Section IV – Cumulative Impact Assessment

Contents

SECTION IV

STATE OF CALIFORNIA
BOARD OF FORESTRY
CUMULATIVE IMPACTS ASSESSMENT

(1) Do the assessment area(s) of resources that may be affected by the proposed project contain any past, present, or reasonably foreseeable, probable, or future projects?

Yes X No___

If the answer is yes, identify the project(s) and affected resource subject(s).
The text and pages that follow provide a summary of past, present and future projects. It shows acres logged by silvicultural system and yarding method, percent of the watershed covered and describes the location within the watershed.
This THP lies in the 8792 acre Robinson Creek Planning Watershed (RCPW) (1113.810002) and the 4628 Doty Creek Planning Watershed (1113.810003)(DCPW). Total flood prone area (FPA), also referred to as the floodplain, in the Robinson Creek watershed assessment area (WAA) is 382 acres or 4.3%. Within the FPA the THP proposes to harvest 68 acres or 17.8% of the FPA. Total flood prone area in Doty Creek watershed assessment area (WAA) is 28 acres or 0.6%. No harvesting is planned within the FPA of the Doty Creek Watershed Assessment area as part of this THP.

1. Past and Present Projects-

In the past 10 years timber operations have occurred on or were planned for the specified acreage within each of the following CAL WATER planning watersheds within the Watershed Assessment Area (WAA):
Robinson Creek: 683 of 8792 acres, or 7.8% of the watershed is under plan or has been harvested. Acres operated on or planned in the floodplain of Robinson Creek: 157 of 382 acres or 41.1% of the FPA.
Doty Creek: 394 of 4628 acres, or 8.5% of the watershed is under plan or has been harvested. Acres operated on or planned in the floodplain of Doty Creek: 24 of 28 acres or 86% of the FPA.

Harvesting Within the Flood Prone Area (FPA)
Since the inception of the Forest Practice Act in 1973 about 88% of the Elk flood prone area stands, within this ownership, have been harvested at least once. Harvest activity on adjacent flood prone areas that have been harvested several times in the last 50 years under the selection management system indicates that these stand areas can maintain a harvest reentry cycle of roughly 15 to 20 years. Timber harvesting in the late 1990s to 2000 became problematic for any timberland owner who had flood prone timber areas within their ownership. For various reasons State and Federal agencies were becoming increasingly concerned over perceived potential impacts to watercourses from operating under the Forest Practice Rules at the time; i.e., the regulatory agencies had concerns that the then-existing rules were not sufficiently protective of water resources with a primary focus on anadromous salmonid habitat, health and abundance. Hence, there was a 12-plus-year hiatus of harvesting the FPAs on the ownership until a more restrictive Forest Practice Rule proposal could be developed and approved by the Board of Forestry that had buy-in from all the regulatory

agencies; i.e., the Anadromous Salmonid Protection (ASP) Rule Package of 2009.

The total timbered flood prone acreage within the GRT ownership encompasses approximately 2,000 acres of Site I timberlands. These floodplain areas have not been harvested since 1999/2000 as the previous owners had determined they would wait until implementation of the ASP Rules in 2010. Harvesting on the floodplains did not occur for 12 years or more until the approval and harvest of the Kestrel THP 1-11-087 SON (112 acres selection) in 2014-15 and the pending Dogwood THP 1-15-042 SON (290 acres selection & 52 acres no-cut) which was partially harvested in 2016 (these latter two plans being predominately located along the South Fork Gualala River); and the Plum THP 1-16-094 MEN (154 acres selection) located along the North Fork Gualala River where harvesting was initiated in 2017 and is to be completed in 2019. Because of the past decade and a half delay awaiting ASP Rule development, much of the floodplain areas within the GRT ownership are now at or are well past their normal selection harvest reentry schedule of 15-20 years. Thus, harvesting on GRT's FPAs is expected to continue into the next 5 to 10-year planning horizon.

Due to the highly restrictive measures required for harvesting practices by the ASP flood prone area (FPA) rules, the cumulative impacts of these harvests are expected to be insignificant. Sediment delivered from upstream watercourses during flood events that inundates the FPA will either continue to be passed downstream or be trapped by vegetation and deposited as flood water movement slows over the inundated area, allowing both coarse and fine sediments to settle out to be deposited on the floodplain surface. The FPA is a net receiver of sediment (acting as a deposition zone) due to this process during flood/inundation events. The amount of sediment deposition during flood/inundation events far exceeds any potential movement of sediment that could be generated from the harvest area as a result of site disturbance from harvest operations. Erosion and movement of sediment generated from the FPA is not anticipated under the restrictions of the ASP Rules and other limitations of the THP. The goals of the ASP Rules are to maintain high canopy levels for stream shading and adjacent streamside thermal temperature control, retain ground vegetative cover and avoid disturbance of critical flood prone area habitat including avoiding wet areas such as abandoned meanders, oxbow lakes and other features that could provide off channel habitat for fish during flood flows. In effect, harvest operations are severely constrained to reduce potential impacts to anadromous salmonids and the fluvial functions of the water flows on the FPA. Proper implementation of the ASP restrictions makes potential adverse effects of timber operations within floodplains in the WAA very unlikely to occur and cumulative impacts to beneficial uses of water are not expected.

Past and present project summary of the watershed harvested, by silviculture and by owner, is included in the THP history tables and maps that follow this section.

2. Future Projects-

Elk THP and Future Projects

The harvest planned on the flood plain of the Gualala River under this THP is part of the normal timber management cycle scheduled for the property. The flood plain was originally clearcut at the turn of the 20th century and the old growth tree stumps re-sprouted and grew back into a dense second growth redwood

stand. The area has been selectively harvested on a periodic basis since the 1950s. The flood plain has not been significantly impacted by recent harvests over the past five decades since the implementation of the Z'Berg Nejedly Forest Practice Act of 1973 due to required streamside protection buffers.

ASP rule implementation results in very light and limited harvests in the flood plains of Class I watercourses such as the Gualala River and the main Class I watercourse tributaries where the plan is located. The ASP rules require that no timber harvesting occur within 30 feet of the edge of the river within the riparian Core Zone. The rules also require leaving 13 of the largest trees per acre and 80% overstory canopy within the area from 30 feet out to 150 feet within the Inner Zone (Inner Zone A). Beyond this Inner Zone A the 13 largest trees per acre and at least 50% overstory canopy must be left in the next zone (Inner Zone B), which extends to the outer edge of the flood prone area at the toe of the slope. There are also strict limitations on road building, skid trail use, slash piling, and a requirement for retention of the larger trees in the flood plain stand with the goal of reducing stand density to 30 to 50 trees per acre of large overstory redwoods. During harvesting, identified wet areas must be avoided and soil impacts must be negligible so not to affect or alter the hydraulics of flood waters as it passes through the floodplain. The ASP Rules are designed to minimize impacts to insignificance. As a result, the harvest is so light that it can be imperceptible within a few years after harvesting. The shady flood plains rapidly revegetate with forbs, ferns and shrubs, quickly hiding and stabilizing any soil disturbances associated with harvesting.

The goal of the ASP Rules in the flood plains is to grow a forest that improves and restores anadromous salmonid habitat with retention of the largest trees that have the most structure and will provide a high, dense, shade canopy. Eventually the older big trees will topple and fall into the watercourse to provide large woody debris and increase stream habitat complexity, including developing deeper pools, better mixing of spawning gravels and increasing cover from predators for the benefit of anadromous salmonid spawning and rearing. Future entries on these floodplains are expected to occur every 15 to 20 years with light selection harvests that have the goal of restoring the stands to a condition more favorable to providing improved anadromous salmonid habitat.

The restoration type of commercial forestry being practiced on the flood plains by GRT is now becoming more common on redwood lands throughout the state. Similar forest restoration commercial harvesting practices are being used by a number of non-governmental organizations (NGOs) including the Sempervirens Fund and Peninsula Open Space Trust on the San Vincente Redwoods property in Santa Cruz County, the Redwood Forest Foundation on the Usal Forest in Mendocino County, and on a number of private tracts the Save the Redwoods League owns and manages as well as in a partnership with the National Park Service at Redwood National Park (in Humboldt County) called Redwoods Rising where younger stands are managed to decrease stand density and increase heterogeneity of forest structure. The Sempervirens Fund description of the Living Landscape plan for the San Vincente Redwoods states: *Our conservation plan reserves two-thirds of the property for restoration and recovery, so that young redwood trees – akin to a 4-year-old human — can live 2,000 years or more and help re-create a vibrant forest. The plan also identifies limited areas where selective timber harvesting may continue – only with great care, under strict sustainability standards – to generate money for ongoing management and restoration of the property.* https://sempervirens.org/protect-redwoods/success-stories/

A note regarding GRT's property ownership. In July of 2015 Gualala Redwoods Inc. (GRI) changed ownership, and Gualala Redwood Timber LLC (GRT) was formed. It is GRT's intent to manage the property in a manner similar to GRI's practices. However, GRT has not had time to fully review all aspects of GRI's future management program, and GRT may make changes in the future. References to GRI in the planning history are for informational purposes and for evaluation of past beneficial practices and impacts.

Future harvest acres and projects over the next 5-year planning horizon, that are planned within the watersheds that make up the Watershed Assessment Area (WAA) on GRT are as follows (see "Elk Cumulative Impacts Assessment Area Map" for each of the watersheds in the WAA):

Robinson Creek Watershed: 475 acres or 5.4% of the watershed area.
Doty Creek Watershed: 398 acres or 8.6% of the watershed area.

Other non-harvest forest management activities can be expected to occur on GRT's ownership in the future. Those projects will or may include:

- **Gravel Mining**. The application process for renewal of the Bed Rock/GRT gravel mining permit on the mainstem South Fork Gualala River and the Wheatfield Fork will be initiated within the year to allow continued mining over the next 10-year permitting period. Averaged annual gravel extractions under the present 10-year plan within the WAA has been 9,745 cubic yards per year. The gravel mining does not directly affect the watersheds of this THP.

- **Road Rehabilitation**. Watershed restoration work and road storm proofing is an ongoing activity. In the last 15 years nearly 60% of the ownership's road system has been improved to reduce potential sediment delivery to the streams within the Gualala River Watershed. This has been accomplished through stream crossing replacements and improvements, removal of legacy earth fill crossings and undersized culverts, storm proofing roads by reconstruction to an outsloped running surface, and hydrologically disconnecting the road surface from nearby watercourses. In all, approximately 295,000 cubic yards of sediment have been prevented from being delivered to the tributaries and the main watercourses of the Gualala River and has been retained on the hillslopes through stabilization work. Within the next 10 years GRT will continue to address treatment of the remaining 40% of its road system through grant funding or as on-site project mitigation through the company's timber harvest management program.

- **Fish Habitat Improvement**. GRT plans to continue its grant funded work with the Gualala River Watershed Council (GRWC), the California Department of Fish and Wildlife, and NOAA Fisheries to improve the on-property fish habitat with additional instream large woody debris placement. To date it is estimated that more than 111 log truck loads of large wood has been placed in the fish bearing streams on GRT property within the Gualala River Watershed. This work was primarily accomplished

through State grant funding and company cost share, and to a limited extent as off-site fish habitat mitigation related to the gravel extraction and mining permit. In 2018 eleven (11) large trees (nearly 14 MBF) were placed in the North Fork of the Gualala River by use of the Option 'v' process in the ASP Rules that allows for site-specific restoration work within the watercourse channel. GRT expects it will continue this work into the future in association with GRWC, California Department of Fish and Wildlife, the North Coast Regional Water Quality Control Board, and NOAA Fisheries.

All this past and expected future restoration and stabilization work as addressed above has been evaluated through monitoring efforts by the GRWC and found to be contributing significant improvements to the Gualala River Watershed. The regulatory agencies support continuing this work into the future as the work is resulting in measurable fish and water quality improvements to the Gualala River Watershed, the WAA and the THP area.

Timber Harvest Scheduling

Harvesting, for practical reasons due to historical past harvest entries, access availability, equipment and manpower mobilization and staging, is often concentrated in one watershed for a period of time and reduced in another watershed. This varying harvest intensity must be addressed in a cumulative effects analysis. In the assessment of potential cumulative effects that may result from harvesting the percent watershed acres harvested is a poor indicator by itself because if all silviculture were even-aged then one would expect on a sixty-year rotation to only harvest 16.7% of a watershed within a ten-year period due to adjacent harvest unit constraints imposed by the Forest Practice Rules. However, if the landowner were to fully engage in uneven-aged silviculture over the entire watershed one could expect to selectively harvest 50 to 100% of the acres over a ten to fifteen-year period. Since there is a mixed employment of silvicultural prescriptions within a watershed the areas harvested in a ten to fifteen-year period become more complicated to decipher. This also does not take into account the fact that these are not fully regulated stands but have been harvested in bursts of activity in the past which has resulted in the majority of these stands becoming harvestable at approximately the same time in many cases. This pattern results in decades with higher harvest rates over an area followed by decades in which little to no harvesting occurs, so potential impacts can be periodic in nature.

For past and future plans within the Robinson Creek Watershed at least 13.2% (1158 acres) of the watershed has been or will be harvested over the assessment period of the past 10 years and planning horizon of the next 5 years. This is less than what would occur at a sixty-year rotation rate if all silviculture was even-age (25% over fifteen years). Also, at least 70% of the acreage has been or will be harvested using selection silviculture or is within no-cut areas.

For past and future plans within the Doty Creek Watershed at least 17.1% (792 acres) of the watershed has been or will be harvested over the assessment period of the past 10 years and planning horizon of the next 5 years. This is less than what would occur at a sixty-year rotation rate if all silviculture was even-age (25% over fifteen years). At least 50% of those acres have been or will be harvested using selection silviculture.

At the present rate of harvest and because of harvest unit adjacency rules it is likely that many of the stands on the landowner's property will not be harvested until they are many decades older than the rules require for minimum stand age using even-aged management. Much of the ownership will continue to be managed

using unevenaged selection silviculture, and older stands of mature timber will continue to exist because of a number of restrictions and considerations including watercourse protection rules, geological hazard set-asides, northern spotted owl habitat protection, as well as other plant and animal retention areas being left across the ownership.

Background and Conclusion Statement

The Timberland Productivity Act of 1982 restricts the use of lands zoned Timberland Production Zone (TPZ) to the growing and harvesting of timber and compatible uses, and establishes a presumption that timber harvesting is expected to and will occur on such lands. The RPF and the Director (Cal Fire) are to include the above legal consideration regarding project feasibility while giving consideration to measures proposed to reduce or avoid significant adverse impacts of THPs on lands zoned TPZ. On TPZ lands, per 14 CCR Section 898 of the Forest Practice Rules (FPR), the harvesting per se of trees shall not be presumed to have a significant adverse impact on the environment. Per the same rule section, cumulative impacts are to 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. After considering the rules of the Board and those mitigation measures proposed in the plan, the RPF is to indicate whether the proposed timber operation would have any significant adverse impact on the environment. With implementation of the FPRs and use of the multi-agency review process, it is the intent to mitigate the environmental impacts of a THP to a less-than-significant level; in most all cases this is achievable. Once done on an individual THP (project) basis, an evaluation needs to be conducted to determine whether multiple projects across the landscape would constitute or combine to create a cumulative adverse impact on the environment.

It is important to recognize that cumulative environmental effects can be either adverse or beneficial, and respectively significant or insignificant. Guidance under Addendum No. 2 of the FPRs is intended to meet the requirements of CEQA Guidelines CA Code of Regulations section 15130. Consistent with section 15130(a)(2), this project, when considered with other past, present and future projects will not have incremental cumulative impacts which could be considered significant.

There are several strategies to deal with potentially negative environmental impacts in the implementation of forestry projects:

Avoidance

- Avoid the impact altogether by not taking action or part of the action.

Minimization

- Minimize impacts by limiting the degree or magnitude of the action and its implementation.

Mitigation

- Repair, rehabilitate, or restore degraded environmental resources.

After it is determined which of these strategies to employ in any given situation, there are a number of practices to achieve avoidance, minimization, or mitigation. They are:

Best Management Practices

- Employ a predetermined suite of management practices that are known to avoid or minimize adverse impacts.

Site-Specific Practices

- Employ individual or a combination of practices, or techniques, that are tailored to avoid, minimize, or mitigate adverse impacts that are specific to the project and/or its implementation.

On-Site Mitigation

- Mitigation that is implemented within the footprint of the proposed project or is very closely associated to the project (e.g., correctional road points along an appurtenant road).

Off-Site Mitigation

- A mitigation that is implemented outside the project area. The mitigation measure can be at a far-removed location but is expected to address any unmitigated on-site impacts as an off-set to those remaining at the proposed project location (ex., mitigation banking).

The methods and practices used during the design and implementation of the present project to address cumulative effects include all the above, and selection of the final suite of practices varies by the resource requiring protection. Selection of final practices employed is an iterative process with feedback and adaptation as the project is developed and reviewed. Drawing upon the final practices to be implemented is not a linear process, but a circular one that may have to be done and redone several times during the course of project design. Often the end goal of the project proponent is not only to achieve the project objective(s) while preventing cumulative environmental effects, but to achieve a positive environmental outcome where feasible.

The cumulative impacts analysis is both a qualitative and quantitative process. It is based on the amount of information that is available at the time of project application and is built upon a level of perceived risk. Every attempt is made to compare the current condition with that of the desired outcome on the affected resource. From this comparison, one can gain an understanding as to whether a cumulative impact from past, present, and future projects will occur, and whether it can be expected to improve or degrade the present site and/or assessment area condition.

The cumulative impacts assessment provided here in Section IV, with its developed suite of mitigation measures that are carried over to the operational portion of the plan (i.e., Section II), is our best effort to meet the intent of the Forest Practices Act and its rules, and to provide the most scientifically credible impacts analysis of forest projects that are implemented on lands zoned for timber production in the State of California.

Analysis of Recent THPs on GRT lands within the WAA:

Plum THP (1-16-094men)

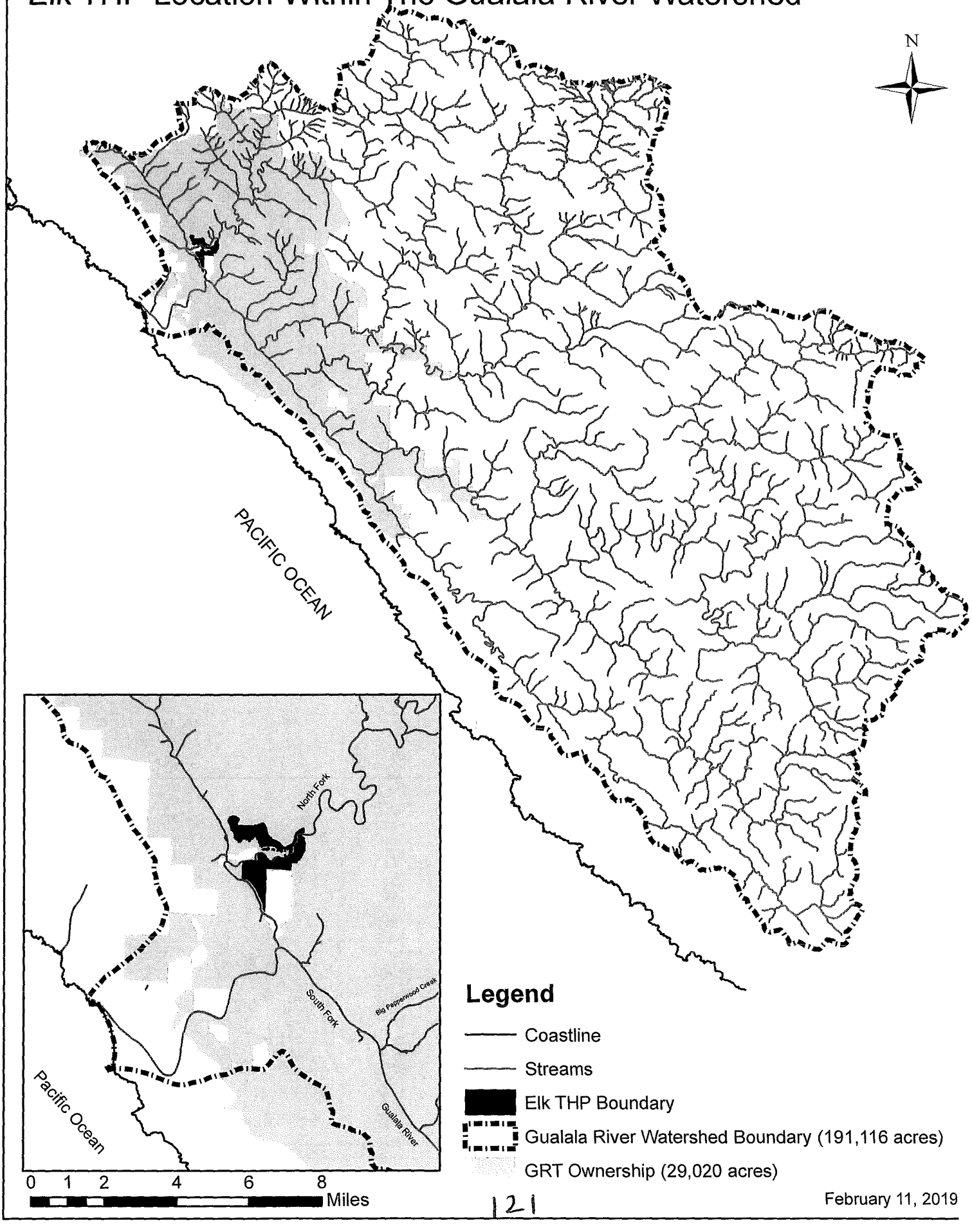
This was a recent THP within the WAA. The Plum THP was approved on January 23, 2017 and was harvested in 2017. As with all timber harvest plans conducted on GRT timberlands, the Plum THP received a multi-agency review that included on-site inspection by staff from the North Coast Regional Water Quality Control Board, the Department of Fish and Wildlife, California Geological Survey, State Archaeologist, and Cal Fire's Forest Practice staff. The THP was found to be in compliance with the Forest Practice Act and the Forest Practice Rules, and like

all previously approved harvest projects, was determined to be sufficiently mitigated by the State review team agencies so as not to have any measured adverse environmental impact on its own, or cumulatively when assessed in combination with other approved or ongoing projects within the various defined assessment areas, most specifically within the Robinson Creek Planning Watershed.

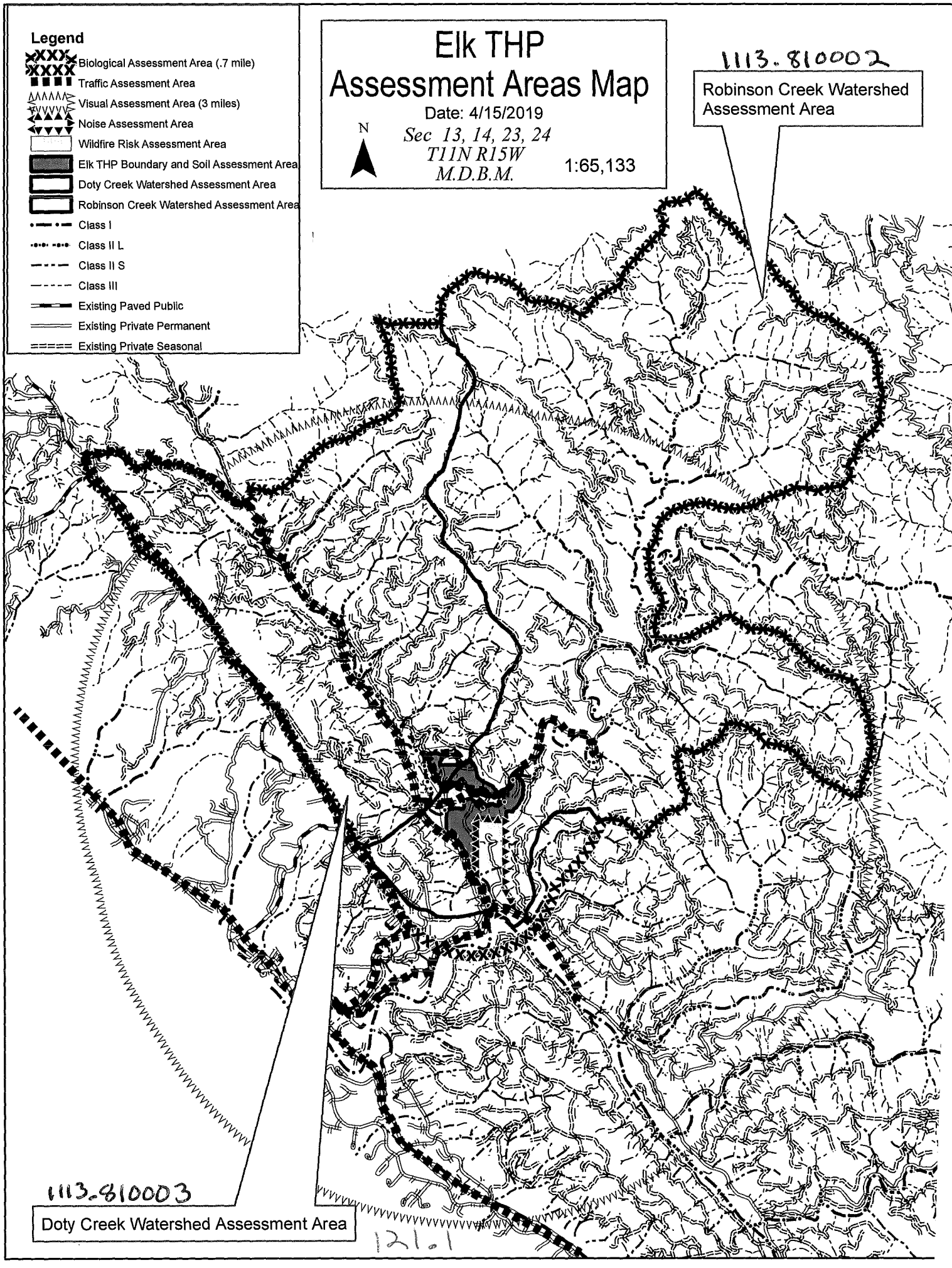
In the spring of 2019 plots were taken in the Plum THP by Eric Sutera to analyze the outcome of the Plum THP in regards to the marking. The results were that postharvest there was between 358 and 466 of conifers per acre and with hardwoods included there was between 466 and 474 square feet per acre remaining postharvest. With this much volume remaining postharvest it shows that these flood prone areas are being very lightly harvested.

