for soils to become nonwettable within the surface layer following a wildfire or broadcast burning where spot areas have burns too hot.

2. Permeability

This is a measure of the rate at which water moves through soil. On a broad basis, soil textural classes can be used to estimate permeability and the associated factor.

TABLE 2

Soil Textures and Associated Permeabilities and Rating Factors

Soil Texture	Permeability	Factor
Sands Loamy Sands Sandy Loams Fine Sandy Loams	Rapid	1
Loams Silt Loams Silty Clay Loams	Moderate	2-3
Clay Loams Clays Extremely Fine Clays	Slow	4-5

ESTIMATED SURFACE SOIL EROSION HAZARD
RM-87 (4/84)

STATE OF CALIFORNIA
BOARD OF FORESTRY

SOIL FACTORS				FACTOR RATING BY AREA		
A. SOIL TEXTURE	Fine	Medium	Coarse	A	B	C
1. DETACHABILITY	Low	Moderate	High			
Rating	1-9	10-18	19-30			
2. PERMEABILITY	Slow	Moderate	Rapid			
Rating	5-4	3-2	1			

B. DEPTH TO RESTRICTIVE LAYER OR BEDROCK

	Shallow	Moderate	Deep			
	1"-19"	20"-39"	40"-60" (+)			
Rating	15-9	8-4	3-1			

C. PERCENT SURFACE COARSE FRAGMENTS GREATER THAN 2 MM IN SIZE INCLUDING ROCKS OR STONES

							FACTOR RATING BY AREA		
	Low	Moderate	High						
	(-) 10-39%	40-70%	71-100%				A	B	C
Rating	10-6	5-3	2-1						
			SUBTOTAL ⇨						

.I. SLOPE FACTOR

Slope	5-15%	16-30%	31-40%	41-50%	51-70%	71-80% (+)			
Rating	1-3	4-6	7-10	11-15	16-25	26-35			

III. PROTECTIVE VEGETATIVE COVER REMAINING AFTER DISTURBANCE

	Low	Moderate	High			
	0-40%	41-80%	81-100%			
Rating	15-8%	7-4	3-1			

IV. TWO-YEAR, ONE-HOUR RAINFALL INTENSITY (Hundredths Inch)

	Low	Moderate	High	Extreme			
	(-) 30-39	40-59	60-69	70-80 (+)			
Rating	1-3	4-7	8-11	12-15			
				TOTAL SUM OF FACTORS ⇨			

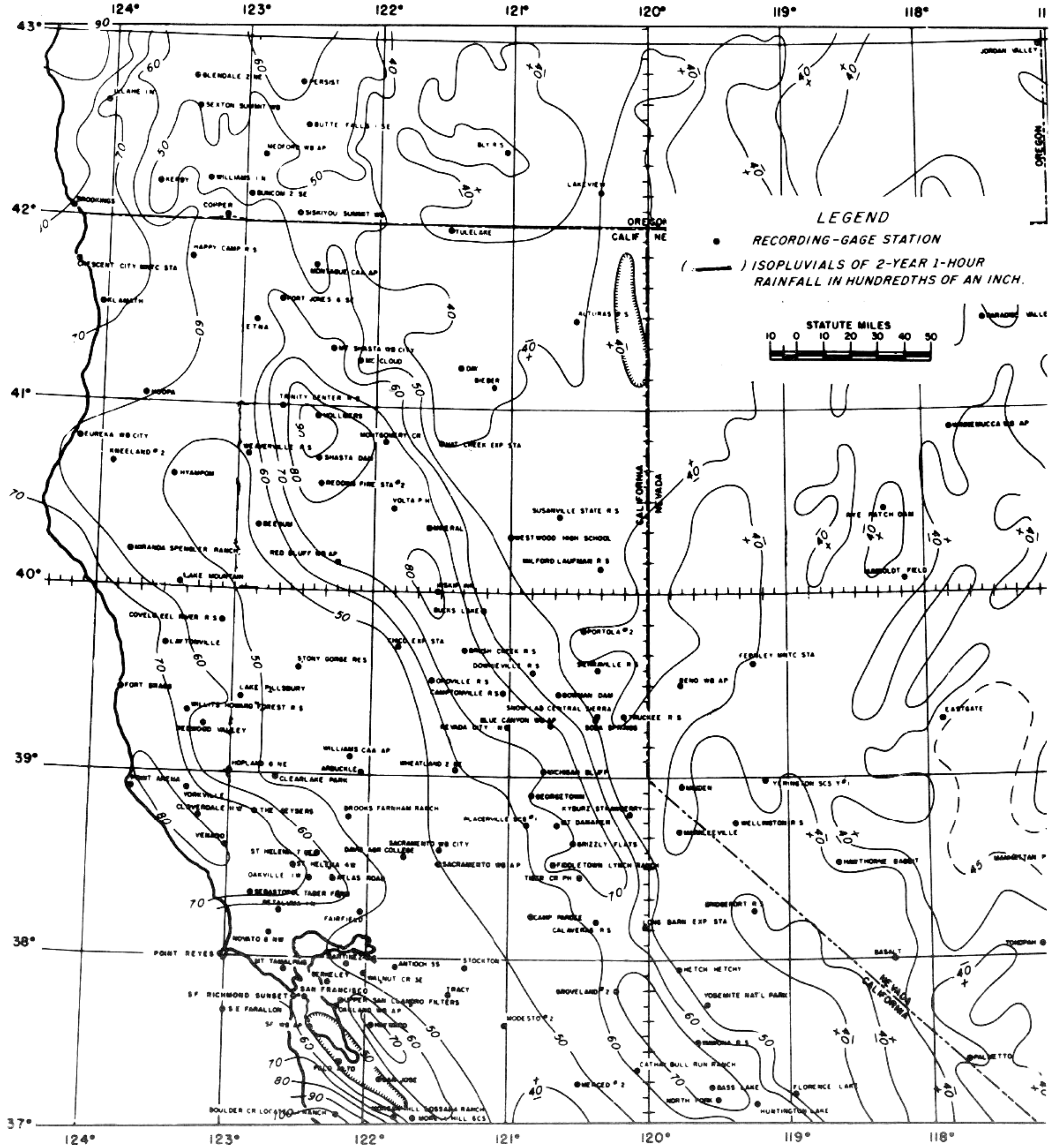
EROSION HAZARD RATING

<50	50-65	66-75	>75			
LOW (L)	MODERATE (M)	HIGH (H)	EXTREME (E)			
			THE DETERMINATION IS ⇨			

7540-130-0435

2-YEAR 1-HOUR RAINFALL

NORTHERN CALIFORNIA



2-YEAR 1-HOUR RAINFALL

SOUTHERN CALIFORNIA