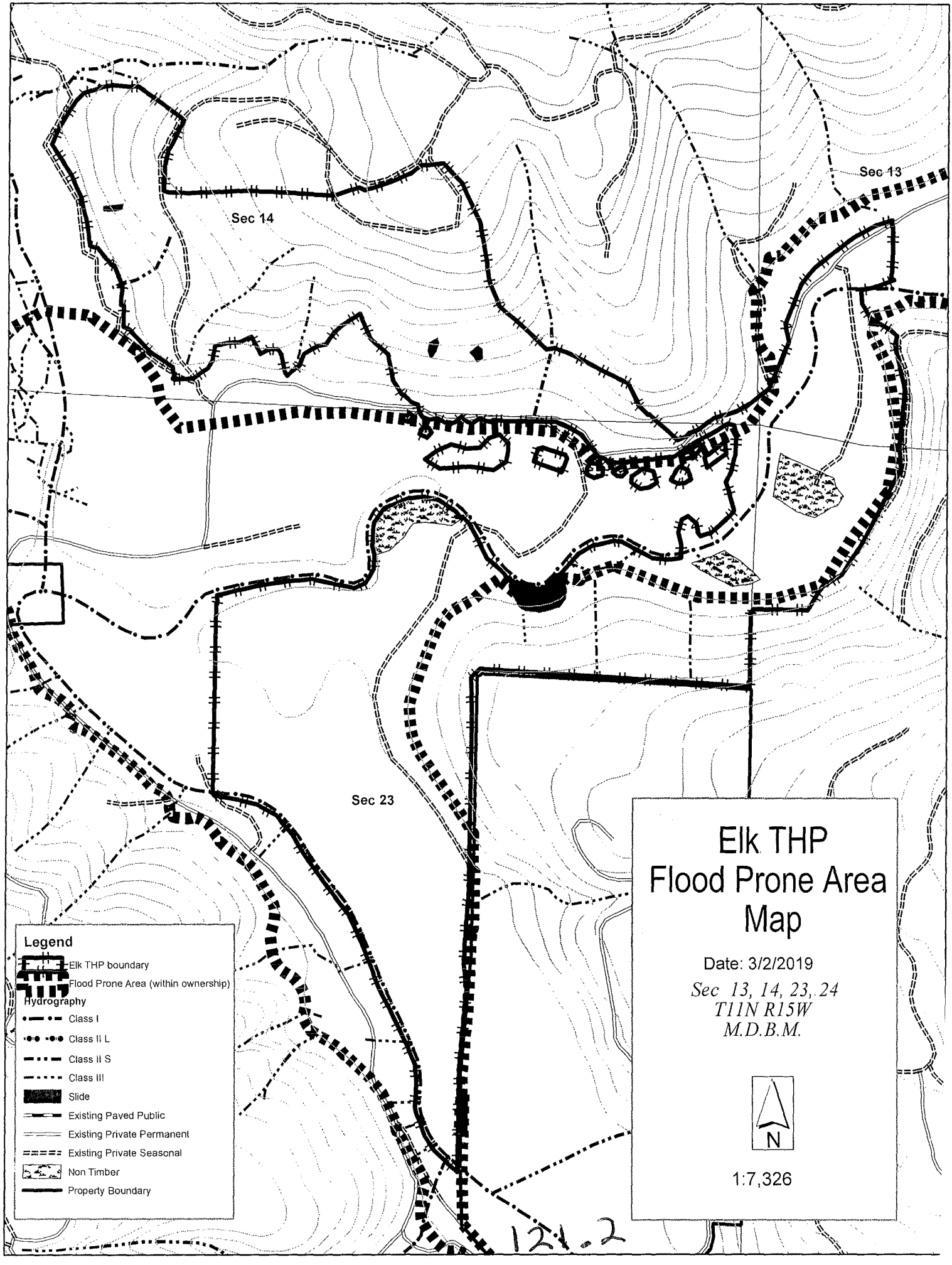
ELK THP
Past, Present, and 5-Year Foreseeable Future Project Assessment Maps and Tables

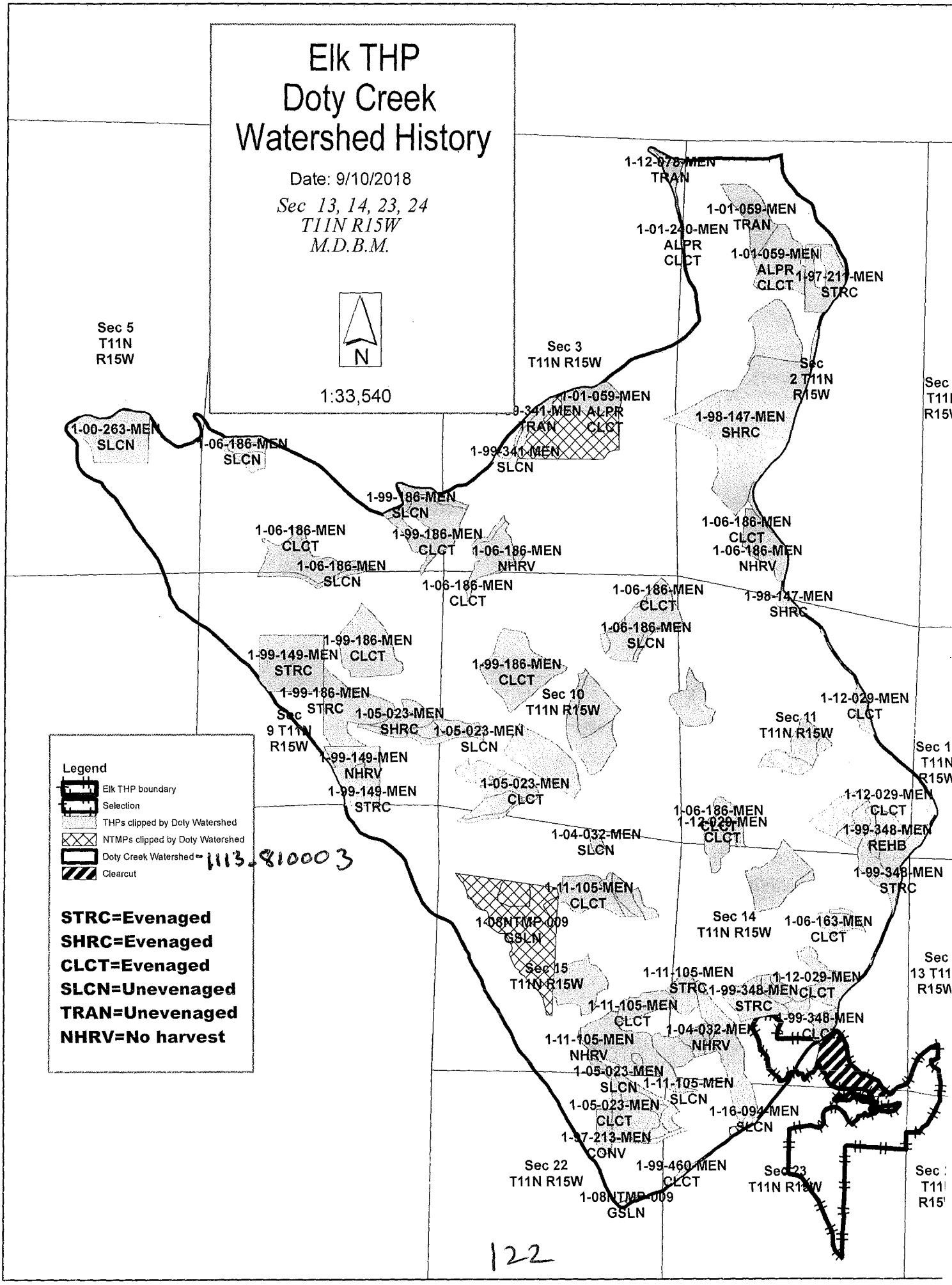
Elk THP Location Within The Gualala River Watershed



February 11, 2019


Legend
Biological Assessment Area (.7 mile)
Traffic Assessment Area
Visual Assessment Area (3 miles)
Noise Assessment Area
Wildfire Risk Assessment Area
Elk THP Boundary and Soil Assessment Area
Doty Creek Watershed Assessment Area
Robinson Creek Watershed Assessment Area
Class I
Class II L
Class II S
Class III
Existing Paved Public
Existing Private Permanent
Existing Private Seasonal
Elk THP
Assessment Areas Map
Date: 4/15/2019
N
Sec 13, 14, 23, 24
T11N R15W
M.D.B.M.
1:65,133
1113-810002
Robinson Creek Watershed Assessment Area
1113-810003
Doty Creek Watershed Assessment Area
121.1


Sec 14
Sec 13
Sec 23
Legend
Elk THP boundary
Flood Prone Area (within ownership)
Hydrography
Class I
Class II L
Class II S
Class III
Slide
Existing Paved Public
Existing Private Permanent
Existing Private Seasonal
Non Timber
Property Boundary
Elk THP
Flood Prone Area
Map
Date: 3/2/2019
Sec 13, 14, 23, 24
T11N R15W
M.D.B.M.
N
1:7,326


Elk THP
Doty Creek
Watershed History
Date: 9/10/2018
Sec 13, 14, 23, 24
T11N R15W
M.D.B.M.
N
1:33,540
Sec 5 T11N R15W
Sec 3 T11N R15W
Sec 2 T11N R15W
Sec 1 T11N R15W
1-12-078-MEN TRAN
1-01-059-MEN TRAN
1-01-240-MEN ALPR CLCT
1-01-059-MEN ALPR CLCT
1-97-211-MEN STRC
1-00-263-MEN SLCN
1-06-186-MEN SLCN
1-99-341-MEN TRAN
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1-99-341-MEN SLCN
1-98-147-MEN SHRC
1-99-186-MEN SLCN
1-06-186-MEN CLCT
1-99-186-MEN CLCT
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1-06-186-MEN NHRV
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1-06-186-MEN CLCT
1-06-186-MEN SLCN
1-99-186-MEN CLCT
1-99-149-MEN STRC
1-99-186-MEN CLCT
1-99-186-MEN STRC
Sec 10 T11N R15W
1-12-029-MEN CLCT
Sec 9 T11N R15W
1-05-023-MEN SHRC
1-05-023-MEN SLCN
Sec 11 T11N R15W
Sec 12 T11N R15W
1-99-149-MEN NHRV
1-05-023-MEN CLCT
1-99-149-MEN STRC
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1-12-029-MEN CLCT
1-99-348-MEN REHB
1-04-032-MEN SLCN
1-99-348-MEN STRC
1-11-105-MEN CLCT
1-08NTMP-009 GSLN
Sec 14 T11N R15W
1-06-163-MEN CLCT
Sec 15 T11N R15W
1-11-105-MEN STRC
1-99-348-MEN CLCT
1-12-029-MEN CLCT
1-11-105-MEN CLCT
1-99-348-MEN STRC
1-04-032-MEN NHRV
1-99-348-MEN CLCT
1-11-105-MEN NHRV
1-05-023-MEN SLCN
1-11-105-MEN SLCN
1-05-023-MEN CLCT
1-16-094-MEN SLCN
1-97-213-MEN CONV
Sec 22 T11N R15W
1-99-460-MEN CLCT
Sec 23 T11N R15W
1-08NTMP-009 GSLN
Sec 13 T11N R15W
Sec T11N R15
Legend
Elk THP boundary
Selection
THPs clipped by Doty Watershed
NTMPs clipped by Doty Watershed
Doty Creek Watershed = 1113.810003
Clearcut
STRC=Evenaged
SHRC=Evenaged
CLCT=Evenaged
SLCN=Unevenaged
TRAN=Unevenaged
NHRV=No harvest

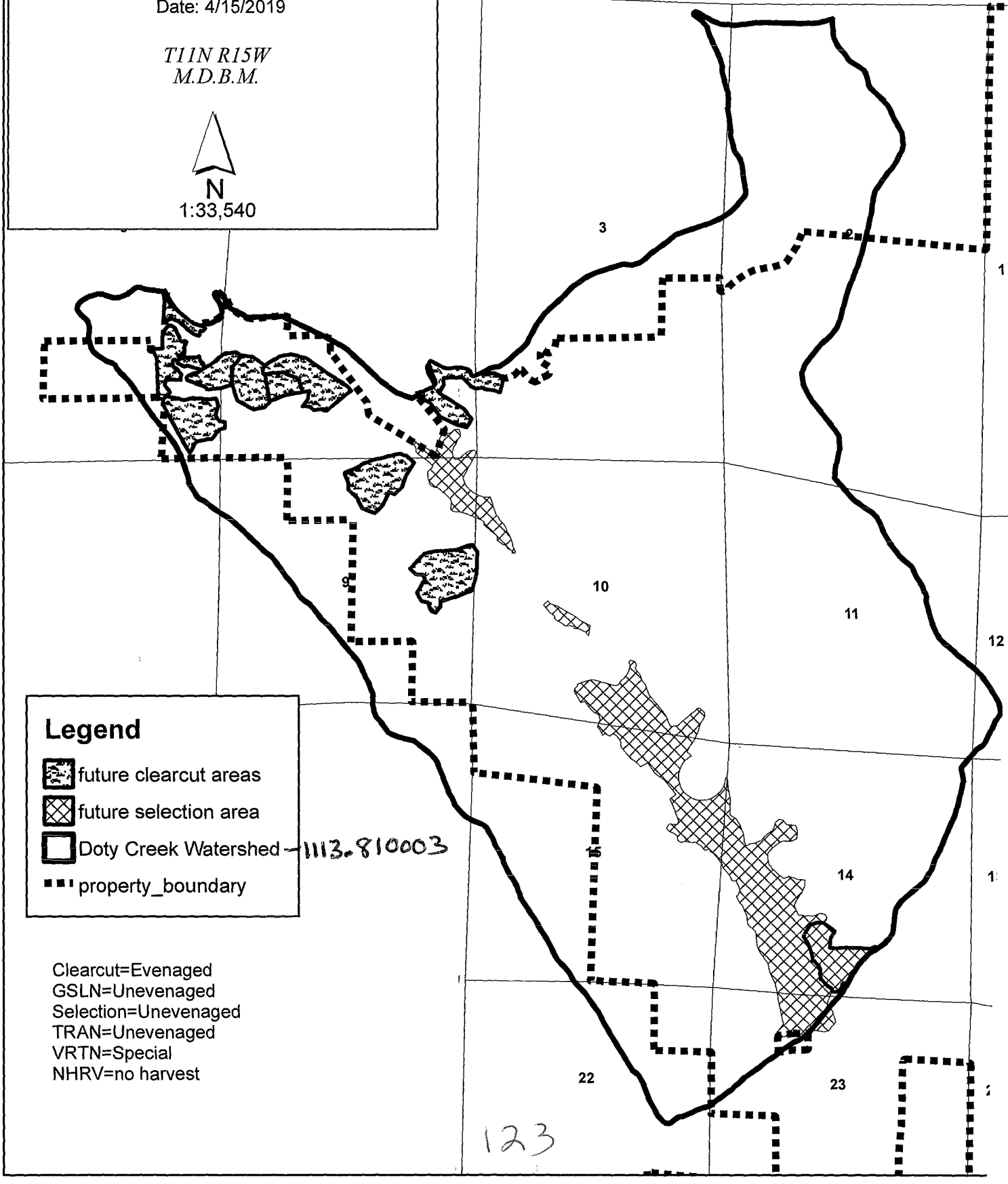
Doty Creek Watershed Future Potential THPs Map

Date: 4/15/2019

T11N R15W
M.D.B.M.

N

1:33,540



Legend

- future clearcut areas
- future selection area
- Doty Creek Watershed – 1113.810003
- property_boundary

Clearcut=Evenaged
GSLN=Unevenaged
Selection=Unevenaged
TRAN=Unevenaged
VRTN=Special
NHRV=no harvest

123

DOTY CREEK PLANNING WATERSHED THP HISTORY FROM 2009 - 2019 1113.810003 **4,628 acres**

Past and Present Projects:

Year	THP Num	Silviculture	Yarding	Landowner	Acres	% of PWS	silviculture category
1998	1-98NTMP-025	Selection		Merle & Patricia Schreiner	50	1.08%	unevenaged
2008	1-08NTMP-009	Group Selection		Bower Limited Partnership	1	0.03%	unevenaged
2008	1-08NTMP-009	Group Selection	Cable System	John & Margaret Bower	11	0.24%	unevenaged
2008	1-08NTMP-009	Group Selection	Tractor or Skidder	Bower Limited Partnership	2	0.04%	unevenaged
2008	1-08NTMP-009	Group Selection	Tractor or Skidder	John & Margaret Bower	65	1.41%	unevenaged
2011	1-11-105-MEN	Clearcut	Cable System	Gualala Redwoods Inc	37	0.80%	evenaged
2011	1-11-105-MEN	Clearcut	Tractor/Cable option	Gualala Redwoods Inc	40	0.87%	evenaged
2011	1-11-105-MEN	STRS	Tractor/Cable option	Gualala Redwoods Inc	10	0.22%	evenaged
2011	1-11-105-MEN	Selection	Tractor/Cable option	Gualala Redwoods Inc	43	0.93%	unevenaged
2012	1-12-029-MEN	Clearcut	Cable System	Gualala Redwoods Inc	56	1.21%	evenaged
2012	1-12-029-MEN	Clearcut	Tractor/Cable option	Gualala Redwoods Inc	72	1.56%	evenaged
2012	1-12-078-MEN	Transition	Tractor or Skidder	Mendocino Redwood Co	5	0.10%	unevenaged
2012	1-12-078-MEN	Variable Retention	Tractor or Skidder	Mendocino Redwood Co	1	0.03%	special
2016	1-16-094-MEN	Selection	Tractor or Skidder	Gualala Redwood Timber LLC	0.25	0.01%	unevenaged
				Sub total from 2009 to 2019	394	8.52%	

Year	THP Num	Silviculture	Yarding	Landowner	Acres	% of PWS	silviculture category
2019	little	Selection	Tractor or Skidder	Gualala Redwood Timber LLC	199	4.30%	unevenaged
2019	elk	Selection	Tractor or Skidder	Gualala Redwood Timber LLC	24	0.52%	unevenaged
next five years	no number	clearcut	tractor	GRT	175	3.78%	even aged
				Sub Total for next five years	398	8.60%	
				Total:	792	17.1%	

DOTY CREEK PLANNING WATERSHED SILVICULTURE HISTORY FROM 2009-2019 1113.810003 **4628 acres**

Past and Present Projects:

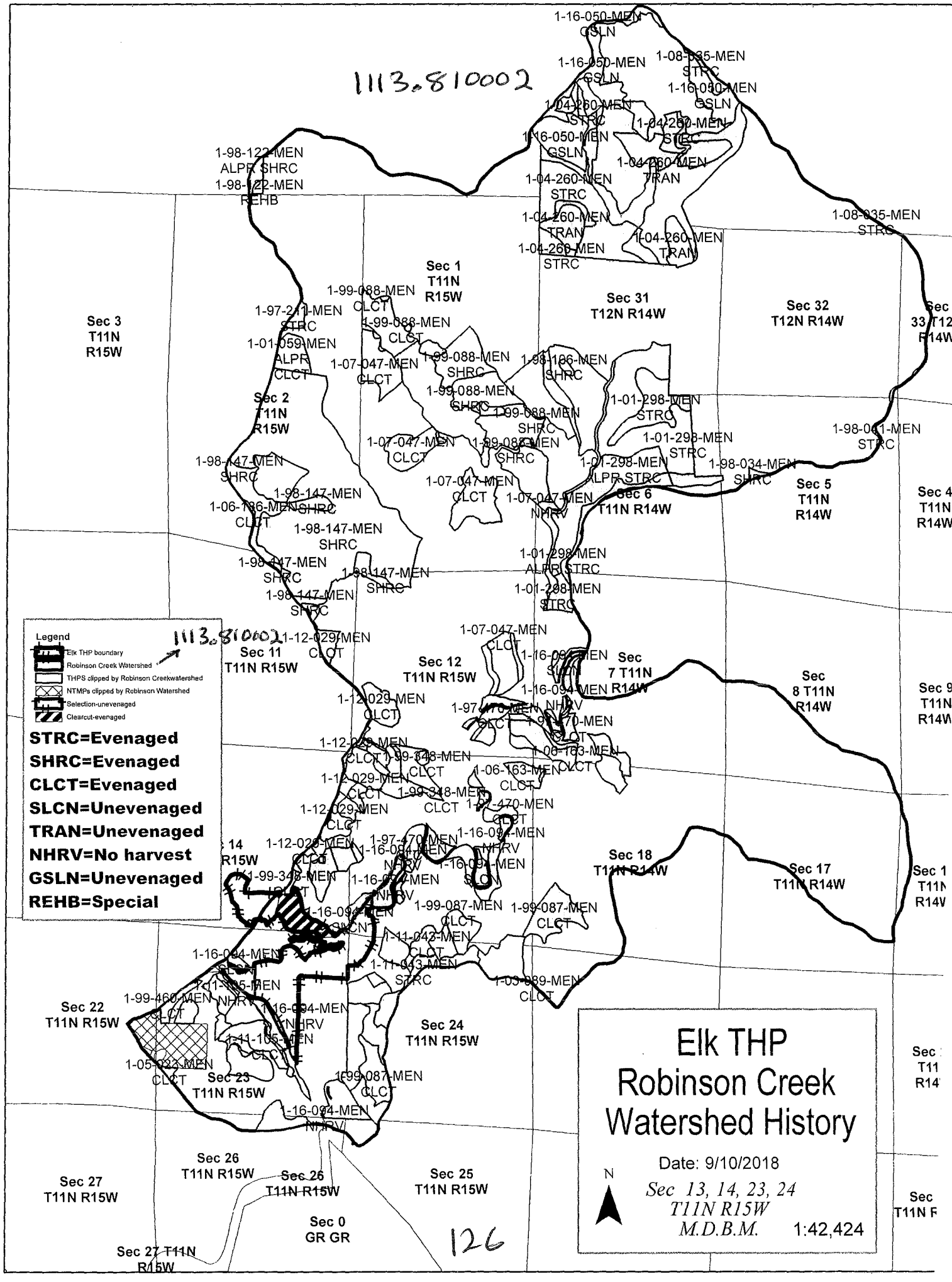
Silviculture	Acres	% of PWS	Silviculture Category
Clearcut	206	4.45%	evenaged
Seed Tree Removal Step	10	0.22%	evenaged
variable retention	1	0.02%	special
Selection, transition	177	3.82%	unevenaged
Sub Total:	394	8.5%	

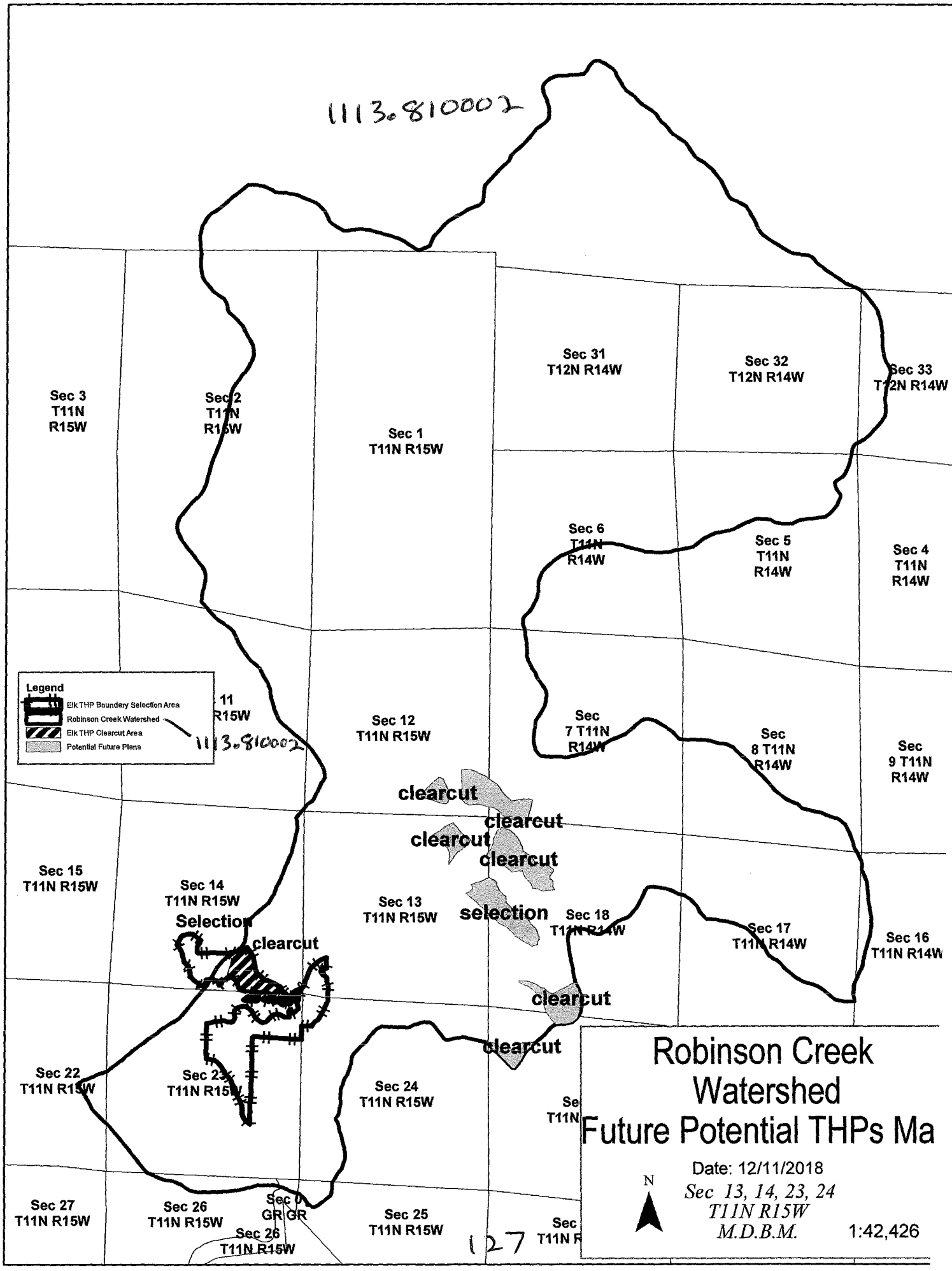
Future Projects:

Silviculture	Acres	% of PWS	
Clearcut	175	3.8%	evenaged
Selection	223	4.8%	unevenaged
SRS	0	0.0%	evenaged
Sub Total:	398	8.6%	

	Acres	% of PWS
Total:	792	17.1%

Last ten years % of watershed unevenaged	% of watershed evenaged	% of watershed special	% of watershed intermediate	totals
3.8%	4.7%	0.0%	0.0%	8.5%


1113.810002
Legend
Elk THP boundary
Robinson Creek Watershed
THPS clipped by Robinson Creekwatershed
NTMPs clipped by Robinson Watershed
Selection-unevenaged
Clearcut-evenaged
STRC=Evenaged
SHRC=Evenaged
CLCT=Evenaged
SLCN=Unevenaged
TRAN=Unevenaged
NHRV=No harvest
GSLN=Unevenaged
REHB=Special
Sec 1 T11N R15W
Sec 2 T11N R15W
Sec 3 T11N R15W
Sec 11 T11N R15W
Sec 12 T11N R15W
Sec 22 T11N R15W
Sec 23 T11N R15W
Sec 24 T11N R15W
Sec 25 T11N R15W
Sec 26 T11N R15W
Sec 27 T11N R15W
Sec 31 T12N R14W
Sec 32 T12N R14W
Sec 5 T11N R14W
Sec 6 T11N R14W
Sec 7 T11N R14W
Sec 8 T11N R14W
Sec 17 T11N R14W
Sec 18 T11N R14W
Elk THP
Robinson Creek
Watershed History
Date: 9/10/2018
N
Sec 13, 14, 23, 24
T11N R15W
M.D.B.M.
1:42,424
126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Sec 3 T11N R15W
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Sec 1 T11N R15W
Sec 31 T12N R14W
Sec 32 T12N R14W
Sec 33 T12N R14W
Sec 6 T11N R14W
Sec 5 T11N R14W
Sec 4 T11N R14W
Legend
Elk THP Boundary Selection Area
Robinson Creek Watershed
Elk THP Clearcut Area
Potential Future Plans
1113.810002
Sec 12 T11N R15W
Sec 7 T11N R14W
Sec 8 T11N R14W
Sec 9 T11N R14W
clearcut
clearcut
clearcut
clearcut
Sec 15 T11N R15W
Sec 14 T11N R15W
Selection
clearcut
Sec 13 T11N R15W
selection
Sec 18 T11N R14W
Sec 17 T11N R14W
Sec 16 T11N R14W
clearcut
clearcut
Sec 22 T11N R15W
Sec 23 T11N R15W
Sec 24 T11N R15W
Sec 27 T11N R15W
Sec 26 T11N R15W
Sec 25 T11N R15W
Sec 26 T11N R15W
Robinson Creek Watershed
Future Potential THPs Ma
Date: 12/11/2018
Sec 13, 14, 23, 24
T11N R15W
M.D.B.M.
N
1:42,426
127

ROBINSON CREEK PLANNING WATERSHED THP HISTORY FROM 2009 - 2019 1113.810002 **8,792 acres**

Past and Present Projects:

Year	THP Num	Silviculture	Yarding	Landowner		Acres	% of PWS	silviculture category
2008	1-08NTMP-009	Group Selection	Tractor or Skidder	Bower Limited Partnership		1	0.01%	unevenaged
2008	1-08NTMP-009	Group Selection	Tractor or Skidder	Bower Limited Partnership		57	0.64%	unevenaged
2011	1-11-043-MEN	Clearcut	Tractor or Skidder	Gualala Redwood Timber LLC		26	0.30%	evenaged
2011	1-11-043-MEN	Clearcut	Tractor/Cable option	Gualala Redwood Timber LLC		42	0.48%	evenaged
2011	1-11-043-MEN	Seed Tree Removal Ste	Tractor or Skidder	Gualala Redwood Timber LLC		26	0.30%	evenaged
2011	1-11-043-MEN	Selection	Tractor/Cable option	Gualala Redwood Timber LLC		27	0.30%	unevenaged
2011	1-11-105-MEN	Clearcut	Cable System	Gualala Redwoods Inc		34	0.39%	evenaged
2011	1-11-105-MEN	Clearcut	Tractor or Skidder	Gualala Redwoods Inc		4	0.05%	evenaged
2011	1-11-105-MEN	No Harvest Area		Gualala Redwoods Inc		2	0.02%	
2011	1-11-105-MEN	Selection	Cable System	Gualala Redwoods Inc		4	0.04%	unevenaged
2012	1-12-029-MEN	Clearcut	Cable System	Gualala Redwoods Inc		27	0.31%	evenaged
2012	1-12-029-MEN	Clearcut	Tractor/Cable option	Gualala Redwoods Inc		51	0.57%	evenaged
2016	1-16-050-MEN	Group Selection	Cable/Tractor option	Conservation Fund		201	2.29%	unevenaged
2016	1-16-050-MEN	Group Selection	Tractor or Skidder	Conservation Fund		79	0.90%	unevenaged
2016	1-16-094-MEN	No Harvest Area		Gualala Redwood Timber LLC		18	0.20%	
2016	1-16-094-MEN	No Harvest Area		Gualala Redwood Timber LLC	0.3575		0.00%	
2016	1-16-094-MEN	Selection	Tractor or Skidder	Gualala Redwood Timber LLC		104	1.19%	unevenaged
				Subtotal from 2009 to 2019		683	7.8%	

Year	THP Num	Silviculture	Yarding	Landowner		Acres	% of PWS	silviculture category
2019	Little THP	Selection	Tractor or Skidder	Gualala Redwood Timber LLC		199	2.26%	unevenaged
2019	Little THP	No Harvest Area		Gualala Redwood Timber LLC		52	0.59%	
2019	Elk THP	Selection	Tractor or Skidder	Gualala Redwood Timber LLC		93	1.06%	unevenaged
2019	Elk THP	No Harvest Area		Gualala Redwood Timber LLC		16	0.18%	
2019	Elk THP	Clearcut	Tractor or Skidder	Gualala Redwood Timber LLC		24	0.27%	evenaged
next five years	no number	Selection	tractor	GRT		35	0.40%	even aged
next five years	no number	Clearcut	tractor	GRT		124	1.41%	even aged
				Sub Total for next five years		475	5.4%	
				Total:		1158	13.2%	

ROBINSON CREEK PLANNING WATERSHED SILVICULTURE HISTORY FROM 2009-2019 1113.810002 **8792 acres**

Past and Present Projects:

Silviculture	Acres	% of PWS	Silviculture Category
Clearcut	184	2.1%	evenaged
Seed Tree Removal Step	26	0.3%	evenaged
variable retention	0	0.0%	special
Selection, transition	472	5.4%	unevenaged
Sub Total:	683	7.8%	

Future Projects:

Silviculture	Acres	% of PWS	
Clearcut	148	1.7%	evenaged
Selection	327	3.7%	unevenaged
SRS	0	0.0%	evenaged
Sub Total:	475	5.4%	

	Acres	% of PWS
Total:	1158	13.2%

Last ten years % of watershed unevenaged	% of watershed evenaged	% of watershed special	% of watershed intermediate	totals
5.4%	**2.4%**	**0.0%**	**0.0%**	**7.8%**

The resources that are possibly affected by the projects listed above are Watershed, Soil, Biological, Recreational, Visual, Noise, Traffic and Climate.

The planned levels of harvesting, when mitigated with the procedures prescribed by the rules, will not create significant adverse cumulative impacts to these assessment areas.

(2) Are there any continuing, significant adverse impacts from past land use activities that may add to the impacts of the proposed project?

Yes X No ___

If the answer is yes, identify the activities, describing their locations, impacts and affected resource subject(s).

The following cumulative effects analysis reference the following documents: the Gualala River Watershed Council (GRWC) Monitoring Plan Report 2000-2005 (GRWCMPR) and from the North Coast Watershed Assessment Program (NCWAP March 2003). The GRWCMPR is the most comprehensive analysis available and summarizes the data that has been collected as part of the Gualala River Watershed Monitoring Program Plan and includes a Quality Assurance Project Plan (QAPP) vetted by the California Department of Fish and Wildlife and the North Coast Regional Water Quality Control Board. It is part of the ongoing development of a Watershed Management and Enhancement Plan (WMEP) for the Gualala River Watershed. This monitoring plan was funded by grants from the State Water Resource Control Board (State WRCB) 319(h) program and the California Department of Fish and Game (CDFG) SB271 program.

The GRWCMPR and NCWAP reports were published in 2006 and 2003 respectively and contain the most comprehensive and scientifically valid information to date regarding existing conditions and how those conditions relate to past land use practices. NCWAP was developed through cooperative efforts with landowners, government agencies and public cooperators. The Gualala River Watershed Technical Support Document (GRWTSD) prepared by the Water Quality Control Board in 2001 as supporting documentation for the TMDL analysis by the EPA was also reviewed for this cumulative impacts analysis. The primary objective of the GRWTSD is to identify and quantify sources of sediment in a way that allows a relative comparison of those sources and to provide information for non-point source erosion control measure prioritization and implementation.

Additional references are THP reports prepared for GRI by fisheries experts, in particular a report by fisheries biologist Dennis Halligan of Natural Resources Management Corporation (Halligan 2000). Mr. Halligan's report contained valuable analysis of the available watershed information and some of his conclusions are included in this analysis.

In addition, Mr. Halligan was contacted recently (June 2019) and an email from him laid out the concerns associated with operations in the flood prone areas. Basically he reiterated the critical value of flood prone areas to salmonids. That operations on these areas during dry periods will have no direct impacts. That certain activities, most of which are incorporated into the plan, will mitigate indirect impacts. Finally he stated that "The FPRs WLPZ rules for anadromous streams were created to mitigate THP-related impacts on anadromous fish species to a less than significant level. It is incumbent on CalFire to support and defend their rules."

Watershed analysis is currently being conducted by the Gualala River Watershed Council (GRWC). The GRWC stream monitoring program revisits specific stream reaches on a periodic basis to evaluate trends in water temperature, stream channel characteristics such as depth, width, and thalweg, riparian shade cover, and presence and absence of anadromous salmonids. GRWC crews have been annually monitoring stream reaches since the two reports sited above were published in 2003. GRT is continuing these monitoring programs on its property in the Gualala River Watershed.

Past Watershed Impacts-

Prehistorically, the greatest impact to the watercourses within these watersheds was landslide activity. This resulted in the delivery of sediment into watercourses through large mass wasting events over the course of geologic time. Tim Best, a consulting State Licensed Engineering Geologist studied the Gualala Redwood property for unstable areas and wrote a report on his findings in 1998. This information was updated and reassessed in 2006 by Mr. Best. In that analysis he quantified landslides by time period using aerial photos. Smaller landslides that are found during THP preparation are added to the unstable area database for the property. This unstable area database can be found on the pages titled "Landslide Sites" in Section V (misc. addendums). All known landslides, both historic and prehistoric, are listed on these pages. Although prehistoric slides are not considered "past land use activity" they have been included in the database to be assessed in terms of potential additional watershed impacts.

Historically, timber harvesting (with its associated activities) and road building for timber purposes have been the human activities occurring within this watershed with the greatest potential for impacting watershed resources. The first logging in this watershed occurred approximately 100+ years ago. In the early part of the last century when logging was just beginning, most of the skidding was by cable logging systems that dragged logs on the surface of the ground, typically downhill to railroad spurs. The logging patterns in the earlier part of this century made heavy use of draws and watercourse channels as skid and haul roads. Around the early 1940's, timber harvesting methods began to be converted to tractor logging. The seasonal roads within the planning watersheds were sometimes constructed on the old railroad grades. During the early tractor logging operations and up to the early 1970's, roads and skid trails were mostly constructed by cut and fill methods on the slopes and in and around watercourse channels to provide a means to remove the timber. In some cases, water was diverted out of natural watercourse channels or was channeled under the skid trails and roads by means of Humboldt crossings using log chunks with and earth cap as fill material. Between 1952 and 1965 aerial photos show that extensive harvesting took place in the inland portions of the Gualala River Watershed however, existing age classes of trees indicate that the majority of harvesting of old growth on this property took place earlier than this, (1890-1910), probably because of the property's close proximity to the coast.

macr

Within the assessment area these old fills at skid trail and road crossings have long since been washed out, stabilized, or replaced by more storm proofed crossings. Eroded sediments have mobilized through and out of the Gualala watershed or have become deposits on flatter downstream reaches of the Class I and II watercourses. The majority of the sediment effects associated with the old logging before the modern Forest Practice Rules in the mid-1970's occurred shortly after the original logging took place. Long term impacts from the old logging tend to decrease with time after the activities occurred. Over time, impacted watercourse channels have reached greater levels of stability as sediments have moved downstream and stream banks have revegetated, though there is still likely to be some watercourse bank erosion where old fills and soil depositions are still actively eroding due to downcutting or bank cutting. Natural inner gorge slumping will be an on-going process. Known specific present and past impact locations are described in the "Landslide Sites" and "Completed Road Work" document summaries present in Section V of the THP. Also see THP Road Work database in Section II with the accompanying maps.

Recent Past and Present Watershed Impacts

Negative Impacts-

The recession of 2008 and the collapse of the housing bubble caused a dramatic reduction in timber harvesting across the state with many mills closing and remaining mills working at reduced rates. This was likely a short-term state of affairs, however medium term trends (i.e. over the last couple of decades) show a steady dropping off in THPs submitted and acres and volume being harvested statewide.

Not all negative environmental impacts can be attributed to pre-forest practice rule operations. Roads have continued to be constructed during the last forty years (although often the reason has been to switch from tractor logging, which requires roads at the bottom of slopes, to cable logging which needs roads at the top of slopes). Even with much more restrictive rules regarding the placement of roads and the construction and maintenance of watercourse crossings, new roads can still have potential sediment impacts if they are not designed properly to handle peak flow events or if the crossing is not properly sized and maintained. Culverts have the potential to create negative impacts through failure and the diversion of water onto unstable or erodible ground unless critical dips are placed to prevent diversions.

Surface erosion may occur where bare ground has been exposed and waterbars potentially can fail on roads and skid trails if not constructed properly or maintained. Prior to the 1973 Forest Practice Rules (FPR), skid trails were frequently built on steep slopes by large tractors and were constructed by pushing fill onto the steep slope below the trail. Some of these skid trails have had fill failures over time and usually during peak rain events as fill materials became saturated. Many of these skid trails and the associated fill failures have revegetated with thick conifer reproduction and potential fill failure has since stabilized or fill leaving the slopes has settled out onto lower gradient reaches. More of a problem than the pre-FPR road and skid trail fill failure is the concentration and diversion of the surface flow of water (and sometimes subsurface flow) onto hill side slopes creating eroded rills and gully erosion. Diversions of watercourses on pre-FPR constructed roads and skid trails has also been a major source of human caused erosion in the past.

The practice of storm-proofing roads by outsloping road surfaces and installing rolling dips, armoring watercourse crossings, replacing culverts with rock armored fords or dips whenever feasible has become a standard industry practice in the last decade. Gualala Redwoods has storm-proofed more roads as a percentage of their entire road system than any other north coast timber company (personal comm. Pacific Watershed Associates). To date nearly 60 percent of GRT's management service roads and old legacy roads have been treated to reduce erosion and/or to prevent any measured sediment delivery to a watercourse. GRT intends to continue this road storm-proofing program for the remainder of the roads that have not yet been treated. Storm-proofed roads can withstand the peak flow events that in the past would wash out culverts and road fill or overtop waterbars and inside ditches. This new way of designing or reconstructing road systems is having a significant calculable positive effect. Breached waterbars resulting in deep road gullying are no longer a common site on roads that have been storm proofed. Inside ditches that need constant maintenance no longer exist on these roads and washed out culverts are becoming a rarity. This watershed improvement activity within the Gualala River Watershed on GRT lands is correcting decades of man caused problems, and it often has a noticeable affect the first winter after storm-proofing with associated streams running clearer of sediment.

Other potential impacts that have occurred within these watersheds in the recent past have been 1) the increased use of even-aged silviculture over uneven-aged silviculture by the landowner, which has potential watershed impacts, both negative and positive, 2) trespass by all-terrain vehicles and motorcycles using roads and skid roads in the winter period which impacts the road system by damaging waterbars and creating

small gullies that channel water down the roads, 3) climate change is a serious potential impact, the effects of which are more intense storms and wildfires that can increase soil erosion, and since the main stem of the Gualala River is in the upper range of temperature that is suitable for salmonids, a warmer climate could have serious negative impacts on salmonid health and regeneration, and 4) the potential conversion of land to other uses such as housing or vineyards is an issue in this watershed as societal and economic pressures increase.

Positive Impacts

1) The landowner is involved in an ongoing project to evaluate and rehabilitate their entire road system in order to offset any sediment impacts that result from their timber harvesting activities. GRI improved 55.4% of their road system at their own cost of $3,433,000.00 not including grant money and prevented at least 295,000 cubic yards of sediment from being delivered into watercourses through work completed on their lands in the Gualala River Watershed from the period 2003 to 2018. The average cost of road upgrading has been $17,900.00 per mile. GRT has a goal of assessing their remaining road system over the next ten years and upgrading all roads to a storm-proofed condition over the next twenty years as money is available. In addition, roads are inspected annually and most road erosion sites that develop during the winter that are found and are accessible are repaired immediately so that small problems do not develop into big problems. Under miscellaneous addendums in Section V is a listing of "Completed Road Work" projects for each watershed. In these "Competed Road Work" addendums "Yards Stabilized" were only provided if a qualified person addressed the site, and many of the stabilization sites were repaired but actual quantitative sediment savings has not or is yet to be documented.

2) New Forest Practice Rules implemented since 2000, and especially the Anadromous Salmonid Rules of 2009 have resulted in significant amounts of sensitive areas being designated as no-harvest areas for resource protection. Additionally, WLPZs now have higher canopy and Large Woody Debris (LWD) retention requirements. These include areas in Class I watercourse floodplains, areas adjacent to Class I watercourses that contain listed salmonids, inner gorge areas, unstable areas, areas for wildlife protection, areas for botanical protection, archaeological sites, and areas on steep slopes near Class I and Class II watercourses. Many areas with difficult access near Class I watercourses end up as virtual no-cut zones because of high canopy retention standards. These areas will continue to age and develop into mature successional stands. Many of these areas on the GRT property already contain a stand cohort that is 100 plus years old. These protection measures have been developed by interdisciplinary teams and are constantly being assessed for effectiveness.

3) Wildlife and botanical surveys that have occurred for harvest plans have resulted in the discovery of many rare plants, listed birds, and frogs that otherwise would not be protected. Numerous areas designated for protection have been flagged out or designated as no-cut as a result of these surveys.

Other Impacts

Surface gravel mining of the open bars above the Gualala River summer flow may have an impact on the river but its extent is unknown as to whether the impact is positive or negative. Gravel mining opponents argue that any activity in the stream channel is potentially disruptive by destabilizing stream banks, exposing areas of fine sediment, damaging riparian vegetation or in some cases affecting the water table. Gravel mining advocates argue that removal of gravel actually enhances downstream habitats by reducing the oversupply of gravel in depositional reaches of the river thereby reducing the chance of flooding, increasing pool depth and creating greater channel diversity. State and County permitting requires that measurements are taken annually to ensure that gravel bars are replenished each year and in low replenishment years gravel removal is reduced

or stopped altogether.

Potential Biological Impacts-

The major biological impacts in the Biological Assessment Area, which includes all of the WAA and is dominated by timberland that has been under active management for the last 100 years would primarily be 1) erosion of the soil with the resulting loss of forest productivity and the sedimentation of the watercourses affecting downstream fisheries and instream habitat for aquatic species; 2) change of habitat for certain groups of species through the conversion of existing eighty to one hundred year old timber stands to younger age classes and a reduction in the diversity of hardwood tree species as forest management favors growth of conifers; 3) the loss of snag recruitment trees and the unintentional knocking down of existing snags (snags being important for a number of species); 4) disturbance of animal species in the summer time through logging and trucking activity; and 5) directly killing certain slow moving or non-mobile plant and animal species through falling, skidding, logging, trucking and road building activities.

Potential Offsetting Actions

1) Forestry related: Increased canopy retention and large woody debris standards near watercourses along with no-cut areas implemented for a number of reasons (i.e. avoidance of unstable areas, wildlife protection, botanical protection, archaeological site avoidance, etc.) will result in increasingly older forests adjacent to watercourses and in random locations, resulting over time in development of late seral corridors and islands. As this trend continues it is likely that a significant amount of the property, estimated at 20%, will eventually end up as forests with late seral type characteristics with only light selection taking place into the future. Flood plains are part of this forest type due to the restrictions of the ASP Rules. These areas are often adjacent to linear features that are contiguous with other no-cut areas and have an added benefit of creating wildlife corridors and islands across the property.

2) Evenage management results in the temporary establishment of low growing vegetation that is different from vegetation in a closed canopy forest, and this shrubby and brushy vegetation increase forage and habitat for a different set of wildlife species and creates edge effect along margins of evenaged units. The impacts of evenaged management are temporary in nature and tend to mimic natural disturbance events such as fire that create variations in age, size and structure of forests. Openings and gaps created by timber management are where rare plants are typically found on the property, and this is often a result of these species preferring recent soil disturbance where invasive and non-native plants have not yet become established.

3) The 2009 ASP rules expanded Watercourse and Lake Protection Zones with increased canopy retention requirements and increased Large Woody Debris (LWD) retention requirements adjacent to salmonid streams which is expected to result in cooler stream temperatures favorable to salmonids and more structure in the streams which increases pool depths, spawning habitat, and provides cover from predators.

4) GRT is also involved in the facilitation of ongoing stream reach, stream cross sectional, and LWD placement monitoring being conducted annually by the Gualala River Watershed Council (GRWC) on GRT's property in the WAA and within the Gualala River Watershed in order to offset any potential impacts that result from their timber harvesting activities. See biological section below for discussion of the monitoring and rehabilitation efforts that have been conducted for the past decade.

Will the proposed Project, as presented, in combination with Projects, and Reasonably Foreseeable Probable Future Projects identified in items (a) and (b) above, have a reasonable potential to cause or add to significant adverse Cumulative Impacts in any of the following resource subjects?

Resource Subjects	Yes after mitigation (1)	No after mitigation (2)	No reasonably Potential significant adverse Impacts (3)
A. Watershed			X
B. Soil Productivity		X	
C. Biological			X
D. Recreation			X
E. Visual			X
F. Traffic			X
G. Greenhouse Gases (GHG)			X
H. Wildfire Risk and Hazard			X
I. Noise		X	

1) "Yes, after mitigation" means that potential significant adverse Cumulative Impacts are left after application of the Rules and mitigations or alternatives proposed by the Plan Submitter.
2) "No after mitigation" means that any potential for the proposed Timber Operation to cause or add to significant adverse Cumulative Impacts by itself or in combination with other Projects has been reduced to insignificance or avoided by mitigation measures or alternatives proposed in the Plan and application of the Rules.
3) "No reasonably potential significant adverse Impacts" means that the operations proposed under the Plan and application of the Rules do not have a reasonable potential to join with the Impacts of any other Project to cause, add to, or constitute significant adverse cumulative Impacts.

Current harvesting and forest management practices in combination with adherence to regulations of the Forest Practice Rules and beneficial actions developed in this THP should reduce the risk of significant adverse cumulative impacts to the resources. See below for specific beneficial actions.

Project Description –For a description of the current project see the beginning of Section III (preceding the impacts analysis).

A Description of the Assessment Area used for each Resource Subject

WATERSHED ASSESSMENT AREA (WAA):

Assessment Area: The watershed assessment area is the 8792 acre Robinson Creek Planning Watershed (RCPW) (1113.810002) and the 4628 Doty Creek Planning Watershed (1113.810003)(DCPW).

Total acreage of the assessment area is 13,420 acres which is 7 percent of the total Gualala River Watershed comprised of 191,116 acres.

Rationale: The THP area is located within these CAL WATER planning watersheds and operations from this THP have the most potential to affect water quality within these watersheds. These planning watersheds include a variety of topographic aspects, a variety of slope inclinations from steep to flat, a variety of soil types

from very stable to highly unstable, and a variety of watercourses that range from large Class I salmonid bearing watercourses to small ephemeral Class III watercourses. They also include flood prone areas within the Gualala River Watershed and significant reaches of the North Fork and Little North Fork of the river as well as some of their larger tributaries.

SOIL PRODUCTIVITY ASSESSMENT AREA (SAA):
Assessment Area: The area within the THP boundary will be the assessment area.
Rationale: All effects on the soil will occur within the THP area.

BIOLOGICAL RESOURCES ASSESSMENT AREA (BAA):

Assessment Area: The Biological assessment area will be the same as the watershed assessment area plus an additional 0.7 miles perimeter around the THP boundary which is the area assessed for Northern spotted owls and other mobile non-aquatic species. For aquatic species the assessment area is the Class I and II watercourses, springs, ponds and wet areas within the planning watersheds of the WAA.
Rationale: This area encompasses a large enough area to account for wildlife movement and includes a variety of habitat types representative of the area.

RECREATION ASSESSMENT AREA (RAA):

Assessment Area: Within 300 feet of the THP boundary will be the assessment area.
Rationale: All effects on recreation are most likely to occur within this area.

VISUAL ASSESSMENT AREA (VAA):

Assessment Area: The assessment area for impact to visual aesthetics is the area within 3 miles of the THP.
Rationale: Beyond three miles forestry activities are difficult to discern.

TRAFFIC ASSESSMENT AREA (TAA):
Assessment Area: The assessment area for traffic is the private road system west of the THP to county road 501 and from there to Old State Hwy and then to Hwy 1. It is also the private road system west and north of the THP to Fish Rock Road and from there to Old Stage Road and then to Hwy 1. See appurtenant road map in section II.
Rationale: These are the first roads not part of the logging area on which logging traffic must travel.

NOISE ASSESSMENT AREA (NAA):
Assessment Area: The areas east of the THP.
Rationale: These are the only populated areas that could conceivably be affected by the noise of the logging operations.

GLOBAL WARMING ASSESSMENT AREA (GWAA):
Assessment Area: The area within the THP boundary will be the assessment area.
Rationale: Virtually all effects relating to the sequestration of carbon will occur in the immediate vicinity of the growing trees on the THP.

WILDFIRE RISK AND HAZARD ASSESSMENT AREA (WRHA):

Assessment Area: The plan area and that area within 300 feet of the plan boundary on the north south and west sides. Additionally that area within a quarter mile on the east side is included.
Rationale: Modification to the vertical and horizontal distribution of forest fuels and the use of tools or vehicles that can affect wildfire risk or hazard associated with proposed timber operations is limited to the plan area. The assessment area outside the plan boundary is consistent with existing notification requirement distances. This allows for assessment of possible ignition sources and forest fuel loading not associated with the proposed project, but could combine to produce a cumulative increase in wildfire risk and hazard.
Privately owned parcels occupied by year round residences to the east of the THP also pose risks.

For a listing of the individuals, organizations, and records consulted please see the end of this CWE analysis.

A. Watershed Resources Assessment

1. Beneficial Uses of Water

The watershed resources that are affected by potential adverse impacts of this project are the beneficial uses of water in the Gualala River which are designated in the Water Quality Control Plan for the North Coast Region (Section 2, Table 4) as: municipal supply and domestic supply, agricultural supply, industrial service supply, water contact recreation, non-water contact recreation, commercial and sport fishing, cold freshwater habitat, wildlife habitat, groundwater recharge, navigation, migration of aquatic organisms, spawning, reproduction and/or early development, estuarine habitat, rare, threatened, or endangered species, water quality enhancement, flood peak attenuation/flood water storage, wetland habitat, water quality enhancement and subsistence fishing. The following table indicates estimated cubic feet per second (cfs) diversions during the year from the entire Gualala River Watershed as determined by the Gualala River Watershed Technical Support Document (GRWTSD) prepared by the Water Quality Control Board (2001).

Estimated Water Uses in the Gualala River Watershed

Water Use	Estimated Maximum Withdrawal Rate (cfs)
SWRCB appropriative rights	8
Vineyards—dry and frost	27-100
Rural Residential	2.5
North Gualala Water Company	2
Sea Ranch	2.8
Potential total diversion amount	**42.3 – 115.3**

2. Watershed Description

The Gualala River Watershed produces high volumes of sediment due to the geology and the topography. "The combination of the underlying pervasively sheared and often folded Franciscan rocks, recent uplift, and a distinctive climate accounts for the large sediment yields." (Kelsey et al 1981). The THP area is located within the floodplain and on the adjacent slopes of the North Fork Gualala River and Little North Fork Gualala River. These Class I watercourses have extensive alluvial flats or floodplains which support a productive second and third growth redwood forest. These alluvial flats act as a buffer between the steeper upslope areas, from which sediment is migrating, and the major watercourse channels. During peak flows sediment that is carried from transport reaches in steep Class I, II and III watercourses at the headwaters of the watersheds drop out of suspension as they cross the lower gradient storage reaches, and deposit sediment on the alluvial flats, that occur adjacent to the river. Some smaller Class III watercourses that feed directly into the alluvial flats

disappear into the sandy soil without contributing their sediment load directly to higher order watercourses. Numerous low spots within the flats along the river also act as sediment catch basins when the main tributaries of the Gualala River periodically overflow their banks during peak flow events during the winter and spring seasons. The slopes above the floodplain of the Gualala River are well vegetated with redwood, Douglas-fir, bishop pine, buckeye, tan oak, madrone, big leaf maple, California bay, and several other hardwood species in small amounts. Floodplains are dominated by coastal redwood with intermixed hardwoods of California bay and red alder, all of which can tolerate short term water inundation.

Precipitation within these watersheds average around 40 inches per year, which comes mainly in the form of rain. Much of the year the area has coastal fog that provides moisture to the redwood forests from leaf drip and reduces evaporation by providing cover from solar radiation.

The lower reaches of the Gualala River system, where the plan is located has limited ability to retain large woody debris because of the width and size of the channels. The bank vegetation, although thick, is incapable of shading the entire watercourse in many locations due to the wide channel. Sediment that is washed down, often from many miles upstream during peak flow events will drop out of suspension on the alluvial flats due to the slower low gradient flows that occur there. The thalweg of the North Fork and Little North Fork of the Gualala meanders within the stable active channel banks. The development of the adjacent floodplains is based on the fact that they are sediment deposition areas. On the South Fork of the Gualala GRI has documented an increase in floodplain elevation between 1953 and 1986 of approximately 3.5 feet. Measurements on the North Fork of the Gualala indicate that at least 1 foot of sediment has been deposited in the flood prone areas within the last thirty years.

3. Potential Specific Watershed Impacts

There are two CAL WATER planning watersheds that are included in WAA. The Robinson Creek Planning watershed contains 85% of the plan area. This portion of the THP area comprises about 1.5% of the Robinson Creek planning watershed.. The Doty Creek Planning watershed contains the other 15% of the plan area. This portion of the THP area comprises about 0.52% of the Doty Creek planning watershed.

Section 916.4 (a)(1) of the Forest Practice Rules states that the RPF or supervised designee shall evaluate areas near, and areas with the potential to directly impact, watercourses and lakes for sensitive conditions including, but not limited to, existing and proposed roads, skidtrails and landings, unstable and erodible watercourse banks, unstable upslope areas, debris jam potential, inadequate flow capacity, changeable channels, overflow channels, flood prone areas, and riparian zones wherein the values set forth in 14 CCR §§ 916.4(b) are impaired. The RPF shall consider these conditions, and those measures needed to maintain, and restore to the extent feasible, the functions set forth in 14 CCR §§ 916.4(b), when proposing WLPZ widths and protection measures. The plan shall identify such conditions, including where they may interact with proposed timber operations, that individually or cumulatively significantly and adversely affect the beneficial uses of water, and shall describe measures to protect and restore to the extent feasible the beneficial uses of water. This field assessment was done by the RPF and the following characteristics of the plan area were determined.

1. **Existing and proposed roads, skidtrails and landings** - There are no proposed roads in this plan. In section II a work order that contains road points has been prepared. These points contain beneficial actions for a number of items. Probably no aspect of logging has more potential to negatively impact watercourses than the improper creation and maintenance of the road systems. Elsewhere in this analysis information has been given on the efforts being made to stormproof GRT's road system. On the road system that is specific to this plan the following points that relate to Section 916.4 (a)(1) can be made. The majority of the road system is in the WLPZ. Fortunately, between the road system and the major watercourse of concern (the North Fork of the Gualala River) there is a flat, sometimes back

tilted buffer of heavily vegetated ground except in a couple of locations. The use of skid trails that enter the WLPZ is requested in those cases where the alluvial flat is wide and then all skid trails have been preflagged. The use of the landings that fall into the WLPZ also have the advantage of existing and therefore not requiring new excavation. The use of these landings also reduces the amount of skidding that will be needed on the haul road which reduces the production of fines. Overall the road system in this plan has a low probability of creating negative impacts because of the flat buffer and the low gradient crossings. The skid trails and landings are similarly buffered and any generated sediment should be filtered or trapped prior to entering the watercourses.

2. **Unstable and erodible watercourse banks** - The banks of the North Fork of the Gualala River often have conifers growing right down to the waters edge and in general these banks appear stable. The conifers that exist in this zone are usually quite large and are leaning out over the river and are the main source of future large woody debris. Bank avulsion and bank erosion is a concern the farther upstream you go because the difference in elevation between the active channel and the flood prone area diminishes. The first thirty feet of the alluvial flat adjacent to the wetted channel is the main source of large instream woody debris and the main stabilizing factor of the banks and no trees will be harvested from this core zone as designated by the new ASP rules. After that the ASP rules require that the thirteen largest trees per acre be left and that the silviculture be uneven aged. The banks of Little North Fork of the Gualala River are steep and erodible. The twenty four acres of this plan that are in the Doty Creek watershed (in which the Little North Fork is located) are not in the flood prone area but are in upslope areas and do not have the potential of impacting the banks of this branch of the Gualala.

3. **Unstable upslope areas** - The CGS map basically shows that the much of the upslope areas adjacent to the alluvial flats in these watersheds are part of ancient mass wasting features. However, in the vicinity of the THP there are few mapped unstable areas. Since no road building or reconstruction will be taking place there should be no effect on unstable slope areas.

4. **Debris jam potential**-The North fork of the Gualala has a low potential for debris jams. The problem with the river is not debris jams but the retention of woody debris. Anything but the largest trees are swept away by the river. The Little North Fork has had a large woody debris placement program and is seen as a positive development for fish habitat. There is some chance of debris jams occurring on the Little North Fork because of its narrow width and unstable banks.

5. **Flood prone areas and inadequate flow capacity**- During the winter the alluvial flats in this plan periodically flood which indicates inadequate flow capacity in the active channel. Inadequate capacity is sometimes caused by increased deposition which raises the channel bottom causing the banks to flood. This portion of the Gualala is a low gradient depositional reach and bed load is transported from high gradient reaches and drops out of suspension in this area of the river. Permanent plots that were put into the stands adjacent to the Gualala River several decades ago show that portions of these flats have had as much as three and a half feet of sediment deposited on them in recent decades. Some of this sediment is undoubtedly also coming from upslope class IIs and IIIs that drain directly onto these flats and often disappear into the sandy soil without ever reaching the river. Although this process may have accelerated in the past century due to increased upslope erosion the process itself (alluvial flat flooding and aggradation) has been going on for thousands of years according to NCWAP. Nothing proposed in this plan has the potential to increase flooding or decrease the flow capacity of the river.

6. **Changeable channels and overflow channels**- On these alluvial flats evidence can be found where class IIs and IIIs that are coming down from upslope have, in the past changed location. This is not a common occurrence but as sediment builds up in these smaller watercourses there is the

possibility of these channels migrating. There are also small bays that sometimes extend into the alluvial flats from the main class I channel. These areas may be important for small fish that are trying to escape out of the main stream during high flow periods. It is unusual for these features to extend more than 50 feet inland from the wetted channel and since this plan only proposes very limited harvesting this close to the class I it is not likely to affect the stability of these features. The new ASP rules require the protection of these overflow and changeable channels and in fact they are already protected by their location within the WLPZs of the watercourses. The migration of the class IIs and IIIs is a process that occurs as a result of upslope sediment inputs. This has the potential to release sediment through the creation of a new channel and it is the result of the alluvial flats continual trapping more and more sediment. Usually the old channel that has dried up has trapped so much sediment it has returned almost to the state of never having downcut. The net result of sediment entering the river from these migrations is low.
Of more concern is the possibility of the main river changing channels as a result of overflowing the banks and downcutting through areas where natural flows have downcut over time or where the process has been accelerated by roads and or skid trails.

The skid trails that are proposed for use are carefully selected and have been laid out to run perpendicular to these channels when possible.

7. **Riparian zones**-Some of this plan falls into the riparian zone of the North Fork of the Gualala River (which is listed for sediment and temperature), therefore it is of concern and any negative effects that operations in this unit could have on the river must be mitigated. In the following sections temperature and sediment concerns and beneficial actions are addressed in depth. In order to mitigate any effects on the riparian zone a number of steps are being taken including 1) a conservative determination of the transition line, 2) a no-cut zone adjacent to the transition line, 3) a light harvest from below that will result in concentration of growth on the larger trees that are capable of reaching the watercourse 4) a light selection harvest on the outside edge of the WLPZ , 5) reduced use of all historic WLPZ skid trails.

   Additionally, the ASP rules require no removal of LWD in the WLPZs and very high canopy closure standards throughout the flood prone portions of the plan.

Finding: This plan is not likely to adversely affect existing watershed conditions within the WAA due to the very light harvest, the soil erosion protection measures, the design of the log skidding landing and road system, and the seasonal restrictions on operations. Over time it will provide for enhanced diversity in forest structural development by concentrating growth on the larger trees, trees that will extend a shaded canopy over the watercourse to a greater extent and be in a more favorable position to contribute LWD to the watercourse channel.

4. Watershed Effects General Discussion

The Gualala River is 303d listed for sediment and temperature.

In attempting to analyze and mitigate watershed effects, several sources of information have been reviewed and an attempt to summarize this information is made on the following pages. The most comprehensive study to date, The North Coast Watershed Assessment Program (NCWAP), has been extensively reviewed and cited as a pertinent source of watershed conditions in this harvest plan. Additional information is taken from reports written for previous harvest plans such as the report by consulting Fisheries Biologist Dennis Halligan of Natural Resources Management Corporation (Halligan 2000). Mr. Halligan's report contained valuable analysis of the available information and some of his conclusions are included on the following pages. The archives at the California Department of Fish and Wildlife have previously been examined for information

regarding the Gualala River system and most of that information has also been included in the NCWAP report. Of particular value was the white paper titled Flood Prone Area Considerations in the Coast Redwood Zone dated November 2005.

The Gualala River Watershed Technical Support Document (GRWTSD) prepared by the Water Quality Control Board as supporting documentation for the TMDL analysis by the EPA was also reviewed. The primary objective of the GRWTSD for sediment is to identify and quantify sources of sediment in a way that allows a relative comparison of those sources and to provide information for non-point source assessment, project planning, and implementation.

The North Coast Watershed Assessment Program (NCWAP) provides a description of the North Fork Gualala River.

"The North Fork Subbasin encompasses 47.9 square miles of private land in the northern end of the Gualala River Watershed. The main channel has a zig-zag pattern in response to faulting. There are 127 miles of "blue line" streams, and five major tributaries:
Little North Fork, Robinson Creek, Dry Creek, Stewart Creek, and Billings Creek.

Predominant land uses include timber production, grazing, small vineyards, and some 40-acre and larger subdivisions. The North Fork Subbasin has the highest timber site quality in the watershed. With over 70 inches of rainfall per year within the coastal fog influence, the lower and middle reaches of the North Fork Subbasin contain prime timber growing ground for Redwood and Douglas fir. In the upper third of the North Fork Subbasin, there is an abrupt vegetational transition to the mélange clay soil type. At the base of the Billings Creek Planning Watershed (PWS) along the Tombs Creek fault, dense conifer stands give way to prairie grasslands and oak woodland. Mixed conifer hardwood stands dominant north slopes. Conifers dominate stream floors. Approximately 17 percent of the North Fork Subbasin consists of prairie grasslands/oak woodland."

The North Fork Subbasin has the longest span of past land use practices in the watershed. The subbasin has been subject to three eras of intensive land use: (1) old growth redwood harvesting in the lower to central reaches 1868 to 1911, (2) tractor harvesting between 1942 to 1968, and (3) cable/tractor harvesting throughout the lower to central reaches in excess of 50 percent of the Doty, Robinson, and Stewart Creek PWS between 1990 to present.

The NCWAP report is a significant amount of data collected and analyzed by qualified licensed professionals. NCWAP was published in March 2003 and contains the most comprehensive and scientifically valid information to date in regard to the existing conditions and how it relates to past land use practices. NCWAP was developed through cooperative efforts with Gualala Redwoods Inc., government agencies and public cooperators. The NCWAP report and executive summary was studied as part of this analysis. GRI and cooperators collected most of the data that relates to the watersheds affected by this plan.

The following important points have been taken from the executive summary of the NCWAP report.

1) Most of the Gualala River Watershed has improved from 1984 to 1999/2000, based on aerial photo interpretation of accumulations of sediment that were interpreted as indicative of channel disturbance. Specifically, since 1984 total erosion from upslope areas has not resulted in a net increase of sedimentation within the majority of the tributaries to a degree discernable in 1999/2000 aerial photos.

2) Pool habitat, escape and ambush shelter/cover, and water depth are unsuitable for salmonids in some mainstem and tributary stream reaches in the Gualala River Watershed. Large woody debris function in the

channel is low throughout the watershed. Increasing the instream habitat complexity is the top recommendation category for all of the sub-basins.

3) Water temperatures are suitable in the smaller tributaries for which we had data. In contrast mainstem temperatures were in the unsuitable range in most of the sub-basins.

4) Gravel and substrate suitable for salmonids is limited in some streams and abundant in others.

5) Harvest of coastal redwood and Douglas-fir actively occurs today, but with substantially improved practices. While some areas of the watershed experienced more improvement than others during this period, an overall trend towards improvement in the transport reaches was observed.

Also, according to NCWAP-

Based on the information available for the Gualala River Watershed, salmonid populations are currently being limited by

1- General watershed-wide lack of instream habitat complexity;
2- Instream sediment conditions in some areas;
3- High summer water temperatures in the mainstems; and
4- Reduced watershed-wide coho salmon and steelhead trout populations over those observed in the 1960s.

What habitat improvement activities would most likely lead to more desirable conditions in a timely and cost-effective manner?

A restoration plan that targets the general areas identified below.

1- Reduce sediment delivery and deposition.
2- Improve riparian canopy density and diversity
3- Continue road assessments, storm proofing, improvements and decommissioning.
4- Evaluate and address non-road sediment sources.
5- Add more large organic debris and shelter structures. (Pool depth and shelter consistently were limiting)
6- Protect high quality habitat from degradation.
7- Reduce livestock and feral pig entry.
8- Evaluate fish rescue activities.
9- Continue in-channel characteristics and stream flow monitoring.
10- Expand aerial photo interpretation of channel characteristics.
11- Expand temperature monitoring into eastern portions of watershed.

Findings: After having studied the information that is available a conclusion can be made that the 303d listing for sediment for the Gualala River was not based on scientific evidence that the river was in fact impaired. The 303d listing was based on limited anecdotal evidence. In contrast to past information, the NCWAP report is a significant amount of new data collected and analyzed by qualified licensed professionals.

(The following quotation taken from NCWAP applies to the whole Gualala watershed, **emphasis added**)
"The consequence of active timber harvesting conducted in the watershed since 1990 indicates that

contemporary timber operations did not preclude recovery in both fluvial geomorphic stream channel characteristics and riparian canopy cover. Between 1991 to 2001, 45,070 acres or 24% of the watershed has been subject to Timber Harvest Plans. Timber harvest operations include road building, use, and maintenance associated with the active Timber Harvest Plans. **These operations have taken place during the period where CGS NCWAP mapping documents a 30-40 percent improvement in detrimental sediment storage or source attributes between 1984 and 1999/2000. Similarly, riparian canopy cover continued to improve from the midcentury bank to bank clearance operations. By the end of the tractor era in 1968, a range of 40 to 70 percent bank exposure gradually improved to approximately 25% by 1999/2000".**

"The study documented long term trends in overall watershed conditions. None of the improving trendlines have been reversed by any concentration of Timber Harvest Plan activities between 1991 and 2001. This contradicts certain projections of recent land use for cumulative effects by which a high density of Timber Harvest Plans may trigger adverse cumulative impacts in excess of the individual potential contributions from each project alone. No such cumulative processes from any collection of Timber Harvest Plans were realized in the Gualala watershed".

Another conclusion that can be drawn with some degree of certainty is that salmon are not as common today as they have been in the past. This conclusion is derived from reports in NCWAP, GRWTSD and Gualala River Watershed Literature Search and Assimilation by Patrick Higgins. Studies made in the 1960s noted the presence of coho throughout the watersheds studied, but this was during an active fish stocking program that eased in 1999. Fish surveys conducted in the 2006 indicate that coho have fallen to dangerously low levels or were absent entirely from many streams. Similar conclusions cannot be drawn from the data for steelhead even though such a conclusion is tentatively made in the GRWTSD. NCWAP reports that steelhead distribution does not appear to have changed over the past 37 years. Natural radical fluctuations in salmon populations have been noted as early as the turn of the century, however, it is a conservative approach to assume that the present declines are man caused and corrective measures are being taken by the landowner to reduce potential man caused impacts while still maintaining the land as an active tree farm.

As a proactive measure, the landowner is investing money in beneficial actions to reduce sediment impacts through extensive road upgrading and storm-proofing. Under miscellaneous addendums in Section V there is a listing of the numerous road upgrades that have occurred within the WAA watersheds involved. The landowner is also foregoing a considerable amount of present and future income from the harvesting of timber in the WLPZs of Class I, II and III watercourses and in the protection zones around wet areas, sumps, ponds, wildlife and botany set-asides, unstable features and archaeological sites. Most of these areas (except for wildlife, botany and archaeology sites) are being protected for two reasons. The first reason is to prevent, or at least reduce, the amount of sediment delivered to the fish bearing watercourses and the second is to recover tree canopy over all watercourse classes in an effort to reduce water temperatures so as to maintain acceptable fish habitat.

Water Temperature Effects:
From NCWAP- "Water temperature data from continuous recorders were available for 29 sites in the North Fork Subbasin . The period of record from 1994 to 2001 yielded 81 observations for maximum weekly average temperature (MWAT) and seasonal maximum temperature.
MWATs in the tributary sites were moderately to fully suitable. The mainstem sites varied from moderately suitable to moderately unsuitable for summertime rearing .
There was a trend from higher water temperatures upstream in the North Fork to lower temperatures as the stream flowed towards the ocean. Air temperatures are generally higher and canopy

density lower in the upper, northeastern oak woodland and grassland, probably contributing to higher water temperatures. As the North Fork flowed west into the coastal influence and better canopy coverage, it also received flows from cooler tributaries, combining to reduce the mainstem water temperatures." Since this NCWAP report came out water temperature has continued to be monitored in the North Fork and Doty Creek watersheds and MWATs have continued to be suitable for salmonids, (see stream reports in section V for specifics). The North Fork Hydrologic Unit has an average MWAT of 15.8 and the Doty Creek Hydrologic Unit has an average MWAT of 14.2

NCWAP also states, "Overall watershed-wide riparian shade canopy has improved since the 1960s, but still falls short of the 1942 levels of canopy density and coverage." The 1942 levels showed 95% canopy coverage. It is also noted that overstory canopy cover in the lower reaches of the watershed are the highest (this happens to be the area of GRT ownership). Another way of looking at it is that GRT owns less than 30,000 acres out of the 191,116 acres comprising the Gualala River Watershed. Less than 20% potential management caused adverse effects on the Gualala River system is therefore caused by GRT activities. In retrospect, GRT owns all of the Pepperwood Creek and Groshong tributaries and these tributaries show significantly better temperature numbers than the mainstem South Fork Gualala River. Most of the creeks that originate off property have higher temperatures where they enter GRT's land than they do when they hit the main stems, which shows that GRT practices are probably not a cause of high temperatures, but stream temperatures are actually decreasing or at least not warming as they pass through GRT property.

Halligan states, "Increasing water temperatures in a downstream direction has been identified in streams and rivers throughout the world except where the watercourses become influenced by coastal weather conditions that can result in a cooling pattern. The general tendency for incremental increases in temperature has been attributed to increasing channel width reducing the effectiveness of shading from riparian vegetation, increasing air temperature, increasing stream depth and decreasing proportion of cooling groundwater inflow."

The fact that stream temperatures moderate as they pass through GRT lands may not have as much to do with management and as it has to do with the zone of coastal influence (fog belt). Besides the zone of coastal influence, the Forest Science Project out of Humboldt State University found in their study titled "Regional Assessment of Stream Temperatures Across Northern California and their Relationship to Various Landscape-Level and Site Specific Attributes" (Lewis et.al 2000) that water temperature has a positive correlation between watershed size, distance from watershed divide, bank full width and canopy cover. Watershed size and distance from watershed divide are often related as are bank full width and canopy cover. In the case of the GRTs holdings we have a river in a large watershed at the furthest point from the watershed divide and with a very wide bank full width. Therefore, you would expect higher temperatures. This is modified by the coastal zone of influence for macro air temperatures.

It may be that the local larger streams naturally have temperatures above the 60° F, above which is stress inducing threshold for local salmonids. To test this, Gualala temperatures were compared with temperatures collected in old growth watersheds in Humboldt Redwood State Park. The old growth watersheds, by increasing acreage, are Cow Creek (93% uncut old growth), Squaw Creek (61% uncut old growth) Canoe Creek (62% uncut old growth) and Bull Creek, where the stream flows through 3 miles of uncut old growth, including the Rockefeller Grove, before it gets to the Bull Creek temperature station. The trend line equation for the old growth (y=2.2886Ln(x)+43.713) was almost identical to the equation for the Gualala trend line (y=2.2707Ln(x)+43.683).

The most comprehensive study regarding shade canopy and its relationship to water temperature changes

was done by Cajun James in 2003 and the following quotation is taken from the abstract of that study.

"Data collected before and after timber harvest operations in years 2000, 2001, and 2002 was analyzed to determine changes in response variables to wider (175 ft.) or narrower (100 ft.) riparian buffers. Angular canopy cover was measured to be 85% at mid-stream and no less than 80% within the riparian buffer regardless of buffer width. Vertical canopy cover was measured to be 50% within the riparian buffer for each harvest unit following the first phase of timber operations. Microclimate results show that edge effects from the adjacent upslope clearcut harvest units had no discernible impact within 40 ft. of the stream bank. In this experiment, no practical difference in the canopy cover, near-stream microclimate, or water temperature patterns were found between the wider 175-ft. and the narrower 100-ft. buffers. Results from this study show that 100-ft. vegetative buffers that maintain at least 50% vertical or 80% angular canopy cover minimize potential negative impacts to the temperature of stream water and the near-stream microclimate from adjacent upslope clearcut harvest operations."

Findings: Canopy and temperature on Class I watercourses will not be measurably altered since no harvesting will take place within 30 feet of the watercourse transition line of the Class I watercourse as part of this plan. The ASP rules also require that the thirteen largest trees per acre are to be left so the maximum canopy height will not change significantly post harvest. Also, a minimum of 80% canopy will be maintained within Inner Zone A (which is variable in width but is the area between 100 and 150 feet of the transition line) and 50% canopy will be maintained throughout the rest of the flood prone area (Inner Zone B). The prescribed practices in silviculture use and canopy retention by the ASP rules amounts to a requirement of leaving all the dominant trees within Inner Zone A, and only conducting tree removal by thinning/selection from below. All of the Class II watercourses within this plan will maintain at least 50% canopy cover. However, since most of the Class II watercourses are also within the Class I watercourse WLPZ the higher Class I watercourse canopy retentions standards shall apply. The slight canopy reduction on Class II watercourses is not expected to have a significant effect on adjacent stream water temperatures.

Organic Debris Effects:
Organic debris entering a watercourse can have both positive and negative effects. Medium to large debris can act as a stabilizing agent. However, the introduction of large amounts of unstable debris can obstruct stream flow. Large quantities of small debris introduced into small streams can lower dissolved oxygen content and increase water acidity. FPRs require the removal of organic material delivered to watercourses during felling operations. Therefore, there is not expected to be any increase in acidity or reduction in dissolved oxygen from the proposed project. Acidity and dissolved oxygen levels of water generated from the project watershed will not interact with current or reasonably foreseeable acidity or dissolved oxygen levels within the WAA to create or add to a significant adverse cumulative effect. Nutrients derived from decaying organic debris, especially leaves and small twigs, is an important source of food for small aquatic insects, which form a substantial portion of food for fish populations.

One hundred year old redwoods are extensively established right up to the edge of the wetted channel along the North Fork of the Gualala. No harvesting will be taking place within the first thirty feet adjacent to the transition line. Also, since there is a flood prone area the 13 trees per acre are retained in inner zone A and inner zone B. As a result, the largest trees in this plan area are being left to provide shade canopy and provide future recruitment trees for large woody debris (LWD).

Working with the grants obtained by the Gualala River Watershed Council (GRWC), the owners of the property have placed a large number of large woody debris in Class I watercourses; over 560,000 board feet of logs into watercourses on the property to date. GRT intends to continue this program. The placement of these logs has been photographed, mapped and numbered. By doing this it will be possible to record the downstream movement of these pieces (and learn how to place them more effectively) and to record the creation of pools. These logs have also been placed so that, besides creating pools, they provide shade, armor unstable banks, and redirect water flow away from potential sediment sources while creating refugia for both large and small fish. Preliminary measurements indicate that there is substantial pool creation even after the first year of placement and it is expected that these pools will continue to deepen over time. Through this process it is possible to create in a few years the positive impacts of large woody debris that would otherwise take decades from natural windthrow.

Findings: This THP proposes buffers and tree retention that will retain high levels of potential organic debris recruitment to watercourses, and it contains provisions to remove accidental deposition of small, potentially harmful debris. A 30-foot or more no-cut tree retention corridor adjacent to the Class I watercourse shall provide for future large tree (LWD) recruitment. GRT's active LWD recruitment placement program will continue to provide future enhancements to instream fish habitat on the property moving forward and accelerates the improvement of fisheries habitat with anticipated increases in numbers of fish in the river and upstream tributaries from that work.

Chemical Contamination Effects:

Chemical contamination of watercourses can occur with the introduction of chemicals or petroleum products. Chemical contamination is not known to be a significant impact to watercourses within the WAA. Potential chemical pollution sources associated with this THP are accidental spills or releases of fuels or oils from equipment or vehicles. The LTO shall adhere to 14 CCR 936.3, which states that "...the timber operator shall not place, discharge of or deposit in such a manner as to permit to pass into the water of this state, any substances or materials, including, but not limited to, soil, silt, bark, slash, sawdust, or petroleum, in quantities deleterious to fish, wildlife, or the quality and beneficial uses of water." The RPF does not propose to use any oil or chemical dust retarding materials on truck roads. Watercourse buffers limit equipment use adjacent to watercourses. Helicopter yarding (a potential source of chemical contamination due to on-site fuel storage) is not proposed as part of this THP. The major concern regarding chemical contamination would be from accidental release of equipment fuels and oils during refueling, servicing or operations.

Herbicides may be used in the clearcut unit for site preparation in order to achieve stocking in this THP. If herbicides are applied they will be used to favor survival and growth of forest seedlings by reducing competition with other plant species, and will only be prescribed in the one upslope unit far from any class I watercourses.

Although the plan submitter may utilize herbicides on their land following timber harvest as part of their vegetative management strategy, such use is conducted over a very small proportion of any given watershed in any one year. Herbicides are not applied near the active watercourses because of restrictions on their application and, to an even greater extent, because little or no harvest has taken place in these areas and vegetation management is unnecessary. Best Management Practices ensure protection of water quality.

Waters passing down and through the project area are not expected to interact with any current or reasonably foreseeable chemical use issues in WAA or contribute to a significant adverse cumulative effect. No slash pile or broadcast burning which is a potential source of nutrients being released into watercourses during runoff events is proposed. Another source of chemical contamination is the practice of people to use the Gualala River gravel bars as an all-terrain vehicle path and/or off-road access to swimming holes along the river. These vehicles could conceivably puncture an oil pan or gas tank on a rock and pollute the river. They also contribute small amounts of oil every time they drive through the water. GRT personnel notify the sheriff's department when this type of activity is observed.

Findings: Because there are currently no known chemical contamination problems within the assessment area and any future proposed chemical use will require unique permits for that purpose and be regulated to prevent chemical contamination, no significant adverse cumulative watershed effects caused by chemical contamination are expected.

Peak Flow Effects:

When soils become saturated and excess water is present, the result is run-off. Every watercourse has a maximum limit to which it may deliver run-off before the peak flow results in flooding. The factors that determine flooding are the timing, intensity, and duration of the rainfall or water source; soil properties and topographic controls that affect the volume and timing of available runoff, and the depth or carrying capacity of the channel.

Timing refers to the intervals between storms. Intensity is a measure of the rate of rainfall (i.e. inches per hour). Duration is a measure of how long the rain continues to fall. Depth is the total amount of rain that fell (in inches). It is recognized that there is no reasonable control over the timing, intensity, depth, or duration of rainfall. Simply put, if it rains hard enough and long enough, flooding will result in almost any watercourse.

Cutover watersheds generally have higher peak flows than uncut watersheds from storms occurring early in the season. This is a result of less interception and evapotranspiration. Research in a local coastal watershed shows that early season storm events result in higher peak flows following disturbance from timber harvesting. As soil moisture deficits are satisfied changes in peak flow become insignificant. Large peak flows usually occur after rain on snow events. Since snow is a rare event in this area the chance for a large peak flow event is unlikely. Also, this THP's proximity to the mouth of the Gualala means that any increase in peak flow would have a minor effect. The very low level of disturbance from the proposed harvest will not significantly add to past operations within the watersheds, such that no impacts from increased peak flow events such as increased erosion of channel banks downstream shall occur.

Findings: The watercourses in the plan area have been walked, ocular evaluations have been weighed, and peak flows on this property have been considered. Since 85% of the THP is using the selection method or is no-cut, ground and vegetation disturbance shall be minimized and impacts from peak flows are not likely to increase due to the harvest of the THP. Peak flows fed from water generated from the project area will not interact with current or reasonably foreseeable timing or intensity of peak flows in the WAA to create or add to a significant adverse cumulative effect.

Fog Drip:

Timber stands close to the coast receive significant amounts of moisture from fog drip. Dawson (1996)

determined that 8-34% of water used by coastal redwood trees and 6-100% of water used by under-story vegetation originated as fog drip. The closer to the coast the more pronounced the effect since more days have significant fog. The removal of canopy by harvesting would necessarily reduce the amount of fog interception and therefore reduce fog drip (at least temporally until the canopy closes).

The effect on ground water and stream flow is less clear since although fog drip is reduced by removal of canopy through logging, evapotranspiration is also reduced by the removal of the tree. Loss of evapotranspiration from forest harvest may be a more significant variable to changes in watershed hydrology than fog drip (Keppeler 1998).

Findings: Since this THP is close to the coast vegetation receives a significant amount of moisture from fog drip, according to these studies. This is balanced by the fact that much of the plan is on the flood prone area of the Gualala River and the water table is significantly more available to the standing timber than in upslope areas. In addition, the high canopy retention standards mean that the overstory canopy will only be reduced by approximately 20% at most in the Inner Zone A and at most 50% in the Inner Zone B and will only have a short term effect on the amount of fog drip water available as the canopy will soon close back in. Any reduction in timber growth from less fog drip will probably be more than made up for by the increase in sunlight available to the residual stand. No significant effects on stream flow either positive or negative would be expected from this light harvest where only approximately 17% of the basal area of conifers is being removed in the FPA. Fog drip may be reduced in the clearcut unit for several years, although so will evapotranspiration.

5. Watercourse Conditions (Stream Morphology):

The major watercourses in these watersheds are the North Fork of the Gualala River, Robinson Creek, Dry Creek, Stewart Creek, Lost Creek, Hoodoo Creek, McGann Gulch, the Little North Fork of the Gualala, Doty Creek, Roxanne Creek and Log Cabin Creek.

Embeddedness- North Fork, Log Cabin Creek, Robinson Creek and Little North Fork met the target values for pool tail embeddedness. Doty Creek and McGann Gulch did not meet the target value for embeddedness. Target values are >50% or more of the stream length is < 50% embedded.

Stream Aggradation –NCWAP report indicates that aggradation is not occuring. The conclusion of the NCWAP report is that "Instream sediment depositions indicative of disturbance occur along 33 of 140 miles of blue line streams, representing a 42 percent reduction from 1984 observations." Similar degrees of streambed aggradation were observed in aerial photos from 1942 and 1999/2000. Several years of Thalweg profiles taken by GRT and cooperators now tentatively supports a conclusion that stream aggradation is not now occurring. Evidence suggests thalwegs are slightly increasing in average depth and the variation index is above 20 which is a good indication of recovery. The variation index in the Doty Creek watershed is between

20 and 57 with an average of 32 and the variation index in the Robinson Creek watershed is between 13 and 31 with an average of 22.

Stream channel characteristics- Pool depth and frequency have been reported in NCWAP as lacking in almost all of the subbasins including these. Placement of large woody debris that GRI (the previous owners) have been conducting for several years has shown an impact on pool depth and frequency. See Thalweg reports. On the Little North Fork pool depth, although increasing dramatically, still is lacking in deeper pools (3 feet plus).

Temperature and canopy cover- The average MWAT over the last 20 years of stream temperature measurements : on the upper North Fork of the Gualala River MWAT 20.4, on the lower North Fork of the Gualala River MWAT 17.1, Robinson Creek MWAT 14.7, Dry Creek MWAT 15.2 , Lost Creek MWAT 15.4, Hoodoo Creek MWAT and McGann Gulch MWAT 14.7 **For the lower North Fork Hydrologic Unit (Robinson Creek planning watershed) the overall average MWAT was 15.8 . For the Little North Fork Hydrologic Unit (Doty Creek watershed) the overall average MWAT 14.2. (for reference 15.C is considered fully suitable and 17C is somewhat suitable)**

Canopy cover for all stations measured in the Robinson Creek watershed average 83% and average 88% in the Doty Creek watershed.

Pool Filling- Improvement of the thalweg profiles on the North Fork of the Gualala seems to have occurred over the last twenty years of measurements. Thalweg has deepened an average of 5/10 of a foot on the watercourses in the Doty Creek watershed. The watercourses in the Robinson Creek watershed do not show a similar average drop but also are not increasing in elevation.

Bank Cutting and Bank Mass Wasting - Bank cutting and bank mass wasting, appears to be happening along the banks of the Little North Fork more dramatically than in the main stem North Fork where the elevation change between the flats and the creek are not as dramatic. This may be partially a result of the Thalweg drop mentioned above as sediment flushes out of the system thereby increasing the steepness of the banks. These are not study reach measurements but the RPF's observations during plan layout.

Scouring and downcutting- No areas of scouring have been noted during plan layout however scouring has been reported in McGann Gulch. Channel avulsion and subsequent downcutting was noted in one location upstream of the THP area on the North Fork of the Gualala.

Woody Debris – Bank full LWD measurements on the North Fork hydrologic unit show an average of 85 pieces (>6in & 4ft or > 10cuft) per 1000 feet.. The Doty Creek hydrologic unit has significantly higher amounts of LWD because of an LWD placement program with an average of 138 pieces per 1000 feet. However the cubic volume of LWD (as opposed to number of pieces) is similar. This indicates that the LWD in the North Fork are generally larger.

Bank Vegetation (includes understory and low lying vegetation) – The North Fork hydrologic unit shows an average of 83% canopy closure and 153 square feet of basal area. (Note this includes areas not included in the THP which were excluded because of low canopy closure so the averages within the project area are significantly higher.) Canopy retention standards and no-cut zones will maintain a large tree canopy adjacent to Class I and II watercourses. An analysis of aerial photos by NCWAP notes that there has generally been a significant increase in stream side canopy in the last thirty years in the Gualala River watershed in general.

NCWAP notes that "overall, watershed-wide riparian shade canopy has improved since the 1960s but still falls short of the 1942 levels... however riparian zones in the western portion have largely recovered from the first round of logging". Class II watercourses in this THP generally have dense bank vegetation. The Doty Creek hydrologic Unit has high canopy closure adjacent to the watercourse with canopy closure of 88%.

Recent Floods – The Gualala River regularly floods its banks in this extreme downstream end of the river. A rise in elevation of the alluvial flood plain adjacent to the river (a sediment trap) has been documented. It has been estimated that the alluvial flats have risen up to 3.5 feet in some areas in the last thirty years. These flats therefore act as sediment traps during flooding.

Beneficial Efforts Specific to the Plan –

Beneficial Efforts for Sediment Reduction:

1) Potential sediment sources on the road systems have been identified and are being stabilized and mitigated. See maps and road database. Also see planned road stabilization work and completed road storm-proofing work databases in Section V of the plan.
2) Longlining of trees from the main haul road will occur when possible. WLPZ skid trails are existing, have all been flagged by the RPF and the LTO will be limited to using these existing trails. This will require extra effort and expense on the part of the landowner and LTO. During the PHI for THPs that have flood prone areas the NCRWQCB representative asked for the following stipulation in order to minimize soil disturbance and it has been incorporated into the plan **"In order to ensure minimal ground disturbance from ground based yarding, tractors may not drive with their blade lowered, except as needed to move debris. No excavation shall occur on flood prone areas except at watercourse crossings described in Section II of the plan or as needed to improve drainage or resolve access problems resulting from previous logging operations."**
3) Bare mineral soil created by timber operations within the Class II Watercourse and Lake Protection Zones (WLPZ) and within the Class III ELZs equal to or greater than 100 contiguous square feet shall be stabilized with a minimum of 90% coverage of either mulch or slash prior to October 15 during the year of operation except as modified by Item 27a and f, Part 2 in Section III of the plan. Such areas created after October 15 during the year of operation shall be treated as described above within ten (10) days of creation.
4) No log hauling shall occur when turbid water is running in the inside ditch or when water is running across the road that has direct access to a watercourse. Seasonal roads and landings shall be used only during dry rainless periods when they are generally firm and easily passable.
5) No winter operations are proposed for the period between Nov 15th and April 1st.
6) The LTO shall install waterbars on skidtrails and unrocked landings prior to the next working day, extended periods of shutdown, or weekends whenever the national Weather Service forecasts a 30% or greater chance of rain within any 24-hour period. LTO shall be responsible for monitoring the weather forecasts.
7) All Class III watercourses will have a 25' or 50' ELZ. Soil deposited in Class III watercourses during timber operations shall be removed, and debris deposited during timber operations shall be removed or stabilized before the conclusion of timber operations or before October 15 per 14 CCR 936.4(c)(3)

Beneficial Efforts for Temperature Effects -

In order to not impact stream temperatures negatively the following standard FPR beneficial actions are

included.

1) Conservative interpretation of the rules regarding transition line location has resulted in an expanded Class I watercourse WLPZ. Also, the entire floodplain is now a riparian protected zone.
2) A no-cut zone for the first 30 feet past this transition line will result in an approximately seventy-foot-wide heavily forested zone adjacent to the river channel consisting of the largest trees next to the river all being left. This zone along with the thirteen largest trees per acre and a minimum of 80% canopy left in the Inner Zone A and a minimum of 50% canopy left in inner zone B means that there will be no significant impact on the shade canopy of the river.
3) Stream canopy retention standards on all Class II watercourses (see item 26 above) and the leaving of all hardwoods within the WLPZ should maintain good canopy cover on class II watercourses.

Beneficial Efforts for Organic Debris Recruitment -

1) No removal of Large Woody Debris (LWD) from WLPZs will be allowed in this plan.
2) The landowner has proactively introduced LWD into the watercourses in this watershed. GRT plans to continue this practice.
3) Thirteen largest trees per acre are being left along with most trees that are leaning toward the watercourse.

Beneficial Efforts to Prevent Chemical Contamination -

1) All state and federal regulations pertaining to the handling and storage of fuel must be adhered to during logging operations.
2) All state and federal regulations pertaining to herbicide use must be adhered to.

Findings: Summary of Watershed Analysis Specific to this THP

This THP includes a number of protection measures designed to protect watershed resources. These measures include buffer zones to reduce potential soil disturbance near watercourses and within the flood plains, seasonal restrictions to limit wet weather operations, and specific actions to stabilize roads surfaces. Although timber operations have occurred and are planned to occur within the WAA, those operations have been and are expected to be identified by the RPF preparing the plan and by the responsible agencies reviewing the plan and mitigated to prevent significant adverse impacts. In terms of cumulative impacts, the very limited potential of sediment discharge from operations on this THP and other THPs in the WAA are not expected to combine to create cumulative adverse effects on beneficial uses of water. Additionally, the road stabilization and watercourse restoration efforts that have been performed within the WAA during the past fifteen years have had a significant positive impact in reducing significant amounts of sediment that would have entered the Gualala River Watershed. More than 295,000 cubic yards of sediment discharge have been avoided. In summary the operations on this THP, on past and future THPs, in regard to road stabilization work and hydrological disconnection of those roads from the watercourses within the WAA by the landowner, and watercourse fish habitat enhancements implemented in concert with the Gualala River Watershed Council within the WAA has led to the conclusion that no cumulative watershed impacts will occur with the implementation of this plan.

B. SOIL PRODUCTIVITY ASSESSMENT

Past Projects- Two THPS have been conducted within the same footprint of the proposed plan going back to 1975 following the passage of the Z'Berg-Nejedly Forest Practice Act of 1973.

Past THPs

1-91-179men selection
1-82-257men selection

It has been approximately 28 years since the last entry into this area according to the records.

Site factors to be addressed for cumulative soil productivity impacts include:

1. **Organic matter loss**
2. **Surface soil loss**
3. **Soil compaction**
4. **Growing space loss**

Organic Matter Loss: Loss or displacement of organic matter is primarily caused by use of heavy equipment for skidding and site preparation, surface erosion, and high intensity fires. Organic matter loss can cause loss of nutrients contained in the top soil and biomass associated with the harvest area. Most of the biomass nutrients are contained in the top soil and foliage of the existing vegetation. Use of existing skid trails per plan mitigations will limit the amount of organic matter disturbance on the plan. Flagged skid trails will be located to access timber efficiently, with a minimum of ground disturbance. In the clearcut unit the greater disturbance through falling and skidding can be expected to displace more organic matter and the exposure to weather can further translocate surface organic matter.

Specific Mitigation: In order to ensure minimal ground disturbance from ground based yarding, tractors may not drive with their blade lowered within the FPA, except as needed to move debris. No excavation shall occur on flood prone areas except at watercourse crossings described in Section II of the plan or as needed to improve drainage or resolve access problems resulting from previous logging operations. This mitigation shall reduce the potential for significant impacts in combination with past, present, and reasonably foreseeable probable future projects identified above, from having a reasonable potential to cause or add to significant cumulative impacts to soil resources.
The use of selection and thinning from below silviculture prescriptions for the majority of the plan will retain a canopy cover that will continue to contribute organic matter to the heavy duff layer within the flood prone area.

Surface Soil Loss: Loss of top soil can significantly reduce soil productivity as the highest nutrient content is contained in the top layer of the soil. Surface soils can be lost due to erosion and displacement by heavy equipment. While displacement of some top soil and organic matter is unavoidable on haul roads and skid trails, the loss will be minimized by proper installation and maintenance of erosion control structures, and straw mulching and grass seeding where needed as specified in Section II, Item #18, of the THP. With skidding equipment 1) limited to rolling over existing understory vegetation and the heavy duff layer without any blade use in the FPA, 2) skid access confined to existing skid trails used by past harvest entries, and 3) with the objective to minimize skid trail use to access marked timber by end-lining where feasible, disturbance to soil within the flood prone area shall be minimal. Observations from the impact of past harvest entries onto these areas or similar areas on the property have showing that no measured soil exposure occurs when harvest operations are conducted under the stated mitigated conditions. Surface soil loss on clearcut areas

will be potentially greater because of the silviculture and the slope of the ground.

Soil Compaction: Within the plan area soil compaction is associated with the use of heavy equipment, especially during saturated conditions. Soil compaction can affect site productivity through the loss of the ability to transmit air and water and by restricting root penetration. The restrictions of the operations during the winter period as specified in Section II, Item #18 and Item #23 will prohibit tractor operations during periods when soil moisture is high and compaction is most likely to occur. Also, outside of the winter period, the plan has wet weather restrictions for heavy equipment use well. This operation will not result in or create any level of soil compaction.

Growing Space Loss: Loss of growing space to road, landing and permanent skid trail construction is an unavoidable factor in most harvest systems. It will not be necessary to build any new roads for this THP and existing skid trails will be sufficient to access the plan areas. Many old skid trails will not be used and all necessary skid access within the WLPZ has been flagged. No foreseeable net loss of growing space will occur.

Findings: The soil productivity assessment area includes the area within the THP boundary where potential adverse impacts are most direct and is exclusive of the appurtenant road system accessing the plan. As indicated in the soil impacts analysis above any impacts to the soil resources are expected to be very limited with no discernable adverse impacts with the mitigation measures incorporated regarding skidding of logs. An Erosion Control Plan (ECP) is imbedded as an active operation feature of the THP as well to facilitate enrollment with the State Regional Water Quality Control Board's General Waste Discharge Requirements (GWDRs) program. This ECP reiterates the measures to be taken to control and monitor sediment discharge off the project area. Along with the THP the ECP addresses any necessary mitigations for the protection of the soil resource, the drainage off truck roads, and the installation and monitoring of sediment control structures. Little to no change in soil productivity is expected to occur as the result of this harvest operation.

This project combined with past and expected future projects will not result in significant adverse cumulative impacts to the soil assessment area due to requirements and mitigations included in the THP to protect soil resources.

C. BIOLOGICAL RESOURCES ASSESSMENT:

Biological Resources:

Animals (non-aquatic): The scoping process involved doing a query of the Natural Diversity Database on February 11, 2019 for Gualala, McGuire Ridge and the quads surrounding them. Although the biological assessment area is two watersheds (except for spotted owls) this NDDB search gives a wider geographic assessment of possible occurrences in the general vicinity of the THP. The NDDB printout can be found in section V (miscellaneous addendums). The following animal species (goshawk, grasshopper sparrow, point arena mountain beaver, Sonoma tree vole, pacific tailed frog, obscure bumble bee, western bumble bee, marbled murrelet, rhinoceros auklet, Townsend's bigeared bat, monarch butterfly, California giant salamander, North American porcupine, western pond turtle, tufted puffin, Bald Eagle, foothill yellow legged frog, California red-legged frog, pink salmon, southern torrent salamander, coho salmon, steelhead, Behrens silverspot butterfly, red-bellied newt and American badger) occurred on the Natural Diversity Database nine quad search . The scoping process also involved reading adjacent THPs, reading the Gualala River Watershed Assessment Report, reading Lawrence Kobernus' report titled "Wildlife Species with Special Status that may be present On Gualala Redwoods or other HJW managed properties" (updated May 1999). The stream reports prepared by landowner were also studied.

GRT's GIS database, which is updated continually with new findings, was also consulted for known listed wildlife in the scoping area. Spotted owls are reported within 0.7 miles in a CNDDB query. Coho salmon have been known to occur when there was an active fish planting program, and steelhead trout occur naturally within watercourses in the scoping area of the Gualala River Watershed.

Plants: Near the end of this section is the rare plant survey.

The following reference sources were used to determine the range and habitat requirements of listed species and to aid in field identification.

CNPS website

California Natural Diversity Data Base, February 11, 2019.

Raptors of California, Hans and Pam Peeters, 2005 University of California Press

The Audubon Society Field Guide to North American Bird, John Whitaker, Alfred Knopf Inc 1992

The Audubon Society Field Guide to North American Bird, Bebler and King, Alfred Knopf Inc 1992

California Mammals, E.W. Jameson and Hans Peeters, University of California Press, Berkeley, 1988.

California's Wildlife, Vol. I - Amphibians and Reptiles, California Statewide Wildlife Habitat Relationships System, May 2, 1988.

California's Wildlife, Vol. II - Birds, California Statewide Wildlife Habitat Relationships System, November, 1990.

California's Wildlife, Vol. III - Mammals, California Statewide Wildlife Habitat Relationships System, April, 1990.

Field Guide to the Birds of North America, National Geographic Society, 1987.

Scats and Tracks of the Pacific Coast, James Halfpenny, 1999 Falcon Publishing

SENSITIVE AQUATIC SPECIES

Sensitive Fish species

Fisheries Habitat

The following are the Class I watercourses within the Biological assessment area for aquatic life. The major watercourses in these watersheds are the North Fork of the Gualala River, Robinson Creek, Dry Creek, Stewart Creek, Lost Creek, Hoodoo Creek, McGann Gulch, the Little North Fork of the Gualala River, Doty Creek, Roxanne Creek and Log Cabin Creek.

Additional information may be included below for upstream and downstream areas even though they are outside the assessment area.

Current Fish Species in the Gualala River Watershed, California

Common Name, Scientific Name

Anadromous

Coho salmon, *Oncorhynchus kisutch*
Steelhead trout, *Oncorhynchus mykiss*
Pacific lamprey, *Lampetra tridentata*

Freshwater

Gualala Roach, *Lavinia symmetricus parvipinnis*
Coast range, sculpin *Cottus aleuticus*
Prickly sculpin, *Cottus asper*
Riffle sculpin, *Cottus gulosus*
Threespine stickleback, *Gasterosteus aculeatus*

Marine or Estuarine

Surf smelt, *Hypomesus pretiosus*
Pacific herring, *Clupea pallasii*
Staghorn sculpin, *Leptocottus armatus*
Starry flounder, *Platicthys stellatus*

Many of the issues that affect fish survival such as large woody debris, sedimentation and temperature are addressed above in the watershed assessment.

The following aquatic species, Southern Torrent Salamander, California Red-legged Frog, Pacific Tailed Frog, Foothill Yellow Legged Frog, red-bellied newt and the Western Pond Turtle have potential habitat in the watercourses and will be protected by WLPZ protections and other FPA rules as listed elsewhere in the THP.

Coho Salmon (Oncorhynchus kisutch), Steelhead (Oncorhynchus mykiss), and Chinook Salmon (Oncorhynchus tshawytscha)

The life cycles of anadromous fish involve habitation of both inland freshwater streams and the ocean. Adult fish migrate into inland fresh water from the ocean and spawn. The offspring hatch and live a portion of their lives in freshwater and then migrate into the ocean. In the ocean the fish continue to grow and mature. After several years the fish return to the streams (usually of their birth) and spawn.

The decline of anadromous fish populations has been attributed to many factors. Quantitative data, that would reveal which problems are real and which are perceived, is lacking. Possible factors affecting the anadromous fish include stream habitat conditions, water diversion, ocean conditions, global and regional climate changes, introduction of hatchery bred fish, introduction of exotic species, spread of disease by hatchery stock, predation by birds and mammals, commercial, sport and subsistence fishing, and poaching. Most likely, declines in coho populations are caused by the combination of multiple factors with higher temperatures, shallower pools, and

limited ocean access to the river (because the mouth is often closed by the gravel bar) being primary causes for decline in populations.

Chinook Salmon (Oncorynchus tshawytscha) Status: Federal- Threatened- Past surveys do not show this species to be present. Anecdotal evidence may indicate that the species was in the Gualala watershed in the past. Small runs of Chinook reportedly were observed in the 1990's (CFL 1997).

Silver Salmon / Coho (Oncorynchus kisutch). Status: Federal – Threatened, California – Endangered. See below for summary for what is known about this species.

Steelhead (Oncorynchus mykiss) Status: Federal-Threatened. See below for summary for what is known about this species.

Summary of Historic (1964-1981) Stream Surveys Conducted in the Gualala Mainstem/South Fork Subbasin (from NCWAP)

Mainstem South Fork Subbasin	Date Surveyed	Habitat Comments	Barrier Comments	Recommendations Management
South Fork	9/23 and 9/24 1964 5/17 and 18/1977	Plentiful spawning areas throughout the stream. Pool: Riffle 95:5. Generally poor shelter consisting of overhanging banks, boulders, logs, aquatic plants and overhanging aquatic plants. Summer flows are limited. Pool: Riffle ratio 7:3. The majority of pools had little to no shelter. Shelter consisted of boulders, aquatic plants, logs, undercut banks, and overhead canopy	Old Log Jams. None Complete. No barriers observed. Each summer a dam is constructed approximately ½ mile below the Wheatfield Fork.	Continue to manage for production of juvenile steelhead trout and coho salmon.
Marshall Creek Marshall Creek Tributary #3 Marshall Creek Tributary #5	9/28/1964	Deposits of good spawning gravel exist throughout the stream from the mouth to the upper fisheries value. Pool: Riffle ratio 50:50. Good shelter provided by logs, boulders, undercut banks, roots, and trees.	No complete barriers.	Should be managed as a steelhead trout and coho salmon spawning and nursery stream.
	9/28/1964	Very limited fisheries value. Watershed severely burned 10 years ago. Lower half mile has spawning gravel available, but summer flow is very low.	Total barrier to fish a half mile above the mouth.	None
	9/29/1964	Summer flows are limited. Some suitable spawning gravel directly above large log jams.	Over 40 log jams in a 1 mile stretch of stream. A number form complete fish passage barriers.	Remove log jams.
McKenzie Creek	9/23 and 24/1964	Spawning areas fair to good in the lower 1/3 of stream, excellent in the middle section of stream, and fair in the upper 1/3 of stream; Pool: Riffle ratio 60:40; Good shelter provided by rocks and undercut banks.	7 partial barriers; Large 7 feet high 40 feet dam present 1/6 mile upstream from mouth; Large bedrock falls 1-1/4 miles upstream	Continue to manage as a coho salmon, steelhead trout spawning and nursery area. After removal of falls, possible planting of coho salmon to re-establish a self-sustaining population.

Coho Salmon and Steelhead Trout Data Summary by Decade, Gualala River Watershed, California		
Decade	**Coho Salmon**	**Steelhead Trout**
1940s	A.C. Taft, chief of the Bureau of Fish Conservation, noted that the fishing pressure on the Gualala River increased 200-300% immediately after World War II ended in 1945	A.C. Taft, chief of the Bureau of Fish Conservation, requested that the entire Gualala River and its tributaries be closed to fishing for small and immature steelhead trout and salmon. Upon his recommendation, the summer closure began in 1945 and remained until 1982.
1950s	In 1952, electrofishing below the confluence of the North Fork revealed that the length frequencies of the fish removed showed a healthy condition (Kimsey 1952). Bruer (1953) wrote that there are millions of young steelhead trout and coho salmon in the Gualala watershed. In 1957, Fisher, cited that the adverse logging conditions and past improper practices had done considerable damage to the headwaters. This was primarily in the form of old logjams, debris and siltation. By 1959, the summer opening was not worth while for a person who must travel any distance (Kastner 1959).	During December 1954 through February of 1955, creel surveys were conducted to determine the quality of the steelhead trout fishery on the Gualala River. Five hundred and seven fish were checked. A total catch estimate of 1,352 fish for the season was extrapolated with data from a use count. In 1956, Fisher, concluded that the Gualala remained one of the better Region III steelhead trout streams. It appeared to sustain a good steelhead trout population despite the poor environmental conditions over a considerable portion of its headwaters. He speculated that unaffected tributary streams must have provided good spawning conditions.
1960s	Stream surveys were conducted in 1964. The species presence and relative abundance of salmonids were estimated from observations recorded while walking upstream along the banks. These surveys had no quantitative basis from which to estimate populations. Where coho salmon were observed during these stream surveys the management recommendations included "possible planting to re-establish a self supporting run" (Table 3-5). Based on CDFG's management prescriptions of the time, this recommendation likely indicated that the native coho salmon populations were not self-sustaining prior to 1964. CDFG reported population estimates of 4000 coho salmon in 1965. This population estimate was made without any supporting data thus is not reliable. The estimate was ranked "C without data" the lowest quality rating designated by the California Fish and Wildlife Plan, Volume III. In 1969, 90,000 coho salmon were planted.	Steelhead trout were present during stream surveys in 1964. Only one creel census survey was conducted on January 24, 1962. The result of the survey showed 11 steelhead trout caught by 18 anglers. Total angler hours were 56.5 resulting in a catch-per-unit-effort of 0.20 fish/hour. CDFG reported steelhead trout population estimates of 16,000 in 1965. This population estimate was made without any supporting data, thus is not reliable. The estimate was ranked "C without data", the lowest quality rating designated by the California Fish and Wildlife Plan, Volume III.
1970s	Hatchery plants of coho salmon; 1970, 30,000; 1971, 30,000; 1972, 15,000; 1973, 20,000; 1975, 10,000. Total number of coho salmon planted in the 70s, 105,000. Some streams were surveyed in 1970 with methods similar to those conducted in 1964 (Table 3-5). It is not known how many of the coho salmon observed during these stream surveys were from the 120,000 planted in 1969-1970. No mention of marked or unmarked hatchery coho salmon were found in the planting records or stream reports In the mid-1970s, the CDFG's Coastal Steelhead Project was conducted, in part, on the Gualala River, California. In 1972-73, the creel censuses began in November and resulted in high counts of coho salmon catches with 831 total coho salmon counted. All other years, the creel censuses began in December after the peak of the coho salmon run had passed. In the 1973-74 survey fifty-two coho salmon were counted, in the 1974-75 survey ten coho salmon were counted, in the 1975-76 survey ten coho salmon were counted and in the 1976-77 survey no coho salmon were counted.	Some streams were surveyed in 1970 with methods similar to those conducted in 1964 (Table 3-5). The steelhead trout observed during these stream surveys were assumed native as planting did not occur until 1972. The steelhead trout planted during the 1970s were 12,750 in 1972; 20,300 in 1973; 15,600 in 1974; 24,600 in 1975; and 10,070 in 1976, a total of 83,320. The Mad River Hatchery yearling steelhead trout were marked by a fin-clip. CDFG reports cite origins of brood stocks as Mad River Hatchery, South Fork Eel River and San Lorenzo River. In 1972-73, L.B. Boydstun, CDFG fish biologist, estimated that the fishing effort on the Gualala River had probably increased over 60% since the early 1950s, when the only other creel censuses were conducted. In spite of the increased pressure during the 1972-73 season, the steelhead trout catch was around 25% of what it was during the 1953-54 and 1954-55 seasons. He attributed the poor catch to smaller populations. During the 1972-73 creel census, 288 steelhead trout were caught. No recognizable hatchery fish from the

	California Drought	spring planting in 1972 were observed. During 1975-76 and 1976-77, steelhead trout population estimates were made as part of a five-year study. This study utilized creel census, use counts, adult tagging, and downstream migrant trapping in conjunction with the planting of steelhead trout. The goal of the project was to estimate winter adult steelhead trout populations, estimate angler harvest rates and evaluate the contribution of hatchery steelhead trout to the fishery. This program focused on enhancing the Gualala River as a sport-fishing stream. The steelhead trout population estimate was 7,608 in 1975-76 and 4,324 in 1976-77, 95% confidence intervals. Two years of data is not sufficient to establish a population trend. Adult steelhead trout population data does not exist after 1977. Harvest estimates were made at the end of the fishing seasons for each of the five years studied. In the 1972-73 season, 288 fish were surveyed. In 1973-74, 1682 steelhead trout were marked for possible recapture. In 1974-75, there were 793 fish counted and in 1975-76, there were 1418 fish counted. Eleven percent of the fish surveyed in 1975-76 were hatchery fish, and a 20.3 % harvest rate was calculated. In the 1976-77 season, there was a 19.8% harvest rate with no hatchery fish recorded. No creel census results were documented from the 76-77 season. The surveys typically began in December. The 1972-73 survey began in November.
1980s	From 1985-1989, 102,000 coho salmon were planted.	From 1983-89, 301,770 steelhead trout were planted in the Gualala River. The year totals of steelhead trout planted were; 12,500 in 1983; 13,400 in 1984; 9,700 in 1985; 57,450 in 1986; 26,250 in 1987; 108,750 in 1988 and; 73,700 in 1989. Bag seines were employed five times during the years of 1984-1986, to sample the game and non game fishes of the Gualala River estuary. The purpose of this survey was to assess the impact of proposed water diversions on aquatic species, in general, and juvenile salmonids, in particular. On Robinson Creek, one station was three-pass electro fished and showed a steelhead trout density of 0.85 per meter. Since electrofishing data were collected only in 1983 on Robinson Creek, insufficient data exists in which to make comparisons. Three pass electrofishing data were collected on a lower and upper site in the Little North Fork in 1988 and 1989. The surveys resulted in an average steelhead trout density of 0.45 on the Little North Fork. In 1989, juvenile steelhead trout population on Fuller Creek (approx. 6 mile long, 3rd order stream) was estimated at 62 with a standard error of 8.599. Four stations were fished with a two or three pass depletion electro-fish method. These stations were located on South Fork and Mainstem of Fuller Creek. The intent of this survey was to assess the impacts from the upstream logging. Station 4 was upstream of the falls on the South Fork, where resident rainbow trout were observed. Young-of-the-year and one year and older steelhead trout, western roach, and three-spined stickleback were found during these surveys.
1990s	Over three years, 45,000 juvenile coho salmon from the 1995-1998 brood years were planted in the Little North Fork. The juveniles were from the Noyo River Egg Collecting Station run by CDFG in Fort Bragg, CA. During snorkel surveys, Gualala Redwoods, Inc. observed	In 1990, a total of 41,300 steelhead trout were planted in the Gualala River. Since1993, the Gualala River Steelhead Project rescued steelhead trout juveniles from streams in danger of drying up during the summer months. Rescued fish are kept in

	coho salmon young-of-the-year on the Little North Fork, Robinson and Dry Creek in 1998 Between July 1, 1999 and June 30, 2000, spawner and electrofishing surveys were conducted on the Little North Fork Gualala River. These surveys were conducted to determine whether the planting of coho salmon during the 1996-98 periods was effective. No coho salmon were found.	two Doughboy pools at the hatchery on Doty Creek, a tributary to the Little North Fork of the Gualala River. The fish are released in the North Fork Subbasin and main stem Gualala River after the first substantial winter rains increase stream flows. From 1993-1997 and 1999-2000, 37,030 steelhead trout have been rescued and 20,328 have been released. During 1990-93, 95, 98, 99 and 2000 three-pass electrofishing data were collected on a lower and upper site in the Little North Fork. No effort was recorded in 1990-1992. Both sites showed small fluctuations in young-of–the year populations. Both sites showed a slight increase in one year old fish from 1995-2000. Two year and older steelhead trout numbers were identical at the lower site and slightly increased at the upper site from 1998-2000. In 1995, one-pass electrofishing surveys were conducted on Fuller Creek and South Fork Fuller Creek. Young of the year, year plus and two year plus steelhead trout were observed. The results were not comparable to the 1989 survey, due to differences in sampling techniques. Gualala Redwoods, Inc. conducted snorkel surveys in 1997, 1998 and 1999. In 1997-98, one year and older steelhead trout were observed in Buckeye Creek and South Fork. In 1998, one year and older steelhead trout were observed in the Wheatfield Fork. In 1999, one year and older steelhead trout were observed in Little North Fork, Robinson Creek, North Fork and Doty Creek.
2000	Between July 1, 1999 and June 30, 2000, spawner and electrofishing surveys were conducted on the Little North Fork, a tributary to the North Fork by CDFG. These surveys were conducted to determine whether the planting of coho salmon during the three-year period of 1995/96-1997/98 were effective. Robinson Creek and Dry Creek were surveyed in 1999, 2000, and 2001, no coho salmon were found (CDFG unpubl. data) Historical coho salmon streams listed by Brown and Moyle (1991) were electro-fished in September, 2001. The method used was the modified ten-pool protocol (Attachment D). The streams electro-fished were North Fork, Doty Creek, South Fork, Franchini Creek, Wheatfield Fork, Haupt Creek, Tombs Creek, House Creek, Pepperwood Creek and Marshall Creek. This survey was specifically aimed at establishing coho salmon presence in the streams sampled. Coho salmon were not found in any of the streams surveyed. Coho Salmon Status Review (2001) stated no known remaining viable coho salmon populations in the Gualala River system. In September 2002, coho salmon young-of-the year were present on Dry Creek, a tributary of the North Fork during a snorkel survey and two sites on the Little North Fork and Doty Creek during electrofishing. Coho young-of-the-year were present on McGann Creek, rescued and released (R. Dingman, pers. comm.)	In 2000-2001, 7,600 and 5,450 steelhead trout were planted on the North Fork between Elk Prairie and Dry Creek. During snorkel surveys, Gualala Redwoods, Inc. observed one year and older steelhead trout on: Little North Fork, Robinson, North Fork, and Dry Creek in 2000 and 2001; on the mainstem of Buckeye Creek in 2000 and 2001; and on the South Fork in 2000 and 2001. February-April 2001, a volunteer effort steelhead trout spawning surveys observed redds on Wheatfield Fork, Tombs Creek, Britain Creek, House Creek, and South Fork. Redds were observed on Rockpile Creek in 2001 (K. Morgan, pers. comm).

2003 to 2019	The last observed Coho were in Dry Creek in 2004.	The survey in 2008 shows steelhead in every creek surveyed which included Dry, Robinson, Big and Little Pepperwood, Buckeye the Little North Fork , the North Fork, the South Fork and Wheatfield forks of the Gualala. Since then surveys have been conducted in 2009 and 2011to 2018 in most of the watercourses listed above with steelhead present in all surveys although numbers have been depressed since 2016 probably as a result of the drought. For additional information on Steelhead see stream reports in Section V

Gualala Roach (Lavinia symmetricus parvipinnis) Status California-Special Concern- Eleven specimens of Gualala Roach were collected by Wendy Jones in 1999 on the South Fork of the Gualala River near the Annapolis road at Valley crossing and the confluence of the Wheatfield fork Gualala River. Numerous other records of this fish in the past are noted in the Gualala River Watershed Technical Support Document (GRWTSD).

Although no population estimates have been conducted, the bulk of stream surveys show that roach have increased in abundance while coho have disappeared and steelhead have decreased in most tributaries of the Gualala.

Snorkel surveys conducted in 2018 – Snorkel surveys which covered the North Fork and Little North Fork did not find Coho salmon. Steelhead were found in every creek surveyed. Additionally, Gualala Roach have been observed during surveys as well as Sculpin, three spine stickleback and lamprey eels. See biological report in section V for details of the snorkel surveys.

Beneficial actions for Fish Populations-

Almost all of the beneficial actions that are stated above in the watershed section of this report are intended for the benefit of the fish populations in the Class I watercourses. Sediment production and stream temperature effects will be minimized by application of the Forest Practice Rules in addition to the raised standards applicable to this plan. Road storm-proofing has already occurred on much of the area.

Most of the factors that affect anadromous fish are beyond the control of the forest landowner. Factors that the landowner could potentially influence have been addressed in the Forest Practice Rules and the cumulative effects analysis.

The following measures have been incorporated into this THP to provide for the protection of anadromous fish habitat resources:

- Rather than relist them here reference is made to all of the numerous provisions described in Section II under Item 18, Soil Protection and 26, Watercourse Protection. These provisions are there for the protection of anadromous fish habitat and for the other listed and unlisted aquatic species.

- Tree marking the WLPZs within the watershed shall be completed before the preharvest inspection to ensure an adequate opportunity for evaluation by the reviewing agencies.

- No winter period operations are proposed.

- 16 out of the 157 acres of this plan are no-cut zones because of the ASP rules or other biological considerations. Most of the remaining areas have the very high habitat protection standards prescribed by the ASP rules.

- At least 80% overstory canopy shall be retained for water temperature regulation within the Inner Zone A WLPZs of the Class I watercourse. At least 50% overstory canopy shall be retained for water temperature regulation within the Inner zone B WLPZs of the Class I watercourse.

- All hardwoods will be left uncut within the WLPZs except where they are a safety hazard.
- All Class I and Class II watercourse core zones and channel zones are no-cut zones.
- Recruitment of large woody debris for instream habitat and shade canopy will be provided by retaining the 13 largest trees per acre in the class I inner zones.
- All road work order points as described in the road work database in Section II have been included in order to minimize sediment production from the existing road system.
- An Erosion Control Plan is included in this THP.

The application of the Forest Practice Rules and specific beneficial actions for soil stabilization, winter operations, and watercourse protection, as described in this timber harvest plan will prevent significant impact to coho salmon and steelhead.

Reptiles

Northwestern Pond Turtle (Clemmys marmorata marmorata). Status: California - Species of special Concern: In California, this species ranges from the Oregon border south to Kern County (Bury 1962). The specific habitat of this species includes areas of permanent water such as ponds, lakes, rivers, marshes, sloughs, and drainage ditches. This species can range up to four hundred meters from their water habitat. It is known that western pond turtles exist and breed within the assessment area. They may be found within the Gualala River and probably in most if not all of its tributaries. There are wet areas that remain wet well into the year during a normal year. There are Class I watercourses that could support pond turtles either within or near the THP area. No turtles have been observed within the THP area.

Amphibians

Southern Torrent Salamander (Rhyacotriton variagatus) Status: California – Species of Special Concern- The range of this species in California coincides with the extent of humid coastal forests in the northwestern part of the state, up to approximately 3,900' above sea level, south to Mendocino County (Anderson 1968). The specific habitat of southern torrent salamanders includes cold mountain streams, springs, seeps, waterfalls, and moss-covered rock rubble with flowing water in humid coastal coniferous forests (Anderson 1968, CWHR 1979, Bury and Corn 1988, Welsh 1990). These salamanders seem to inhabit the splash zone and are rarely found more than one meter from water (Anderson 1968, and Nussbaum and Tait 1977). Southern torrent salamanders' range includes Del Norte, Humboldt, western Siskiyou, Trinity and Mendocino Counties. Marginal suitable habitat does exist within the watershed and but not within the THP. The THP is south of the recognized range. The RPF has had the training to recognize southern torrent salamander habitat. None of these salamanders have ever been discovered on landowner's property.

Tailed Frog (Ascaphus truei). Status: California - Special of Special Concern. Tailed frogs range from southern Mendocino County north through the coastal ranges into Oregon and Washington. THP area falls south of traditional range. Suitable fast rushing creeks do exist within parts of the watershed but not within the THP boundaries. Limitations on equipment operations and canopy retention standards within the WLPZs will reduce potential impacts on this species if they are present.

California Red-Legged Frog (Rana aurora draytonii). Status: Federal- endangered California - Species of Special Concern. Some of the following habitat description is excerpted from: U.S. Fish and Wildlife Service.

2002. Recovery Plan for the California Red-legged Frog (Rana aurora draytonii). U.S. Fish and Wildlife Service, Portland, Oregon. viii + 173 pp.

General Habitat. The frog uses a variety of areas, including various aquatic, riparian, and upland habitats usually below 3500 feet in elevation.

Breeding Habitat. Breeding sites of the California red-legged frog are in a variety of aquatic habitats; larvae, tadpoles, and metamorphs have been collected from streams, deep pools, backwaters within streams and creeks, ponds, marshes, sag ponds, dune ponds, springs and lagoons. Breeding adults are often associated with deep (greater than 0.7 meter [2 feet]) still or slow moving water and dense, shrubby riparian or emergent vegetation (Hayes and Jennings 1988), Reis (1999) found the greatest number of tadpoles occurring in study plots with water depths of 0.26 to 0.5 meters (10 to 20 inches). California red-legged frogs also frequently breed in artificial impoundments such as stock ponds.

Dispersal and Use of Uplands and Riparian Areas. During periods of wet weather, starting with the first rains of fall, some individuals may make overland excursions through upland habitats. Most of these overland movements occur at night. Frogs have been observed to make long-distance movements that are straight-line, point to point migrations rather than using corridors for moving in between habitats. During dry periods, the California red-legged frog is rarely encountered far from water. California red-legged frogs have been known to travel up to 1.4 km straight line from the breeding site however the majority of frogs never travel further than 30 meters from the breeding site.

Summer Habitat. California red-legged frogs often disperse from their breeding habitat to forage and seek summer habitat if water is not available. This summer habitat could include spaces under boulders or rocks and organic debris, such as downed trees or logs, or in mammal burrows and moist leaf litter; industrial debris; and agricultural features, such as drains, watering troughs, abandoned sheds, or hay-ricks. California red-legged frogs use large cracks in the bottom of dried ponds as refugia.

Water Quality: California red-legged frogs are sensitive to high salinity, which often occurs in coastal lagoon habitats. Observations indicate that California red-legged frogs were absent when temperatures exceed 22 degrees Celsius (70 degrees Fahrenheit), particularly when the temperature throughout a pool was this high and there are no cool, deep portions.

Wet Season defined: Wet Season starts with the first frontal rain system depositing a minimum of 0.25 inches of rain after October 15 and ends on April 15.

Dry Season defined: Dry Season starts April 16 and ends with the first frontal rain system depositing a minimum of 0.25 inches of rain after October 15.

Predators and Disturbance:

Raptors, bobcats, racoons, foxes, rough-skinned newts, otters, herons (both great blue and green) and other predators are known to be in or around the project area. The wider assessment area includes developed areas of The Sea Ranch and associated paved roads. Dogs, domestic cats, vehicles, lawn mowers, pesticides and livestock associated with developed areas are a threat to frogs. Residential lighting may affect frogs during migration. Bullfrogs (a predator of red-legged frogs have been heard and seen in ponds in the assessment area. Falling, skidding, log hauling and other vehicle traffic associated with logging could disturb or kill individuals.

Nearest recorded sighting:

Gualala employees discovered what was believed to be a red-legged frog approximately 500 feet west off the THP area in the summer of 2018. Sea Ranch residents reported a red-legged frog in Salal Creek in the summer of 2015 approximately one mile southwest of the THP area and egg masses were reported to have been found in a pond near Mill Bend approximately one mile west of the THP area.

Timber Harvest Plan Habitat: The THP area contains Class I, Class II and Class III watercourses and some ephemeral wet areas. The Class III watercourses flow only in response to rain and do not offer potential

habitat. Class II watercourses in the plan area may exhibit shallow pools but when flowing the current may be too fast to offer breeding habitat. Class II watercourses may have water present into spring and summer. The flood prone area of the THP may provide habitat in the form of shallow standing water but the canopy is quite dense and the flooded areas dry out early in the year so the habitat does not appear to be optimal. The Class I and II watercourses have no-cut zones adjacent to them and then have limited selection harvesting outside of that zone. See item 26 for specifics on watercourse protection measures.

Assessment Area Habitat:

Within the assessment area, known ponds include; numerous sag ponds, several unclassified ponds and numerous seasonal wet areas (low spots that collect water). The sag ponds are generally shallow (less than 2 feet) and dry partially or completely during the spring and summer. Some ponds do have emergent vegetation in the form of pond lilies or cattails. The sag ponds in the area all have riparian canopies and do not resemble "open" stock ponds where California red-legged frog are commonly found. The seasonal wet areas may hold water after rainfall. These areas may be up to several feet deep during the winter but tend to be dry by late spring, early summer.

The Class I watercourses within the assessment area include the North Fork of the Gualala River, Robinson Creek, Dry Creek, Stewart Creek, Lost Creek, Hoodoo Creek, McGann Gulch, the Little North Fork of the Gualala River, Doty Creek, Roxanne Creek and Log Cabin Creek.

Class II watercourses in the assessment area may exhibit shallow pools but when flowing the current would be too fast to offer breeding habitat. Class II watercourses may have water present into spring and summer and can act as a corridor for migration however telemetry studies indicate that the frogs that do migrate usually do so over land in the direction of their destination.

The Class III watercourses flow only in response to rain and do not offer potential habitat.

Foothill Yellow-Legged Frog (Rana boylii). Status: California – candidate for listing- Aquatic. Adult foothill yellow-legged frogs are moderately sized (between 1.5 and 3 inches long) with yellow color under their legs. They inhabit partially shaded, rocky perennial streams and their life cycle is synchronized with the seasonal timing of streamflow conditions. Adult frogs move throughout stream networks from winter refugia to mating habitat where eggs are laid in spring and tadpoles rear in summer. These frogs need perennial water where they can forage through the summer and fall months and the primary cause for mortality in eggs is desiccation. This makes drafting from shallow watercourses where the water level is lowered a concern for this species. Eggs and tadpoles prefer stream temperatures higher than those required for salmonids, with tadpoles selecting temperatures between 16.5C and 22.2C. The installation of crossings on watercourses is another area where this frog or its egg masses can be impacted

This species is also occasionally found in other riparian habitats including moderately vegetated backwaters, isolated pools, and slow moving rivers with mud substrates. (Don T. Ashton, Amy J. Lind, and Kary E. Schlick; 1997) Threats include predators such as garter snakes, bullfrogs, herons and raccoons. Other threats include droughts, floods and human disturbance. Populations of R. boylii have declined in southern and central California south of the Salinas River, Monterey County, and also in the west slope drainages of the Sierra Nevada and southern Cascade Mountains east of the Sacramento and San Joaquin Rivers. In the Coast Ranges north of the Salinas River R. boylii stills occurs in significant numbers in some coastal drainages.

(Jennings and Hayes 1994).

These frogs do occur in suitable habitat in the assessment area. Any adult frogs that may exist near the THP will be protected by WLPZ requirements. This frog's egg masses will also be protected by the limitations that are part of the 1600 agreement which severely limit the reduction of water levels that are allowed during water drafting. Class I crossings are cleared of fish during installation and frogs will be cleared from the immediate area at the same time. The mitigations contained in the plan for protection of the red-legged frog, as well as fish, will also protect the foothill yellow-legged frog and its habitat. Operations of this THP under stated plan restrictions and mitigations will not likely result in a take, nor have any adverse impact on the species.

Sensitive Bird Species

During layout of this plan the THP area was traversed numerous times. Recordings of sharp-shinned hawks, Coopers hawks and Goshawks (both adult and juvenile) were played repeatedly at numerous locations throughout the THP in the summer of 2018 without eliciting a response. Signs of possible raptor predation have been seen on the appurtenant road system but no raptor nests, plucking posts or concentration of mutes were discovered.

Species that are of special concern-

Bald Eagle (Haliaetus leucocephalus). Status: California - Endangered (1971), Federal - Delisted 2007. In California, bald eagles breed in the northern quarter of the state. The species winters throughout most of their breeding range, with half of the state's population wintering in the Klamath Basin (Zeiner et al. 1990b). Specific winter habitat of this species is generally large trees with open crowns near large creeks, rivers, or lakes that have a fish supply.

In Mendocino and Sonoma County bald eagles are a rare winter migrant; only a few individuals are observed annually. These wintering eagles are opportunistic hunters and scavengers, normally passing through the area during their winter migration. The Gualala River drainage provides foraging habitat. Bald eagles prefer large trees to hunt from. The proposed project will have no effect on bald eagles foraging opportunities.

There are no known nests of bald eagles in the assessment area. Bald eagles are a premier species and are quite visible. If nesting was occurring in the area it is doubtful that it would be missed by local residents or by foresters or biologists working for the company. A mature bald eagle was seen wintering on the estuary of the Gualala River in December 2007 and again in the winter of 2013, and a pair have been seen in the vicinity of the lower estuary of the Gualala on a number of occasions in 2017 and 2018.

Golden Eagle (Aquila chrysaetos). Status: California - Special Concern.

The range of golden eagles in California is throughout the state, scarce in the southeastern desert region, and they are found in rolling country with lightly wooded areas, savannas, grasslands, desert edges, farms, or ranches. The species is a rare to uncommon resident and breeder (Harris 1991). The overall breeding densities of this species are relatively low, due to territorial spacing of nesting and foraging habitats. Overall population densities of this species currently appear stable, but excessive disturbance at nest sites can cause nest failure.

In Mendocino County and Sonoma County the golden eagle is an uncommon permanent resident and local breeder. Locally, golden eagles use a variety of habitats, including conifer and hardwood forests, mixed conifer-hardwood woodlands, coastal oak woodlands, and grasslands. Golden eagle forage and roosting habitat with some nesting habitat can be found in the assessment area and golden eagles have been infrequently observed soaring over landowner's property. Usually golden eagles prefer cliff ledges or large wolfy trees in more upslope and remote areas. Adjacent clearcuts provide foraging habitat. No large nest structures were observed and no golden eagle nests are known to exist in the assessment area.

Northern Goshawk (Accipiter gentilis). Status: California - Species of Special Concern.
In California the northern goshawk is an uncommon resident. Goshawks typically breed on north slopes, near water in the densest parts of mature conifer forests but close to openings. The nest is usually located in fork of large horizontal limbs in large live trees at the bottom of the live canopy. In the north coast redwood belt goshawks are extremely rare nesters and irregular transients. They are not known to breed this far south in the coast range. It is unlikely but possible that goshawks will use the type of second growth redwood forest present on this THP however the RPF has searched for visible evidence of goshawks, such as adults or juveniles, plucking posts, or nest structures and played recordings of goshawks repeatedly. It is unlikely that goshawks are present within the THP area.

Cooper's Hawk, (Accipiter cooperi)-Status: California species of special concern.
In California, this species ranges throughout the state, but is not common in the northwest and southeast. In the north coast region they are an uncommon resident, more regularly seen in winter, and breed sparingly throughout (Harris 1991). Incidental sightings on this ownership corroborate this assessment. Nesting habitat of this species in California is most frequently in dense stands of live oak, deciduous riparian stands, and other forested habitats near water.
The potential nesting habitat for this species within the THP is possibly in the hardwoods or small conifers that exist adjacent to the watercourses. Since all harvest trees within the WLPZs will be premarked destruction of any possible nests will be less likely. Coopers hawks have been observed on the east side of the Gualala River downstream of the THP area.

Sharp-Shinned Hawk (Accipiter striatus)- Status: California species of special concern.
Both the breeding and wintering habitats of this species have been characterized as woodlands of young or open forests with a variety of plant life forms (Johnsgard 1990). Remsen (1978) suggested that timber harvest may be a threat to nesting habitat of this species, but the work of other authors indicates that forest harvest resulting in younger stands benefits the species (Postovit and Postovit 1987, Reynolds et al. 1982).
Sharp-shinned hawks prefer to breed in young stands of conifer and tanoak. Habitat does exist within the THP for this hawk. Sharp-shinned hawks are regularly observed hunting on landowner's property. No sharp-shinned hawks or nests were observed during plan layout. Prey remains of small birds are commonly found on the landowner's property and these are most likely from Sharp shinned hawks.

American Peregrine Falcon (Falco peregrinus anatum). Status: California - Endangered (1971), Federal – Delisted
In California, the species breeds and winters throughout the state, with the exception of desert areas (CDF&G 1990). In the north coast region they are an uncommon migrant and winter visitor; a rare, local breeder, and summer resident (Harris 1991). The specific habitat of this species is tall cliffs for nest and perch sites with protection from mammalian predators and the weather, most often close to water and adequate prey populations. Peregrines are not known to be present in the vicinity of the project and there are no large vertical

cliffs within the biological assessment area. It is known that peregrines forage up and down the coast, up some of the major river valleys and over the clearcut blocks, which fall within the biological assessment area. This foraging area will not be affected by operations. Logging activities should not negatively impact the birds' ability to capture prey. The proposed project will have no effect on Peregrine Falcons.

Northern Spotted Owl (Strix occidentalis). Status: Federal - Threatened (1990).
An uncommon, permanent resident in suitable habitat. The Northern Spotted Owl primarily inhabits old growth forests in the northern part of its range (Canada to southern Oregon) and landscapes with a mix of old and younger forest types in the southern part of its range (Klamath region and California) . The species' range is the Pacific coast from extreme southern British Columbia to Marin County in northern California. It nests in cavities or on platforms in large trees and will use abandoned nests of other species. The Northern Spotted Owl is primarily nocturnal. Its diet consists mainly of wood rats (Neotoma sp.) and flying squirrels, although it will also eat other small mammals, reptiles, birds and insects.

One threat to spotted owl populations, at least in the northern part of its range, has been the loss of old-growth and mature late-seral forest, which contains large dead trees for nesting and prey habitat, as well as cool, dark roosts under the dense overstory canopy. Fragmentation of remaining habitat results from logging and roads, and may have increased predation by Great Horned Owls and other species. More recently (since 1960s), a related eastern species, the Barred Owl (Strix varia), has invaded the Pacific Northwest. Barred owls are larger, more aggressive, and compete for both nest-sites and food. It is believed that Barred Owls occasionally attack spotted owls but the evidence for this is sparse. More likely the slightly larger barred owl displaces Spotted Owls from their territory. Barred Owls will also mate and hybridize with spotted owls. Barred Owls in the west occur in both young and old forest and are thought to displace spotted owls from their territories in old growth and mature forests. Additional threats to Spotted Owls include loss of habitat to wildfire and forest diseases, and also the West Nile Virus.

The habitat typing used in this assessment is consistent with the USF&WS Coastal Northern Spotted Owl Habitat Description.

Nesting-roosting habitat includes: 60% (or greater) canopy cover of trees 11 inches (or larger) diameter at breast height.

Foraging habitat includes: 40% (or greater) canopy cover of trees 11 inches (or larger) diameter at breast height. Basal area of 75 (or greater) sq. ft. of trees 11 inches (or larger) diameter at breast height.

The timberland owner is working with Forest Ecosystem Management (FEM) to develop and refine the Northern Spotted Owl habitat classification in GIS, which will allow for more accurate habitat mapping and analysis. FEM biologists ground truth habitat typing during NSO surveys and Activity Center walk-in visits. FEM's preliminary overview finds that company has correctly mapped the NSO habitat, and in some cases is more conservative than the FEM surveyor's typing.

Priority Ranking of Habitat Retention Areas.
Tree Species Composition.
Mixed conifer stands should be selected over pine-dominated stands.

A. Abiotic Considerations include the following:

i. Distance to Nest.

I. Nesting-roosting and foraging habitat should be located closest to identified nest tree(s), or closest to roosting tree(s), if no nesting trees are identified.

ii. Contiguity.

I. Nesting-roosting habitat within the 0.5-radius circle around an activity center must be as contiguous as possible.

II. Fragmentation of foraging habitat must be minimized as much as possible.

iii. Slope Position.

I. Habitats located on the lower one-third of slopes provide optimal microclimatological conditions and an increased potential for the presence of intermittent or year-round water resources.

iv. Aspect.

I. Habitats located on northern aspects provide optimal vegetation composition and cooler site conditions.

v. Elevation.

I. Habitat should be located at elevations of less than 6000 feet, although the elevation of some activity centers (primarily east of Interstate 5) may necessitate inclusion of habitat at elevations greater than 6000 feet.

Size and Shape of Habitat Patch

a. Narrow strips of habitat (WLPZs, retention areas between clearcuts, etc.) may contain the characteristics of nesting-roosting habitat. However, when these narrow strips of habitat are surrounded by unsuitable or low quality habitats, they function as foraging habitat at best.

b. Narrow strips of habitat (100 meters or less) provide for a lot of edge habitat and little or no interior habitat. Franklin et al (2000) describe interior habitats as the amount of spotted owl habitat ≥100 meters from an edge. They describe edge habitat as edge between spotted owl habitat and all other vegetation types.

c. Because WLPZs, for example, are 100 meters or less in total width, they are considered edge habitats surrounded by unsuitable habitat. Edge habitats do not provide for protection from predators nor do they provide the microclimates of interior habitats.

No take discussion-

The THP as proposed will not 'take' NSOs nor will NSO habitat within the assessment area be reduced below threshold levels established by the Forest Practice Rules or guidelines recommended by USFWS. Approval of this THP will require the Director to determine there will not be a take of Northern Spotted Owl (NSO) as a result of timber operations. This determination will be based on the fact that the plan is in conformance with 14CCR 919.9 (e) and current guidelines developed by USF&WS specifically to avoid take of NSO. The USF&WS guidelines are intentionally ultraconservative to ensure that, if followed, the Director can confidently determine no take will occur. THP Section II, Item 32 contains operational actions to avoid take of NSO. THP Section V contains non-operational information such as CNDDB reports, activity center walk-in survey results, evening survey results, pre and post harvest habitat maps, a map of survey routes and tables of activity center habitat acreage summaries. This non-operational information provides the Director supporting evidence that the THP conforms to the USF&WS guidelines and 14CCR 919.9 (e). Methods to avoid take of NSO include locating the birds, seasonal restrictions, restrictions based on proximity to NSO activity centers and prohibitions on reducing acres of habitat below thresholds determined by USF&W and the Rules of the Board of Forestry. Because this THP will not result in take and conforms to USF&WS guidelines, cumulative negative impacts are avoided. The effects of the proposed operations cannot accumulate with effects of past or foreseeable future projects to negatively impact NSO. Additional information on the Spotted Owl has been attached in

Section II and Section V of the plan.

Marbled Murrelet (Brachyramphus marmoratus). Status: California - Endangered (1992), Federal - Threatened (1992). In California the species ranges from the Oregon border south to Santa Cruz County. Specific nesting habitat of this species is large, older, sometimes decadent trees (Carter and Erickson 1988, and others). Although marbled murrelets have been found nesting in some cases in younger trees, and also on the ground, they have primarily been found nesting in over mature coniferous forest throughout most of their range (Carter and Erickson 1988, Paton and Ralph 1988, Hamer and Cummins 1990, 1991. Throughout most of the year this species is found in small groupings in near shore coastal waters where they feed on small baitfish. Habitat loss, gillnetting, and catastrophic events such as oil spills and wildfire are potential threats to this species.
Department of Fish and Game biologists using radar near where the Annapolis Road crosses the South Fork and Wheatfield Fork also suspect that murrelets fly up the Gualala River although at this time murrelets have not been visually confirmed. Private biologists working for landowner have conducted extensive surveys along the South Fork Gualala River and at the confluence of the North Fork and South Fork. The nearest known Murrelets are approximately 12 miles south of the THP area near Clipper Mill Bridge. CDFW documented these birds in 1999 and recent information indicates they may still be in that area. Surveys for this species were conducted in 2013 and 2014 along the mainstem South Fork Gualala, and potential habitat structure was surveyed again in 2017 and 2018 at the confluence of the North Fork and South Fork near the Green Bridge. No Murrelets were detected during these surveys and the habitat available within the THP area is not conducive to murrelet nesting.

Osprey (Pandion haliaetus). Status: California - Special Concern. The range of this species in California is the northern portion of the state where their nest sites are associated with large fish-bearing bodies of water. In the north coast region this species is a common summer resident and breeder; but rare in winter (Harris 1991). Typical habitat consists of large elevated trees or artificial structures for nesting within a few kilometers of a fish source (Johnsgard 1990). Although ospreys are most often very tolerant of human activity and often nest adjacent to roads and other conspicuous locations, disturbance of nest sites during the nest season (April-early October) can cause nest abandonment.
Osprey nests have been continually monitored on landowner's property since at least 1975. There are no known nests within the buffer zones given under FPR 919.3b(5) for this species. There are several known osprey nests clustered around the mouth of the Gualala River. There are also three to five known nests facing the Pacific Ocean either on the German Rancho side of the Gualala or on the north side of the Gualala in China Gulch. None of these nests are close to any units of this plan.

Great Blue Heron (Ardea herodias) Status: California - Special concern- In California this species ranges throughout most of the state up to approximately 4,900' above sea level, with heronries scattered throughout northern California (Zeiner et al. 1990b). Great blue herons inhabit a wide variety of freshwater and salt water habitats. Foraging areas include coastal bays, lagoons, tidal flats, mud flats, and rocks along rivers, creeks, ponds, and lakes (Yocom and Harris 1975) and also agricultural lands and along watercourses in mountainous areas. Their heronries are often found in brush, on rocks and ledges, or on the ground, but they prefer groves of trees near feeding areas (Zeiner et al. 1990). Individual large

trees are sometimes used by single pairs of herons as well. Threats to this species include alteration of habitat through development and harvesting or inadvertent destruction of nest trees.
The birds are often seen foraging along the larger forks of the Gualala River. The main concern with this species would be protection of a nesting colony from disturbance although these species are known to nest singly as well. A heronry or individual heron nest should have been visible during the THP layout and none were observed. An individual heron nest is often placed in the largest tree around and since the 13 largest trees per acre in the near stream environment are being protected on this plan any likely nest sites will be protected.

Great Egret (Casmerodius albus). Status: California- Special Concern- In California, the range of great egrets is widespread throughout the state except at high elevations, and in desert areas (Brown et al. 1986). The specific habitat of this species is nearly synonymous with that of the great blue heron, with the two species often foraging and breeding in close proximity. After severe population declines around the turn of the century due to the harvest of their feathers, populations have rebounded. Alteration or draining of wetlands habitat, as well as industrial or residential development are considered threats to the continued well being of this species.
As with great blue herons, no great egret rookeries are known in the BAA. No egrets or nests were observed.

Vaux's swift (Chaeturi vauxi)- California species of special concern- The range of this species in California is the length of the state in migration, and breeding in a narrow coastal belt from Del Norte County south to Santa Cruz County. On the north coast the species is considered a common summer resident and breeder; casual in winter (Harris 1991). Specific habitat for this species includes hollow trees, snag-tops with cavities, and also chimneys for nests and roosts. The removal of old, decadent redwoods and Douglas-firs with hollow snag-tops can cause loss of nesting habitat for this species. Vaux's swift have been regularly observed over the Gualala River. Snags and large decadent trees for roosting or nesting will be protected. No large decadent trees or snags will be felled (unless they are a safety hazard) that might provide habitat for this species. Within the boundaries of this THP there are no known Vaux's swift nests.

Purple Martin (Progne subis)- California species of special concern- In California, the range of purple martins is throughout the state west of the desert regions from sea level to approximately 6,000' above sea level. Purple martins are most commonly observed near coastal lowlands near river mouths. Harris (1991) lists this species as an uncommon summer resident and breeder. Specific habitat of this species for breeding is abandoned woodpecker cavities in isolated tall trees or snags, man-made martin houses (Allen and Nice 1952), or on cliffs (Bent 1942). Although apparently once a common breeder in this region, populations have decreased due to competition from introduced starlings, removal of snags, and loss of riparian habitat (Remsen 1978, Zeiner et al. 1990b). No Purple Martins were observed. Their preferred habitat will be protected by not harvesting snags or large decadent trees (live culls).

Sensitive Mammal Species

Gray Wolf (Canis lupus) Status-California- Endangered

Range in California-Although gray wolves formerly inhabited California, their historic abundance and distribution is unclear (Schmidt 1991, Shelton and Weckerly 2007). While there are many anecdotal reports of wolves in California, specimens were rarely preserved. The historic range of the wolf in California has been reported to include the Sierra Nevada, southern Cascades, Modoc Plateau, Klamath Mountains, and perhaps the North Coast Ranges (Stephens 1906; Grinnell et al 1937; Hall 1981; Paquet and Carbyn 2003). However, Schmidt (1991) concluded that wolves also "probably occurred in the Central Valley, the western slope of the Sierra Nevada foothills and mountains, and the Coast Ranges of California until the early 1800s, although their population size is unknown and may have been small."

Habitat- The gray wolf is a habitat generalist, and can occur in deserts, grasslands, forests and arctic tundra. Habitat use by gray wolves is strongly correlated with the abundance of prey, snow conditions, absence or low livestock densities, road densities, human presence and topography. Actual dens are usually constructed for pups during the summer period. When building dens, females make use of natural shelters such as fissures in rocks, cliffs overhanging riverbanks and holes thickly covered by vegetation. Sometimes, the den is the appropriated burrow of smaller animals such as foxes, badgers or marmots. An appropriated den is often widened and partly remade. On rare occasions, female wolves dig burrows themselves, which are usually small and short with 1–3 openings. The den is usually constructed not more than 500 meters away from a water source, and typically faces southwards, thus ensuring enough sunlight exposure, keeping the denning area relatively snow free.

A lone wolf, designated OR7, journeyed into northeastern California from Oregon several times since 2011. Recently a pair of wolves was discovered to be raising a family at an undisclosed location in Northern California.

There are no known wolves near the THP. Habitat is poor in the vicinity of the THP because of the lack of prey species, particularly deer, which would be the main prey species available in California. See Section II for protection measures.

Point Arena Mountain Beaver (Aplodontia rufa nigra)- Federal- Endangered

This species is found along streams in dense, riparian-deciduous forest and open stages of most forest types near water. Needs dense understory vegetation and friable, moist soils for burrowing into. WLPZ measures applied properly should protect their food, i.e. herbaceous and deciduous vegetation and the moist, friable soils important for denning.

According to "California's Wildlife" Volume III mammals, this THP is south of their range. Their burrows are described in the Audubon field Guide as being up to 19" in diameter surrounded by fan shaped earth mounds and in wet areas a tent of sticks erected over entrances. No such burrows or structures were observed in the WLPZs. This species has never been known to occur on landowner's property.

Sonoma Tree Vole (Phenacomys longicaudus). Status: California - Special concern.

The range of this species in California includes coastal forests in the humid fog belt (Jameson and Peters 1988) south to Sonoma County on the coast and to Mendocino County in the coastal mountains, and east to Trinity County (Maser 1966). They have been located at elevations of from 150'-3,100' above sea level

(Maser 1966). They have been located at elevations of from 150'-3,100' above sea level (Maser 1966). The habitat of this species predominantly includes the existence of Douglas-fir trees, with grand fir, Sitka spruce, redwood and western hemlock also used (Meiselman 1987, Williams 1986). Some authors have suggested that this species is associated with old growth or fairly dense mature forest with large trees (Carey et al. 1991, Williams 1986). However, habitat records reviewed by Maser (1966) suggested that this species also uses young second growth Douglas-fir trees 7"-15" DBH, and also habitats described as broken, isolated, and scattered by clearcuts, open grassland, bracken fern and cultivated fields; or 30-50 year old stands with a few interspersed older trees, but little evidence of dense forest. It is known from the experience of foresters working for GRT that Sonoma Tree Voles also nest in redwood trees, Bay Laurel trees and snags and are often found near water on GRT property. There also seems to be an affinity for nesting near waterfalls, perhaps because of the higher humidity in the vicinity of a waterfall since this species gets all of its moisture from the vegetation it consumes. Numerous tree voles have been documented and protected in the last ten years on the landowner's property.

Pacific Fisher (Martes pennanti) - Species of special concern

The range of the Pacific fisher in California is the Pacific coastal range, Siskiyou range and Sierra Nevada Mountains. Primarily nocturnal, the pacific fisher is a good climber and swimmer. Its home range on the California coast can be up to 3,700 acres for females and 14,000 acres for males. The fisher prefers stands with large trees and high canopy closure. Douglas fir and true fir were the preferred forest types in the Coast Range. Oaks, especially black oaks appear to be important for denning in some areas. Its main quarry is hares, porcupines, squirrels, mice, chipmunks, carrion, fruit and other plants. It dens in hollow trees, logs or rocky crevices. It has natal denning areas and once kits are old enough they are moved to maternal denning areas. The natal period occurs as early as March 1 and extends to May 15th. Maternal denning occurs from May 16th and is usually completed by July 31st.

Resting areas include large limbs, raptor or squirrel nests, and mistletoe brooms. The fur is especially prized which has caused its extirpation in some areas. It requires extensive wilderness, so loss of habitat has also depleted populations. One threat to fishers may be the loss of large decadent trees that contain cavities that are used for natal and maternal denning.

No fishers have ever been detected within the GRT ownership. Within the watershed, loss of large decadent features that would be used by fishers occurred mostly at the turn of the century and again in the 1950s and 1960s.

Pacific Fisher Analysis

1. Regulatory mechanisms that exist to protect habitat and structural elements for existing fisher populations within the planning watershed and the need to provide additional mitigation measures.

The ASP rules require leaving the 13 largest trees per acre near Class I and large Cass II watercourses. These are the trees that are most likely to have features that are most conducive to fisher denning. These areas are also equipment exclusion zones which reduces the possibility of disturbance. Both Class I and Class IIs have zones adjacent to them that are no-harvest zones and these often have the largest trees in the watershed which are protected from harvest. Also snags are generally left across the entire landscape unless they create a safety concern. GRT will continue a policy of leaving at least two wildlife trees per

acre across the property. These trees are evaluated by foresters and chosen based on qualities such as cavities, large size, platforms, busted tops, large branches, which are many of the same qualities that fishers prefer for denning and for resting. GRT will continue to leave hardwoods 24 inches DBH or larger up to four trees per acre and all downed large woody debris within WLPZs are left. Most large woody debris outside of WLPZs is also left unless it is being used for creek restoration work.

Measures that have been incorporated in this THP to avoid take include:

A. leaving of all snags that aren't a safety risk;
B. marking of two wildlife trees per acre in the evenaged unit which are those trees that have the characteristics that fishers prefer such as forks, cavities, busted tops, nests, mistletoe brooms or decadent trees with large flat branches; and
C. Leaving all large hardwoods (24" or greater) up to 4 per acre.

Townsend's big-eared bat (Corynorhinus townsendii)- Species of special concern

Townsend's big-eared bat is found throughout California, but the details of its distribution are not well known. This species is found in all but subalpine and alpine habitats and may be found at any season throughout its range. Once considered common, Townsend's big-eared bat now is considered uncommon in California. (CWHRS J. Harris)

Specific to this THP-Although this THP is within the historic range of the Townsends big-eared bat (COTO) no bats of this species have ever been known to occur on GRT property and there are no caves, mines, or abandoned buildings within the THP, which are currently considered the preferred habitat based on available literature; however, no targeted COTO surveys have taken place. Within the THP area there are large old snags and large old growth redwood stumps that could contain hollows sufficient for roosting. During layout of the plan no evidence of COTO was found which, given that COTO are widespread, but low-density in California and bats are nocturnal and cryptic in general, may be expected outside of targeted survey efforts by bat biologists. The majority of the plan and all of FPA was marked prior to the preharvest inspection and most of THP has been inspected closely. No suitable roosting hollows (as defined above) were observed. No COTO occurrences have been reported in the last twenty years.

Measures that have been incorporated in this THP to avoid take are:

1. Leaving of all snags and goosepins.
2. Carefully inspecting large basal hollows .
3. Leaving thirteen largest trees per acre in all flood prone areas and leaving all large hardwoods.

Biological Concerns and Significant Wildlife Features Assessment-

Hardwood Cover-

Hardwoods are an important component of wildlife habitat, providing suitable opportunities for roosting and nesting substrate and food production. Hardwoods are evident throughout the BAA in moderate concentrations. There are some unique and extensive areas of large Bay Laurel trees on this THP. All of these areas in the F.P.A. will be protected and are usually in no-cut areas of the plan. There are virtually no tanoak on the alluvial flats because of the periodic flooding that occurs but there are some areas of red alder. In the selection units of this plan only marked trees will be harvested so virtually all of the hardwoods that exist at present will remain post harvest since none have been marked for harvest. The only trees that might be affected are ones that constitute a safety risk for fallers or are knocked down by conifers and hardwoods in the clearcut unit which comprises about 15% of the overall THP area.

Within the Biological Assessment area there are some areas of dense hardwoods. In recent years, forest management activities have become more intensive (planting, pre-commercial thinning and hardwood reduction) and have tended to favor the more valuable coniferous species. This has resulted in a gradual decrease in the relative percentages of hardwood to conifers within the ownership. Hardwoods throughout the ownership may be more prevalent than prior to 1900 when conifers were harvested and hardwoods were left for economic reasons. Hardwoods have been preserved in WLPZs throughout the assessment area and within protection zones for wildlife species.

Hardwood cover is important for many species of wildlife and WLPZ protections and other no-cut areas will preserve a diversity of tree species. In addition to these set aside areas mature hardwoods will continue to exist within uneven aged management areas. Even in the clearcut areas some hardwoods will reproduce during the stand rotation period and although large mature hardwoods provide the most mast and the best nesting sites, some benefits will be provided by these younger hardwoods that reestablish themselves. The landowner makes an effort to leave hardwoods (trees 24" and larger) as wildlife trees, with a retention of at least 4 large hardwoods per acre where they exist so that the young conifers will have adequate light to grow. Wildlife trees are chosen based on the following qualities when available; conky or defective trees that are likely to become snags; trees with cavities, forked tops, large branches or loose bark; less common species such as chinquapin, madrone, maple, bay laurel, dogwood, nutmeg, alder or any oak besides tanoak; trees with any type of nest; and hardwood trees with a large diameter.

Multi-Story Canopy-

The proposed silvicultural prescription is selection with extensive no-cut areas and one unit of even aged management. The stands in the plan area are relative even aged, single-tiered, and have high canopy retention standards as prescribed by the ASP Rules along the streamside no cut Core area and Inner Zone A. This high canopy retention will likely result in little or no redwood sprout reproduction occurring following harvest within Inner Zone A. Thus, within the FPA it may take several decades to a century or two before a multi-story canopy can be developed. At the watershed level there is extensive variability in stand ages, composition, and structure that will provide for multi-story development.

Road Density-
Except for mainline (i.e., designated permanent) roads, the majority roads in use within the BAA are native soil surfaced roads. These roads are maintained on an "as needed" basis. Main haul roads are subject to low to moderate truck traffic during logging season. The landowner is in the process of refining its road system by gradually abandoning a portion of the old roads that parallel near watercourses and on steeper slope areas where cable logging can be conducted. Rerouting the system to facilitate cable yarding systems and road placement above and away from watercourses will ultimately reduce future potential road impacts. Also, a large percentage of the road system on GRT's ownership has been made hydrologically invisible over the last fifteen years through use of cost share watershed restoration grants. Information on the road upgrading program can be found elsewhere in this plan. Many other roads within the BAA over any given year are only subject to infrequent use by GRT's forest management staff. During the rainy season much of the assessment area is inaccessible and receives no traffic. The effect is a seasonal intrusion upon wildlife during the logging season and results in little to no potential impacts over the balance of the year.

This project will not interact with past, present or future levels of road density, and its use, to cause or create a significant adverse impact on animal use patterns in the assessment area, nor is anticipated to cause any adverse impacts to wildlife.

Rock Piles or Cliffs-
There were no cliffs or significant rocky areas in the THP area. Because of the geology of the area cliffs are very rare on the landowner's land.

Ponds and Other Wet Areas-
There are seasonal wet areas within the alluvial flat portions of the plan but because of the sandy nature of the soil most of these ponding areas perk and dry up by the spring. Elk prairie provides a wet meadow habitat adjacent to the plan area.

Woody Debris-
Large woody debris is important for maintaining moisture for amphibians and for providing shelter for other small animals and insects. Large woody debris also stabilizes sediment and may provide shelter for young trees. The THP does contain large woody debris scattered randomly throughout the units. All large woody debris within the WLPZs shall be left.

Nests-
No nests besides the inevitable squirrel nests were discovered during plan layout. No raptor nests were discovered during plan layout. All fallers shall be informed to leave trees in which nests or nest holes are observed.

Snags and Decadent (live culls) Trees-
Snags have not been numerically tallied and even when pre-harvest numbers are available it is difficult to estimate how many snags will survive falling operations. A few large redwood chimneys (hollow snags) exist on this plan and will be protected as wildlife trees. Mitigation for this plan is to save all snags and large decadent trees (live culls) that don't represent a safety risk.

Late Successional Forest and Large Tree Analysis-

Individual effects on wildlife and cumulative effects of the loss of late successional forests and individual large trees through evenaged management or because of repeated entries from uneven aged management have been recognized by the Board of Forestry and addressed by memorandum to RPFs ("Disclosure, Evaluation and Protection of large old trees" Duane Shintaku 2005).

Some of the issues relating to the reduction of large old trees are,

1) loss of late succession stands and late succession continuity;

2) loss of decadent and deformed trees that are of special value to wildlife by providing nesting platforms, nesting cavities for birds as well as basal cavities for mammals;

3) loss of high quality downed large woody debris recruitment;

4) loss of other special habitat elements such as loose bark that provides for bat roosting sites and nest sites for smaller birds, perching opportunities for aerial hunters, foraging opportunities for woodpeckers and other insect eaters, territorial perches, etc.

The greatest impact to a late successional and larger tree resource occurred nearly 100 years ago with the logging of the old growth in the watersheds associated with this THP. The goal of modern forestry is to maintain the elements of this habitat type that remain and recruit additional elements while still harvesting timber products.

No late successional stands remain on the GRT ownership. What does remains of the late seral forest on this ownership is scattered old growth trees that have been left for the following reasons;

1) They are rotten, hollow or busted and previous entries did not take them because of the lack of economic value.

2) They are sound but hanging over Class I or Class II watercourses where the current rules protect them from harvesting for the sole intention of eventual LWD recruitment into the stream or river.

3) They are sound but are on an unstable area or in an area that is inaccessible

4) They contain a known nest site, have some other significant wildlife value, or are being left as part of a wildlife habitat retention area or grouping.

By far the most common reason for sound late seral trees that are still on the property is that they are hanging over watercourses, especially adjacent to the Gualala River but also many of the main tributaries have scattered residuals. Indeed, many of the Class II watercourses have scattered old growth trees hanging over them. Sound late seral trees that are outside of a WLPZ are very rare. Usually these trees are residual old growth that were suppressed and are no larger than the surrounding second growth and have little unique wildlife value. No numbers have been collected regarding the number of residual large old trees per acre across the property, but the number is very likely far less than 0.1 per acre (considering conifers only).

Recruitment of Future Late Seral Elements

Wildlife agencies are concerned that some trees be recruited over time so that the special habitat elements that late seral trees provide do not continue to decrease because of the loss of the existing trees through

mortality and decay. There are several ways that the rules accomplish this;
1) The 2009 Salmonid (ASP) rules require the thirteen largest trees per acre within the Class I and large Class II watercourse protection zones be left.
2) The ASP rules also require that the first 30 feet adjacent to a Class I and variable widths adjacent to Class II watercourses be no-cut zones.
3) Large trees on landslides and on the edges of landslides are often left.
4) Some of the largest trees on the property are in inaccessible areas and although there is no guarantee that someday these won't be taken by helicopter, GRT has no plans to yard with helicopters at this time.
5) Much of the timber on GRT lands is 65 to 105 plus year old second growth which means on the higher site areas there are already some very large second growth trees. The biggest of these trees are often Douglas-fir and many of these Douglas-fir trees already have conk on them as a result of past logging injury or just as a result of natural mortality. Since Douglas fir trees make better wildlife trees than comparably sized redwood trees, and because they have lower economic value (and conky ones have zero economic value), these are the first trees to get marked as wildlife trees. GRT has an internal policy is to mark a minimum of four trees per acre as wildlife trees where feasible. The largest trees with defects are the first to get marked. These trees often occur in upslope areas therefore spreading out the benefit away from the WLPZs.
6) GRT will continue to leave hardwoods (up to 4 per acre) that are 24" or larger. Many hardwoods in this size class are late seral and most of these have high value as wildlife trees. Additionally all hardwoods in WLPZs are left.

Findings- Although late seral stands as defined by the Forest Practice Rules were eliminated from the GRT property almost a century ago (although some may have existed as long as 50-60 years ago in the easternmost portions of the property) some late seral conifer elements still remain. These large residuals trees are often found adjacent to Class I watercourses or as large decadent residuals scattered widely over the property. Late seral hardwood trees are often found in more upslope areas as well as along the watercourses.

Present timber harvests generally do not threaten these late seral remnants, unless they are deemed a safety or fire hazard issue. Although large second growth trees are harvested, the Forest Practice Rules regarding WLPZ protection and GRT policies regarding wildlife tree retention is ensuring that many large second growth trees are being left on a per acre basis as well. As an example, every residual tree that has been left in a clearcut, along a designated Class I and Class II watercourse WLPZ and Class III watercourse channel zone, on landslides, on or within protected archaeological sites, around rare plants and wet areas, or left for any number of other reasons will most likely remain until the next schedule harvest entry onto the site. Under a selection harvest regime this can be a 15-25 year span, and on areas where even-aged management is occurring this is at least 60 years. In each subsequent harvest entry where such structure is being retained these residual trees and/or retained structure continues to get taller and older. In addition, GRT land has many areas of highly productive timberland that have 80-100-year old trees. The trees growing on these higher sites have attained very large diameters and height, and though they don't have all the characteristics of old growth they may approach that stature someday.

The few late seral type large trees that have been observed in the plan area are adjacent to the Gualala

River and being retained as wildlife trees and a source of eventual LWD recruitment to the river and flood prone area. Instructions have been added to Section II to make sure that fallers attempt to protect these trees when falling adjacent timber.

Note- Although wildlife trees are not normally specifically marked in uneven aged units the landowner has agreed to mark any especially good wildlife trees in order to make fallers aware of their location. This marking designation will help to protect these retained trees from impacts during falling and harvesting.

The managed second growth stands, combined with retention of residual later serial forest element, existing today within the BAA do provide some functional wildlife habitat for species primarily associated with late seral forest, in spite of the fact that previous management activities were not designed to retain any particular characteristics. The landowner's THP is designed to retain important functional wildlife habitat elements such that they will be present in the future stands. Late seral structural components are expected to increase within the flood prone areas and WLPZs in the BAA. No significant long-term cumulative adverse impacts to the functional wildlife habitat of species primarily associated with late seral forest characteristics is likely to occur as a result of activities on this proposed THP.

Wildlife trees marked to be left in evenaged unit

wildlife trees Elk THP	redwood	fir	bay	tanoak	madrone	nutmeg	chinquapin	totals by unit	acres being harvested	needed
Clearcut Unit	2	8	6	38	5		1	60	24	48
totals by species	2	8	6	38	5	0	1	60	24	48
								trees per acre	2.50	

178.1

BOTANICAL REPORT
GUALALA REDWOOD TIMBER, LLC
ELK PRAIRIE THP

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Appendices

Executive Summary

During May–August of 2018, William Maslach conducted biological resource surveys on Gualala Redwood Timber's property for the proposed Elk Prairie Timber Harvest Plan. The property is located in Gualala, Mendocino County, California on an approximately 195-acre parcel (APN 14127020) located on the alluvial fault terraces and upland slopes of the North Fork Gualala River. The purpose of the study was to determine the boundaries of rare plants and sensitive natural communities that could be potentially affected by a timber harvest plan, and to recommend protective measures, if needed.

Survey Dates: May 27 & August 18
Survey Area: 195 acres
Survey Time: 21 hours
Results:

Botanical Occurrence	Scientific Name	Global & State Rank	California Rare Plant Rank	CESA/ NEPA
Natural Communities				
Redwood forest	*Sequoia sempervirens*	G3 S3	NA	None
Red alder forest	*Alnus rubra*	G5 S4	NA	None
Water sedge and lakeshore sedge meadows	*Carex aquatills, lenticularis*	G5 S3	NA	None
Plants				
Fringed corn-lily	*Veratrum fimbriatum.*	G3 S3	4.3	None

1 Introduction and Background

1.1 Scope of Work

The purpose of this report is to provide a summary of the botanical resources within Elk Prairie Timber Harvest Plan. When special-status plants or special-status vegetation communities are documented within the proposed project, avoidance or mitigation measures are developed to lessen any potential impacts.

Gualala Redwood Timber, LLC is commercially harvesting timber from their property in Gualala, Mendocino County. As part of the process, the company will file a timber harvest plan with the California Department of Forestry and Fire Protection. This report will provide disclosure of the botanical resources within the proposed timber harvest plan.

This report provides information necessary for the registered professional forester, regulatory agencies, and the general public to evaluate the potential for impacts to botanical resources from the proposed project under the California Environmental Quality Act (CEQA).

1.2 Location & Environmental Setting

The project site is an approximately 195-acre parcel (APN 141-270-20) located in Gualala, Mendocino County, California. Approximately 61% (~120 acres) of the project area is redwood forest on fault-driven alluvial terraces of the North Fork Gualala River; approximately 8% (15 acres) is seasonally wet meadow with grasses, rushes, and sedges, and the remaining 31% (60 acres) is upland redwood forest.

2 Regulatory Background

2.1 Vegetation Communities

The standard for vegetation classification in California is *A Manual of California Vegetation, 2nd Edition* (MCV) Sawyer, Keeler-Wolf, & Evens 2009), which is maintained by CDFW's Vegetation Classification and Mapping Program (VegCAMP) and is based on the National Vegetation Classification System (NVCS). This system is comprised of two levels of hierarchy: vegetation alliances, which are vegetation patterns defined by dominant species at a landscape or statewide level, and vegetation associations, which are patterns or combinations or plant species viewed at a more local level, such as ecological regions, mountain ranges, or preserves.

CDFW maintains the List of Vegetation Alliances and Associations (California Sensitive Natural Communities) (CDFW 2018) in the CNDDB and has assigned global and state rankings to many vegetation alliances. Those alliances and all associations under them with a state ranking of S1-S3 are considered to be highly imperiled under most circumstances.

2.2 Special-Status Species

"Special-status species" is a general term for plant and animal species that warrant special consideration and/or protection due to their rarity. They can include species listed as endangered or threatened under the Federal or California Endangered Species Acts, species listed as rare under the California Native Plant Protection Act, or species not formally listed but considered rare or uncommon by government agencies or non-government

organizations, such as species on the periphery of their range or those with unique or highly specific habitat requirements. (See Leppig & White 2006.)

CDFW maintains a list of plants, including some bryophytes and lichen, inventoried by the California Natural Diversity Database (CNDDB) (CDFW 2018). For the purposes of this document, special status plants include all plant species that meet one or more of the following criteria outlined in this list, entitled "Special Vascular Plants, Bryophytes, and Lichens List":

- Taxa listed or proposed for listing as threatened or endangered under ESA or candidates for possible future listing as threatened or endangered under the ESA (50 CFR § 17.12).
- Taxa listed or candidates for listing by the State of California as threatened or endangered under CESA (Fish and Game Code § 2050 et seq.). A species, subspecies, or variety of plant is endangered when the prospects of its survival and reproduction in the wild are in immediate jeopardy from one or more causes, including loss of habitat, change in habitat, over-exploitation, predation, competition, disease, or other factors (Fish and Game Code § 2062). A plant is threatened when it is likely to become endangered in the foreseeable future in the absence of special protection and management measures (Fish and Game Code § 2067).
- Taxa listed as rare under the California Native Plant Protection Act (Fish and Game Code §1900 et seq.). A plant is rare when, although not presently threatened with extinction, the species, subspecies, or variety is found in such small numbers throughout its range that it may be endangered if its environment worsens (Fish and Game Code § 1901).
- Listed as a Sensitive Species by the Bureau of Land Management, U.S. Fish and Wildlife Service, or U.S. Forest Service Sensitive;
- Listed in the California Native Plant Society's Inventory of Rare and Endangered Plants of California;
- Taxa closely associated with a habitat that is declining in California at a significant rate (e.g. wetlands, riparian, vernal pools, old growth forests, desert aquatic systems, native grasslands, valley shrubland habitats, etc.).
- Taxa that meet the definition of rare or endangered under CEQA § 15380(b) and (d). Species that may meet the definition of rare or endangered include the following:
  - Species considered by the California Department of Fish and Wildlife to be "rare, threatened or endangered in California" (California Rare Plant Rank 1A, 1B, 2A, and 2B);
  - Species that may warrant consideration on the basis of local significance or recent biological information;
  - Some species included on the California Natural Diversity Database's (CNDDB) Special Plants, Bryophytes, and Lichens List (CDFW 2018);
  - Considered a locally significant species, that is, a species that is not rare from a statewide perspective but is rare or uncommon in a local context such as within a county or region (CEQA § 15125 (c)) or is so designated in local or regional plans, policies, or ordinances (CEQA Guidelines, Appendix G). Examples include a species at the outer limits of its known range or a species occurring on an uncommon soil type.
- Plants of regional or specific interest not on any list above.

3 Methods

3.1 Soil

Soils derived from serpentine or ultramafic rock formation, hydric soils, or uncommon soil types can often provide a substrate for special-status plants and plant communities. To determine the occurrence of soil types in the study area, a soil map and report was produced using NRCS's online Web Soil Survey (NRCS 2018) (Appendix

C). These reports are useful in determining the composition of the soil map units, which are rarely comprised of entirely the same soil. The soil map units were overlaid on the project site using GIS data from the Soil Survey Geographic (SSURGO) Data Base, the same data as the Web Soil Survey (NRCS 2018). Essentially, this data is the digitized version of the original county soil survey. These sources were excellent off-site ancillary tools that aided on-site field investigations of botanical resources. Detailed information of these soils follows.

The NRCS assisted Mendocino County, Department of Transportation, in identifying soils with a high probability of containing serpentine or ultramafic rock formations. After reviewing each soil mapping unit (SMU) description and the series description of all soils in the Eastern and Western Mendocino County Soil Surveys, the NRCS determined the relative probability of encountering serpentine based on whether a serpentinitic soil type forms a major or minor component of the entire SMU (E. Mendocino Co: SMU's 117, 136, 137, 156, 214-216, 228-234 and W. Mendocino Co: SMU's 133, 134, 162, 179, 233, 234, 241, 243-245), (Schott 2003). In Sonoma County, soils from the Henneke, Montara, and Huse series are among the soil types that comprise the serpentine formations. Any of these soils occurring in the project site were noted.

The potential presence of hydric soils was also reviewed before the field surveys. The Natural Resource Conservation Service defines a hydric soil as: "... a soil that formed under conditions of saturation, flooding, or ponding long enough during the growing season to develop anaerobic conditions in the upper part." (Federal Register 1994.) NRCS maintains published soil surveys for counties across the United States that provide information on the origin of soils, their composition and texture, and their use for agriculture. Additionally, NRCS maintains the "Hydric Soils List of California," which lists soils from county soil surveys that are sufficiently wet in the upper part to develop anaerobic conditions during the growing season (NRCS 2014).

Some soils are unique in their position on the landscape, and provide habitat for special-status plant communities such as the Mendocino pygmy forest. Among these soils that make up the uplifted marine terraces include formations such as the Gibwell loamy sand, 9-15% slopes, Shinglemill-Gibney complex, 2-9% slopes, Tropaquepts, 0-15% slopes. Some soils types are geographically isolated such as the Seaside-rock outcrop complex, 5-30% slopes.

3.2 **Natural Communities**

A scoping list of vegetation alliances occurring in coastal Mendocino County with a global and state ranking in CNDDB was derived from the California Department of Fish and Wildlife's "List of Vegetation Alliances and Associations" (2018) (Appendix B). Vegetation communities were mapped during field visits by ground-truthing aerial photography and then described using the naming convention in *The Manual of California Vegetation, 2nd Edition* (MCV2), (Sawyer et al. 2009) whenever the vegetation conformed to the standards. Any vegetation communities with a global or state ranking were noted.

3.3 **Botanical Resources**

Field surveys were conducted on May 27 and August 18 to document all plant species occurring in the study area; taxonomy follows *The Jepson Manual, 2nd Ed.* (Baldwin et al. 2012). A total of 21 hours was spent surveying in the field (Figure 1). A target list of sensitive plants potentially occurring on site (Table 1) was developed from a larger scoping list of sensitive plants occurring throughout the coastal region of southern Humboldt to northern Sonoma counties. The scoping list includes plants with a California Rare Plant Rank of 1-4 and any plants with regional significance not on any list (Appendix B). The focal target species includes those plants with a moderate or high potential for occurrence within the study area based on the species' habitat preferences.

Sometimes rare plants are known from the immediate area—sometimes as close as a quarter mile or less—but they are not included in the target list based on the absence of a specific habitat such as wetlands or coastal

bluffs. This is especially true on smaller sites of several acres where survey coverage of all habitat areas is nearly 100% or when the target list for a smaller site is further reduced after the first early-season visit. While the target list is meant to focus attention on a smaller suite of species, all species from the scoping list, even those not on the scoping list, are considered because all plants are identified to the level of species. In general, larger study areas have larger target lists.

Table 1. Target List of Special Status Plants Potentially Occurring in the Study Area.

Scientific Name	Common Name	CRPR	Global Rank	State Rank	CESA	FESA	Blooming Period
Anomobryum filiforme	slender silver moss	4.2	G5?	S2	None	None	year-round
Astragalus agnicidus	Humboldt County milk-vetch	1B.1	G3	S3	CE	None	April - September
Calamagrostis bolanderi	Bolander's reed grass	4.2	G4	S4	None	None	May - August
Calochortus uniflorus	large-flowered star tulip	4.2	G4	S4	None	None	April - June
Campanula californica	swamp harebell	1B.2	G3	S3	None	None	June - October
Carex comosa	bristly sedge	2B.1	G5	S2	None	None	May - September
Carex californica	California sedge	2B.3	G5	S2?	None	None	May - August
Carex lenticularis var. *limnophila*	lagoon sedge	2B.2	G5T5	S1	None	None	June - August
Carex saliniformis	deceiving sedge	1B.2	G2	S2	None	None	June - July
Coptis laciniata	Oregon goldthread	4.2	G4	S3	None	None	(vegetation: all year)
Erigeron biolettii	streamside daisy	3	G3?	S3?	None	None	June - October
Eleocharis parvula	dwarf spikerush	4.3	G5	S3	None	None	(April) June - August (Sept)
Erythronium revolutum	coast fawn lily	2B.2	G4	S2S3	None	None	March - August
Fissidens pauperculus	Fissidens moss	1B.2	G3?	S2	None	None	year-round
Hemizonia congesta subsp. *congesta*	white seaside tarplant	1B.2	G5T2T3	S2S3	None	None	April - November
Hosackia gracilis	harlequin lotus	4.2	G3G4	S3	None	None	March - July
Kopsiopsis hookeri	small groundcone	2B.3	G5	S1S2	None	None	April - August
Lathyrus palustris	marsh pea	2B.2	G5	S2S3	None	None	March - August
Leptosiphon acicularis	bristly leptosiphon	4.2	G4?	S4?	None	None	April - July
Leptosiphon latisectus	broad-lobed leptosiphon	4.3	G4	S4	None	None	April - June
Lilium maritimum	coast lily	1B.1	G2	S2	None	None	May - August
Lilium rubescens	redwood lily	4.2	G3	S3	None	None	April - September
Listera cordata	heart-leaved twayblade	4.2	G5	S4	None	None	February - July
Lycopodium clavatum	running-pine	4.1	G5	S3	None	None	June - August
Microseris paludosa	marsh microseris	1B.2	G2	S2	None	None	April - July
Perideridia gairdneri subsp. *gairdneri*	Gairdner's yampah	4.2	G5T4	S4	None	None	June - October
Piperia candida	white-flowered rein orchid	1B.2	G3?	S2	None	None	March - September
Pityopus californicus	California pinefoot	4.2	G4G5	S4	None	None	March - August
Pleuropogon refractus	nodding semaphore grass	4.2	G4	S4	None	None	March - August
Ramalina thrausta	angel's hair lichen	2B.1	G5	S2?	None	None	year-round
Sidalcea malachroides	maple-leaved checkerbloom	4.2	G3	S3	None	None	March - August
Sidalcea malviflora subsp. *purpurea*	purple-stemmed checkerbloom	1B.2	G5T1	S1	None	None	May - June
Toxicoscordion fontanum	marsh zigadenus	4.2	G3	S3	None	None	April - July
Trifolium buckwestiorum	Santa Cruz clover	1B.1	G2	S2	None	None	April - October
Trifolium trichocalyx	Monterey clover	1B.1	G1	S1	CE	FE	April - June
Usnea longissima	Methuselah's beard lichen	4.2	G4	S4	None	None	year-round
Veratrum fimbriatum	fringed false-hellebore	4.3	G3	S3	None	None	July - September
Viola adunca	Western dog violet	None	None	None	None	None	April-August
Viola palustris	alpine marsh violet	2B.2	G5	S1S2	None	None	March - August

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4 Results & Discussion

4.1 Natural Communities

Generally, the vegetation in the study area is characterized as redwood forest. There is a relatively large meadow (~15 acres) in the center of the parcel. Below is a summary of the sensitive natural communities documented from the project site. All occurrences except redwood forest (predominant throughout the site) are shown in Figure 2.

Redwood Forest (*Sequoia sempervirens*, G3 S3)
The redwood forest alliance has numerous associations within it. Those associations with a rarity rank greater than the alliance rank itself are Sequoia sempervirens – Chrysolepis chrysophylla / Arctostaphylos glandulosa (G2 S2?) and Sequoia sempervirens – Hesperocyparis pigmaea (G1 S1) – neither of which occur in the study area. The redwood forest occurred in two distinct areas: fault-driven alluvial terraces and upland slopes. The alluvial terrace forests were dominant with redwood trees while the upland slope forests were generally comprised of redwood as a dominant tree occurring with Douglas-fir (*Pseudotsuga menziesii*) and tanoak (*Notholithocarpus densiflorus* var. *densiflorus*).

While this vegetation community is considered a special-status vegetation community, it is presumed that by following the California Forest Practice Rules, irreparable damage to the forest resources will not occur.

Red alder forest (*Alnus rubra*, G5 S4)
Red alder forest was often codominant with redwood and followed the North Fork Gualala River.

Because protective measures for watercourses are built in to the harvest plan, no impact to the red alder forest is anticipated.

Water sedge and lakeshore sedge meadows (Carex aquatilis, lenticularis, G5 S3)
A small stand (< 0.1 acres) of Sitka sedge (*Carex aquatilis* var. *dives*) occurred along the road and in the large meadow. Sitka sedge is not common in the northern California redwood region (from Marin Co to the Oregon border) and occurs in less than a dozen places near the coast.

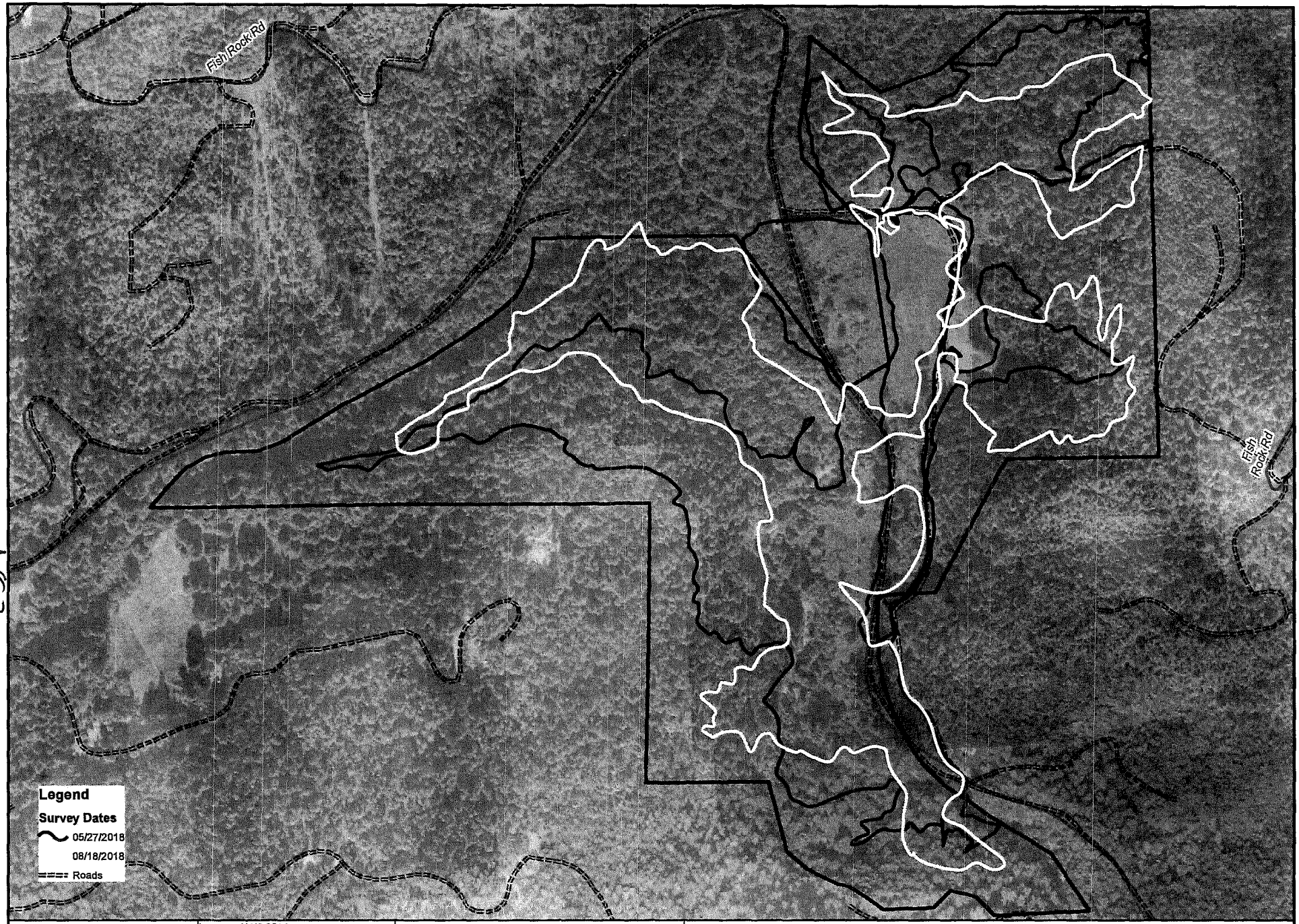
It is a rhizomatous sedge and would likely not be impacted by moderate vehicle traffic, but not tractors or dozers. It is recommended that this stand be avoided.

4.2 Botanical Resources

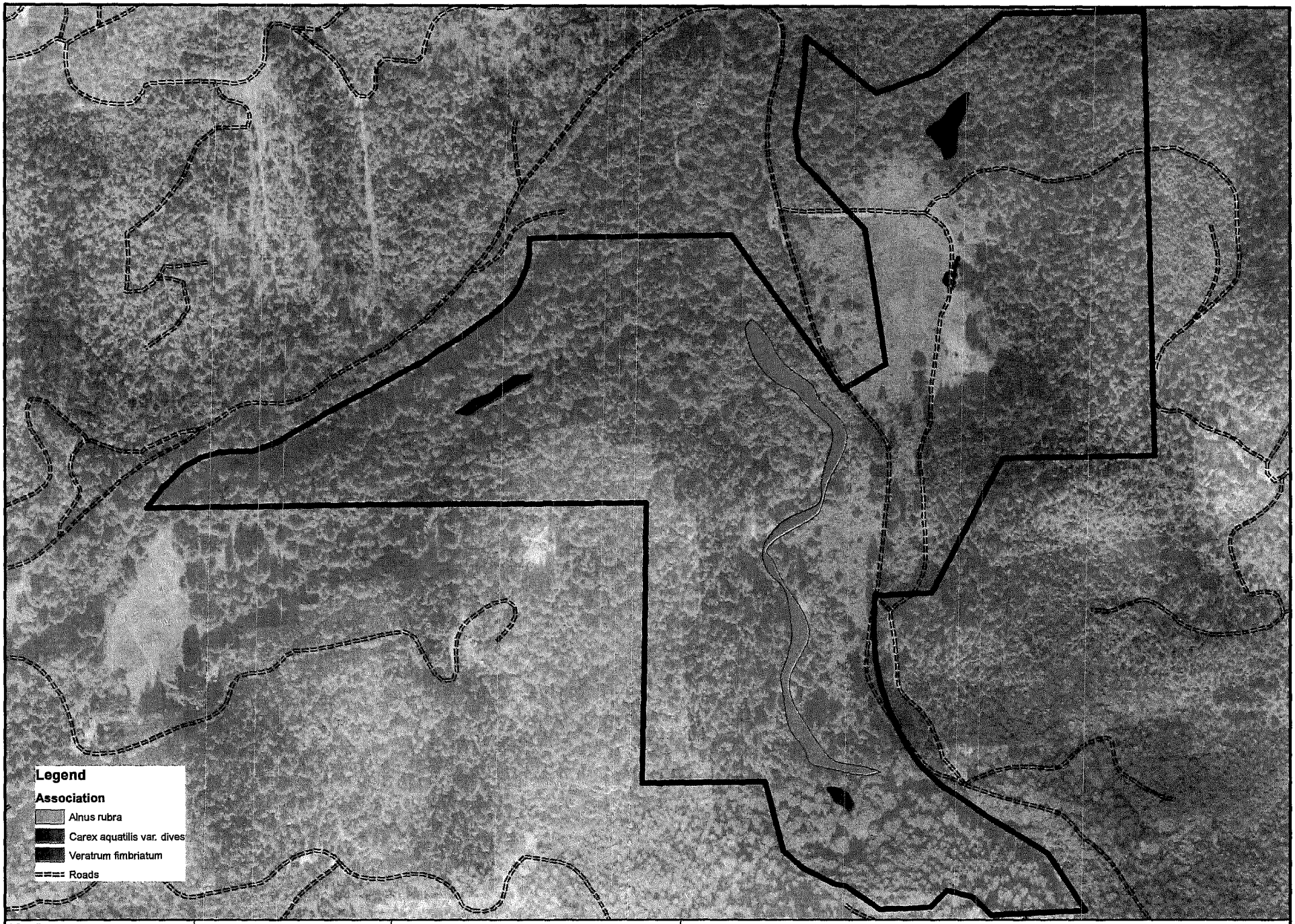
Results from botanical surveys on May 27 and August 18, 2018 identified 145 species. This diversity was greatly attributed to the large 15-acre meadow. A list of all plants documented from the study area is included in Appendix D. Adequate survey coverage allowed the determination to made that no further botanical surveys are need for the detection of rare plants that were possibly missed.

4.2.1 Documented Occurrences

Fringed corn-lily (*Veratrum fimbriatum*, CRPR 4.3, G3 S3)
While plants on the California Rare Plant Rank listed at 3 or 4 are not considered as rare, per se, they were identified during the survey for documentation. Each occurrence of fringed corn-lily had up to and sometime over 100 individuals. It is anticipated that there will be some impact to these occurrences; however, given the large numbers of individuals, long-term persistence of the stands is anticipated.



SCALE: 1 in = 600 ft 1:7,200	Imagery: NAIP 2014	0 100 200 400 600 Feet / 0 50 100 200 Meters	**Botanical Survey Map, Gualala Redwood Timber, LLC.**
DATE: December 2018			Elk Prairie THP — Figure 01
PCS: UTM Zone 10, NAD83			
DRAWN: Maslach			



SCALE: 1 in = 600 ft 1:7,200		**Special-Status Botanical Resources, Gualala Redwood Timber, LLC.**	
DATE: December 2018			
PCS: UTM Zone 10, NAD83		Elk Prairie THP	Figure 02
DRAWN: Maslach			

5 References

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Appendix A

Surveyor Qualifications

Qualifications for Conducting Botanical Surveys
William R. Maslach

BOTANICAL SURVEYS & MAPPING

- Completed the botanical survey, mapping, and associated mitigation for rare plants and vegetation communities for environmental documents and coastal development permits.
- Conducted botanical surveys for private and public land development and timber harvest plans in Mendocino and Sonoma counties.
- Inventoried populations of the federally endangered Howell's spineflower on the Mendocino Coast using sub-meter GPS and GIS.
- Completed Army Corps of Engineer wetland delineations and calculated associated impacts.
- Prepared voucher specimens for herbaria.
- Mapped historical extent of vegetation from aerial photographs in a GIS.
- Submitted occurrence documentation of rare plants to the California Natural Diversity Data Base.
- Consulted with federal and state agencies on projects that potentially affect listed species.

MONITORING

- Analyzed, wrote, and conducted mitigation monitoring plans for restoration and development projects.
- Produced findings for the City of Calabasas Tree Board Subcommittee for recommendations on the inclusion of native tree protection in the development code.
- Developed and reported methods for increasing stands of the federally endangered *Chorizanthe howellii* using statistical analysis.
- Designed a sampling procedure for Los Angeles County Department of Parks to monitor the success of prescribed burns for controlling non-native thistles.
- Discovered and mapped the largest known population of the federally listed *Pentachaeta lyonii*, which resulted in a conservation easement on the property.

ECOLOGICAL RESTORATION

- Supervised restoration projects in lagoon, riparian, chaparral, coastal sage, grassland, oak woodland, and coastal dune communities.
- Designed, built, and managed a native plant propagation and growing facility for California State Parks.
- Identified areas of exotic plant species and designed and implemented methods for their removal.

EDUCATION AND EMPLOYMENT

- M.A., Geography, California State University, Northridge 2000
- B.A., Biology, University of California, Santa Cruz 1993
- Courses in CEQA and taxonomy of *Juncus, Carex,* and *Cyperaceae*
- Environmental Scientist, California State Parks, Mendocino, CA; 13 years
- Assistant Ecologist, California State Parks, Mendocino, CA; 5 years
- Environmental Consultant, Self-employed; 20 years
- Instructor (GIS), College of the Redwoods, Fort Bragg; 2 semesters
- Senior Geographic Information Systems Analyst, Rooney Engineering, Burbank, CA; 2 years
- Ecological Restoration Field Supervisor, Resource Conservation District, Santa Monica Mountains; Topanga, CA; 3 years
- Environmental Services Intern, California State Parks, Santa Monica Mountains; 4 years

Appendix B

Scoping Lists

Special Status Plants with Potential Occurrence in the Northern California Redwood Region
Special Status Animals with Potential for Occurrence in the Northern California Redwood Region
Special-Status Vegetation Communities Occurring in the Northern California Redwood Region

Special Status Plants with Potential Occurrence in Coastal Mendocino County. This table is derived from federal, state, and CNPS–listed plant species, including plants of regional significance. Explanation of column headings:

FESA: federal status includes federally rare (FR), threatened (FT), or endangered (FE)
STATE: California state status includes rare (CR), threatened (CT), or endangered (CE)
CRPR: California Rare Plant Rank - ranked inventory of native California plants (Element Occurrences, EO's) thought to be at risk,
CNDDB ELEMENT RANK

Rank 1A - Plants presumed extirpated in California and either rare or extinct elsewhere
Rank 1B - Plants rare, threatened, or endangered in California and elsewhere.
(usually < 50 extant EO's in CA)
Rank 2A - Plants Presumed Extirpated in California, but more common elsewhere.
Rank 2B - Plants rare, threatened or endangered in California but more common elsewhere.
(usually < 50 extant EO's in CA)
Rank 3 - More information needed, a review list.
Rank 4 - Species of limited distribution, a watch list. (usually > 50 extant EO's in CA)

A Threat Code extension has been added following the CNPS List (e.g. 1B.1, 2.2 etc.)
Threat Code extensions and their meanings:
.1 – Seriously endangered in California (> 80% of occurrences threatened / high degree and immediacy of threat)
.2 – Fairly endangered in California (20-80% occurrences threatened / moderate degree and immediacy of threat)
.3 – Not very endangered in California (<20% of occurrences threatened / low degree and immediacy of threat or no current threats known

GLOBAL RANK: The *global rank* (G-rank) is a reflection of the overall status of an element throughout its global range. Both Global and State ranks represent a letter+number score that reflects a combination of Rarity, Threat and Trend factors, with weighting being heavier on Rarity than the other two.
SPECIES OR NATURAL COMMUNITY LEVEL
G1 = Critically Imperiled - At very high risk of extinction due to extreme rarity (often 5 or fewer populations), very steep declines, or other factors.
G2 = Imperiled - At high risk of extinction due to very restricted range, very few populations (often 20 or fewer), steep
declines, or other factors.
G3 = Vulnerable - At moderate risk of extinction due to a restricted range, relatively few populations (often 80 or fewer), recent and widespread declines, or other factors.
G4 = Apparently Secure - Uncommon but not rare; some cause for long-term concern due to declines or other factors.
G5 = Secure - Common; widespread and abundant.
SUBSPECIES LEVEL
Subspecies receive a T-rank attached to the G-rank. With the subspecies, the G-rank reflects the condition of the entire species, whereas the T-rank reflects the global situation of just the subspecies or variety. For example: *Chorizanthe robusta* var. *hartwegii*. This plant is ranked G2T1. The G-rank refers to the whole species range i.e., *Chorizanthe robusta*. The T-rank refers only to the global condition of var. *hartwegii*.
Not Ranked

STATE-RANK: The state rank (S-rank) is assigned much the same way as the global rank, except state ranks in California often also contain a threat designation attached to the S-rank.
S1 = *Critically Imperiled* - Critically Imperiled in the state because of extreme rarity (often 5 or fewer populations) or because of factors such as very steep declines making it especially vulnerable to extirpation from the state.
S2 = *Imperiled* -Imperiled in the state because of rarity due to very restricted range, very few populations (often 20 or fewer), steep declines, or other factors making it very vulnerable to extirpation from the state.
S3 = *Vulnerable* - Vulnerable in the state due to a restricted range, relatively few populations (often 80 or fewer), recent and widespread declines, or other factors making it vulnerable to extirpation from the state.
S4 = *Apparently Secure* - Uncommon but not rare in the state; some cause for long-term concern due to declines or other factors.
S5 = *Secure* - Common, widespread, and abundant in the state.

SNR = State

Notes:
1. Other considerations used when ranking a species or natural community include the pattern of distribution of the element on the landscape, fragmentation of the population/stands, and historical extent as compared to its modern range. It is important to take a bird's eye or aerial view when ranking sensitive elements rather than simply counting element occurrences.
2. Uncertainty about the rank of an element is expressed in two major ways: By expressing the rank as a range of values: e.g., S2S3 means the rank is somewhere between S2 and S3.
   By adding a ? to the rank: e.g., S2? This represents more certainty than S2S3, but less than S2.
3. Other symbols: GH - All sites are historical; the element has not been seen for at least 20 years, but suitable habitat still exists (SH = All California sites are historical).
   GX - All sites are extirpated; this element is extinct in the wild (SX = All California sites are extirpated).
   GXC - Extinct in the wild; exists in cultivation.
   G1Q - The element is very rare, but there are taxonomic questions associated with it.
   T - Rank applies to a subspecies or variety.

Scientific Name	Common Name	CRPR	Global Rank	State Rank	CESA	FESA	Lifeform	Elevation	Blooming Period	Notes	Potential for Occurrence within Project Area
Abronia maritima	red sand-verbena	4.2	G4	S3	None	None	perennial herb	~ 0-10 m.	February - November	Coastal dunes and coastal strand. Only 2 occurrences in n. CA: 2 miles north of Westport in Mendocino Co., and Doran Park, Bodega Bay, Sonoma Co. Both confirmed vouchered specimens. Extremely disjunct from so. CA.	No coastal habitat.
Abronia umbellata var. *breviflora*	pink sand-verbena	1B.1	G4G5 T2	S1	None	None	perennial herb	0-10 m.	June - October	Coastal dunes and coastal strand with sparse cover. Often the plant growing closest to the ocean.	No coastal habitat.
Agrostis blasdalei	Blasdale's bent grass	1B.2	G2	S2	None	None	perennial rhizomatous herb	5-150 m.	May - July	Coastal dunes, coastal bluff scrub, coastal prairie. Sandy or gravelly soil close to rocks; often in nutrient-poor soil with sparse vegetation.	No coastal bluff habitat.
Alisma gramineum	grass leaf water plantain	2B.2	G5	S3	None	None	perennial rhizomatous herb	390-1800 m.	June - August	Shallow freshwater marshes and swamps. Vouchered from Laytonville and 9 miles west of Willits on Sherwood Road otherwise a plant from Modoc area.	Out of range.
Allium hickmanii	Hickman's onion	1B.2	G2	S2	None	None	perennial bulbiferous herb	5-200 m.	March - May	Mostly from foothill woodlands in the SF Bay area. Grasslands in valley and foothill grassland, coastal prairie, chaparral (maritime), coastal scrub, and closed-cone coniferous forest. Only 1 occurrence (1965) in no. CA; Sonoma Co., Glen Ellen. Extremely disjunct from coastal central CA.	Out of range.
Allium peninsulare var. *franciscanum*	San Francisco bay onion	1B.2	G5T2	S2	None	None	perennial bulbiferous herb	52-305 m.	(April) May-June	Clay, volcanic, often serpentinite in cismontane woodland, valley and foothill grassland. Also from hard, rocky places, ocean cliffs, and steep road banks. Only one coastal occurrence, Bodega Bay, otherwise inland Sonoma Co.	Out of range.
Amorpha californica var. napensis	Napa false indigo	1B.2	G5T2	S2	None	None	perennial deciduous shrub	120-2000 m.	April - July	Broadleafed upland forest (openings), chaparral, cismontane woodland, forming the understory vegetation in a north-facing grove of *Quercus garryana*, yellow pine forest community. From E Marin Co., around Mt. Tamalpais to Novato; Napa Co. foothills around Napa Valley; and Sonoma Co., Santa Rosa Mtns. And So. Coast Range from Bodega Bay to Timber Cove, mostly around Guerneville. Many occurrences with small numbers of plants. *Amorpha* sp. Is the only known host plant of the California dog-face butterfly (*Zerene eurydice*), California's state insect.	Out of range.
Amsinckia lunaris	Bent flowered fiddleneck	1B.2	G3	S3	None	None	annual herb	3 - 500 m.	March - June	Coastal bluff scrub, cismontane woodland, valley and foothill grassland. Mostly from counties around the SF Bay Area and Lake Co. North to Sonoma Co., Bodega Bay and near Annadel SP. One disjunct vouchered occurrence in 1930 from Humboldt Co., near Bridgeville.	Out of range.
Angelica lucida	sea-watch	4.2	G5	S2S3	None	None	perennial herb	0-150 m.	May - September	Coastal bluff scrub, coastal scrub, coastal marshes and swamps, and coastal dunes. Bluff faces and rocky areas near the ocean. Fields and thickets along the coast.	No habitat.
Anomobryum filiforme	slender silver moss	4.2	G5?	S2	None	None	moss	100 - 1000 m.	year-round	Damp rock and soil on outcrops, usually on roadcuts, crevices of sandstone cliffs or other seepy niches in broadleafed upland forest, lower montane coniferous forest, North Coast coniferous forest. Uncommon or overlooked. Sonoma Co., Mark West Springs quad; Humboldt Co., Ferndale and Weitchpec quads.	Low potential habitat.
Arabis blepharophylla	coast rock cress	4.3	G4	S4	None	None	perennial herb	3 - 1100 m.	February - May	Rocky places in broadleafed upland forest, coastal bluff scrub, coastal prairie, and coastal scrub. Throughout Marine Co., mostly coastal; and north to Sonoma Co., Bodega Bay, and 1 northernmost occurrence in Austin Cr., near Cazadero.	Out of range.
Arctostaphylos bakeri subsp. *bakeri*	Baker's manzanita	1B.1	G2T1	S1	CR	None	perennial evergreen shrub	75 - 300 m	February - April	Often on serpentine in broadleaf forests and chaparral. Sonoma Co, from Occidental to south of Monte Rio.	Out of range. No habitat.

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Arctostaphylos bakeri subsp. *sublaevis*	The Cedars manzanita	1B.2	G2T2	S2	CR		perennial evergreen shrub	185 - 760 m.	February - May	Serpentinite seeps. closed-cone coniferous forest, chaparral. Sonoma Co. endemic, mostly found in The Cedars, Austin Cr watershed.	Out of range. No habitat.
Arctostaphylos densiflora	Vine Hill manzanita	1B.1	G1	S1	CE		perennial evergreen shrub	50 - 120 m.	February - April	Chaparral (acid marine sand). Endemic to Sonoma Co., mostly around Forestville and Trenton, also Sebastopol and Camp Meeker.	Out of range. No habitat.
Arctostaphylos hispidula	Howell's manzanita	4.2	G4	S3	None	None	perennial evergreen shrub	120 - 1250 m.	April - May	Chaparral (serpentinite or sandstone). Sonoma Co., near Occidental, Austin Cr SRA, and along Rockpile Road east of Lake Sonoma.	Out of range. No habitat.
Arctostaphylos manzanita subsp. *elegans*	Konocti manzanita	1B.3	G5T3	S3	None	None	perennial evergreen shrub	365 - 1615 m.	(January) Mar - May (July)	Chaparral, cismontane woodland, lower montane coniferous forest. Mostly from Inner North Coast Ranges. One vouchered and unconfirmed collection from ~15 mi. S of Booneville on Fish Rock Rd. Also from E of Laytonville.	Out of range. No habitat.
Arctostaphylos nummularia subsp. *mendocinoensis*	pygmy manzanita	1B.2	G3?T1	S1	None	None	perennial evergreen shrub	90-200 m.	January (vegetation : all year)	Closed-cone coniferous forest. Acidic sandy-clay soils in dwarfed coniferous forest. Only known location 2 miles east of Mendocino.	Out of range. No habitat.
Arctostaphylos stanfordiana subsp. *decumbens*	Rincon manzanita	1B.1	G3T1	S1	None	None	perennial evergreen shrub	75 - 370 m.	February - April (May)	Chaparral (rhyolitic), cismontane woodland. From Napa and Sonoma cos. In the Santa Rosa Mtns., (Yountville to Calistoga, and E of Rincon Valley), and near Cazadero and several occurrences SE of Lake Sonoma.	Out of range. No habitat.
Asclepias solanoana	Serpentine milkweed	4.2	G3	S3	None	None	perennial herb	230 - 1860 m.	May - July (August)	Serpentinite, chaparral, cismontane woodland, lower montane coniferous forest. Mostly Inner North Coast Ranges but occurrences in Sonoma Co., The Cedars at the headwaters of Austin Cr. Also reported from Fort Ross and Cazadero quads.	Out of range. No habitat.
Astragalus agnicidus	Humboldt County milk-vetch	1B.1	G3	S3	CE	None	perennial herb	180-800 m.	April - September	Broadleafed upland forests, North Coast coniferous forests, redwood forests. Disturbed openings in partially timbered forest lands; also along ridgelines; south aspects. Known from east of Point Arena, Mendocino Co. north to southern Humboldt Co.	Potential habitat, although somewhat south of known range.
Astragalus breweri	Brewer's milk-vetch	4.2	G3	S3	None	None	annual herb	90 - 730 m.	April - June	Often serpentinite, volcanic soils in chaparral, cismontane woodland, meadows and seeps, and valley and foothill grassland (open, often gravelly). Mostly from Inner North Coast Ranges but in Marin Co. around Mt. Tamalpais, and Sonoma Co. in the Santa Rosa Mtns north to Cloverdale, and near Occidental.	Out of range. No habitat.
Astragalus pycnostachyus var. *pycnostachyus*	coastal marsh milk-vetch	1B.2	G2T2	S2	None	None	perennial herb	0-30 m.	April - October	Coastal scrub, coastal salt marshes and swamps, mesic sites in coastal dunes, and along streams. Known from coastal San Mateo and Marin Co., and Humboldt Co., from Petrolia to Eureka.	No habitat.
Astragalus rattanii var. *rattanii*	Rattan's milk-vetch	4.3	G4T4	S4	None	None	perennial herb	30 - 825 m.	April - July	Gravelly streambanks in chaparral, serpentine roadcuts, sandy openings, meadow slopes, cliffs in cismontane woodland, lower montane coniferous forest. Mostly from northern Mendocino Co. into Humboldt Co., Eureka. One disjunct occurrence in Mendocino Co., in openings between manzanita bushes on white podzol soil at NE corner of Fish Rock & Iverson roads.	No habitat.
Blennosperma nanum var. *robustum*	Point Reyes blennosperma	1B.2	G4T2	S2	CR	None	annual herb	10-145 m.	February - April	Coastal prairie, coastal scrub. On open hills in sandy soil. From Pt. Reyes and Glass Beach, Fort Bragg.	No habitat.

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Bryoria pseudocapillaris	false gray horsehair lichen	3.2	G3	S2	None	None	fruticose lichen (epiphytic)	0-90 m.		Dark, filamentous, epiphytic, pendent lichen known from Point Arena. Largest known population from Samoa Peninsula in Humboldt Co. Usually on conifers, sometimes huckleberry, in coastal dunes in San Louis Obispo Co.; North Coast coniferous forest on the immediate coast – usually shore pine and Sitka spruce.	No habitat.
Calamagrostis bolanderi	Bolander's reed grass	4.2	G4	S4	None	None	perennial rhizomatous herb	0-455 m.	May - August	Often mesic sites. Bogs and fens, broadleafed upland forest, closed-cone coniferous forest, coastal scrub, wet meadows and seeps, marshes and swamps (freshwater), North Coast coniferous forest. Known from Santa Rosa to northern Humboldt Co; usually not far from the coast, but not always.	Potential habitat.
Calamagrostis stricta ssp. *inexpansa*	Thurber's reed grass	2B.1	G3Q	S2?	None	None	perennial rhizomatous herb	10-60 m.	May - July	Coastal scrub (mesic), freshwater marshes and swamps. Usually in marshy swales surrounded by grassland or coastal scrub. Sporadic in marshes from Crescent City to Marin. Only 1 old record for Mendocino County.	No coastal marshes.
Calamagrostis foliosa	leafy reed grass	4.2	G3	S3	CR	None	perennial herb	0-1220 m.	May - September	Coastal bluff scrub, rocky cliffs and ocean-facing bluffs, clumps in rock crevices of bluff bank of river. North Coast coniferous forests, often on steep wooded cliffs. Many occurrences located in the King Range, Humboldt Co. Westport is southernmost known location.	Out of range.
Calamagrostis ophitidis	serpentine reed grass	4.3	G3	S3	None	None	perennial herb	90 - 1065 m.	April - July	Serpentinite, rocky soil in chaparral (open, often north-facing slopes), lower montane coniferous forest, meadows and seeps, valley and foothill grassland. From Marin to Lake Co. In Sonoma Co from the Santa Rosa Mtns, around Occidental, The Cedars, and SE of Cloverdale on Hot Springs Rd.	Out of range. No serpentine habitat.
Calochortus raichei	The Cedars fairy-lantern	1B.2	G2	S2	None	None	perennial bulbiferous herb	200 - 490 m.	May - August	Serpentinite in closed-cone coniferous forest and chaparral. Known only from The Cedars, Austin Creek watershed.	Out of range. No serpentine habitat.
Calochortus uniflorus	large-flowered star tulip	4.2	G4	S4	None	None	perennial bulbiferous herb	10 - 1070 m.	April - June	Coastal prairie, coastal scrub, meadows and seeps, meadows in North Coast coniferous forest, often wet meadows. North Coast Ranges and elsewhere nearby. Marin Co, Sonoma Co, and Mendocino north to 6 mi. S of Pt Arena and also Glen Blair, E of Ft Bragg; then inland valleys N to Klamath Range.	Low potential habitat.
Calystegia collina ssp. oxyphylla	Mt. Saint Helena morning-glory	4.2	G4T3	S3	None	None	perennial herb	279 - 1010 m.	April - June	Serpentinite in chaparral, lower montane coniferous forest, valley and foothill grassland. Mostly Inner North Coast Ranges N to Lake Co. Coastal from Marin Co. vicinity of Mt. Tamalpais N to Sonoma Co., in prominent serpentine areas: The Cedars and Austin Cr; then E from Mayacamas Range.	Out of range. No serpentine habitat.
Calystegia purpurata subsp. *saxicola*	coastal bluff morning-glory	1B.2	G4T2T3	S2S3	None	None	perennial herb	10-105 m.	May - September	Coastal scrub, road edges and ruderal sites, coastal dunes, North Coast coniferous forest (openings and edges in forests near the coast). From Marin Co., Pt Reyes to Mendocino Co., Ft Bragg. Highly intermediating with subsp. *purpurata* ± N of Manchester.	Out of range; several miles off the coast.
Campanula californica	swamp harebell	1B.2	G3	S3	None	None	perennial rhizomatous herb	1-405 m.	June - October	Bogs and fens, closed-cone coniferous forest, coastal prairie, meadows and seeps, freshwater marshes and swamps, and North Coast coniferous forests. Many occurrences have few plants; uncommon where it occurs. From Marin Co., Pt. Reyes N to Mendocino Co., Ten Mile River N of Fort Bragg and usually within 5 miles of the coast except for Santa Rosa area (Pitkin Marsh) and one location west of Willits.	Potential habitat.

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Carex arcta	northern clustered sedge	2B.2	G5	S2	None	None	perennial herb	60-1400 m.	June - September	Willow, alder, or redwood swamps; stock ponds; seasonal ponds of several feet deep, moist meadows. Mostly from central Humboldt Co. at various elevations, but one 1866 collection from a sphagnum swamp in Mendocino (city or county unspecified) and one collection from Crescent City.	Out of range. Poor habitat.
Carex californica	California sedge	2B.3	G5	S2?	None	None	perennial rhizomatous herb	90-335 m.	May - August	Bogs and fens, closed-cone coniferous forest, coastal prairie, meadows and seeps, marshes and swamps (often on margins or drier areas). Usually within several miles of the coast from Salt Point, Sonoma Co. north to Fort Bragg. One unvouchered specimen from Lassics Botanical Area, Six Rivers National Forest.	Very low potential habitat.
Carex comosa	bristly sedge	2B.1	G5	S2	None	None	perennial rhizomatous herb	0 - 625 m.	May - September	Coastal prairie, marshes and swamps (lake margins), valley and foothill grassland. Rare sedge throughout CA. Sonoma Co., mouth of Salmon Cr. (2008), and flats along Russian R. near Guerneville (1896). Mendocino Co., at UC preserve, Hopland (2006); and Lake Co., Blue Lakes (1927).	Very low habitat.
Carex lenticularis var. *limnophila*	lagoon sedge	2B.2	G5T5	S1	None	None	perennial herb	0-6 m.	June - August	Lakeshores, beaches (often gravelly), bogs and fens, marshes and swamps, North Coast coniferous forest. Rare sedge mostly from Sierra and Klamath Ranges. San Francisco Co., historic 1863 collection from now-extinct Mission Cr. Fen in SF; Contra Costa Co., Tilden Regional Park, 2018; Mendocino Co., Glen Blair and Angelo Preserve; then northern Humboldt Co. & Del Norte Co.	Very low potential habitat.
Carex livida	livid sedge	2A	G5	SH	None	None	perennial rhizomatous herb	0-0 m.	June	Sphagnum bogs in California. Possibly extirpated from the state.	No habitat.
Carex lyngbyei	Lyngbye's sedge	2B.2	G5	S2	None	None	perennial rhizomatous herb	0-10 m.	May - August	Brackish or freshwater marshes and swamps, in water in mucky soil, soughs. May be growing near *Scirpus pungens* and *Triglochin maritima*. From Marin to Del Norte Cos.	No habitat.
Carex saliniformis	deceiving sedge	1B.2	G2	S2	None	None	perennial rhizomatous herb	3-230 m.	June - July	Mesic sites of coastal prairie, coastal scrub, and meadows; seeps, marshes and swamps (coastal salt); boggy ground. Often growing with *Panicum acuminatum* in Mendocino County. Known to grow with *Arenaria paludicola*. Plant very similar to *C. hassei*, and FNA considers *C. saliniformis* a synonym of *C. hassei*. Coastal from Sonoma Co., Sea Ranch to Mendocino Co., Ft Bragg, with two confirmed vouchered specimen: 1944, Santa Cruz Co. and Stone Lagoon, Humboldt Co., 1921. Further work likely warranted.	Low potential habitat.
Carex viridula subsp. *viridula*	green yellow sedge	2B.3	G5T5	S2	None	None	perennial herb	0-1600 m.	June - November	Freshwater marshes and swamps; bogs and fens; mesic sites of North Coast coniferous forest. In Mendocino Co., known only from a 1909 collection in Inglenook Fen.	No habitat.
Castilleja ambigua subsp. *ambigua*	johnny-nip	4.2	G4T3T4	S3	None	None	annual herb (hemiparasitic)	0-435 m.	March - August	Coastal bluff scrub, coastal prairie, coastal scrub, marshes and swamps, valley and foothill grasslands, vernal pool margins, sometimes in alkaline soil. Mostly from northern Monterey Bay, counties around SF Bay, and north to Fort Bragg, Mendocino Co., and a few occurrences from Humboldt Bay north to Del Norte Co.	No coastal habitat.
Castilleja ambigua var. *humboldtiensis*	Humboldt Bay owl's-clover	1B.2	G4T2	S2	None	None	annual herb (hemiparasitic)	0-3 m.	April - August	Coastal salt marsh, sometimes with *Spartina, Distichlis, Salicornia*, Jaumea. Clay-peat soil with above species.	No coastal marsh habitat.

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Castilleja litoralis	Oregon coast paintbrush	2B.2	G4G5T4	S3	None	None	perennial herb (hemiparasitic)	15-100 m.	June	Sandy sites in coastal bluff scrub and coastal scrub; coastal dunes. Grassy coastal bluffs. Cliffs above shore. In understory of mixed conifer forest with *Maianthemum* sp. Reported from the bank of the Ten Mile River and Jug Handle SNR; vouchered from Navarro Pt. Mostly from Petrolia to Orick, Humboldt Co.	Out of range. No habitat.
Castilleja mendocinensis	Mendocino Coast paintbrush	1B.2	G2	S2	None	None	perennial herb (hemiparasitic)	0-160 m.	April - August (vegetation : all year)	Coastal bluff scrub, coastal scrub, closed-cone coniferous forest, coastal dunes, coastal prairie. Primarily coastal bluffs. From southern Mendocino Co. around Gualala R. north to Usual, then from one collection at Patrick's Point, Humboldt Co.	No coastal habitat.
Ceanothus foliosus var. vineatus	Vine Hill ceanothus	1B.1	G3T1	S1	None	None	perennial evergreen shrub	45 - 305 m.	March - May	Chaparral. Mostly occurring around Forestville, near Santa Rosa, Sonoma Co., but also confirmed vouchered specimens from Guerneville; unconfirmed from Laytonville and Leggett in Mendocino Co., and confirmed from S Humboldt Co near the coast at Horse Mtn.	Out of range. No habitat.
Ceanothus gloriosus var. *exaltatus*	glory brush	4.3	G4T4	S4	None	None	perennial evergreen shrub	30-610 m.	March - June (vegetation : all year)	Chaparral, often in pygmy forest or edges. From S Marin Co. to southern Humboldt Co. and extending inland in Mendocino and Sonoma Cos.	No potential habitat, lacking marine terrace soils.
Ceanothus gloriosus var. *gloriosus*	Point Reyes ceanothus	4.3	G4T4	S4	None	None	perennial evergreen shrub	5-520 m.	March - May (vegetation : all year)	Sandy, coastal bluff scrub, closed-cone coniferous forest, coastal dunes, coastal scrub. Similar range as *C. g.* var. *exaltatus* but ± restricted to near-coastal areas from S Marin Co., to Fort Bragg, with one 1890 collection from Cahto Pk. area, Mendocino Co.	No coastal habitat.
Ceanothus purpureus	holly-leaf ceanothus	1B.2	G2	S2	None	None	perennial evergreen shrub	120 - 640 m.	February - June	Volcanic, rocky soils in chaparral, cismontane woodland. Mostly from mountains east of Napa Valley. Also from Cazadero east to Santa Rosa Mtns., Sonoma Co., and disjunct in Mendocino Co: two early-1900's unconfirmed vouchered specimens from Albion area.	Out of range. No habitat.
Chlorogalum pomeridianum var. *minus*	dwarf soaproot	1B.2	G5T3	S3	None	None	perennial bulbiferous herb	305 - 1000 m.	May - August	Chaparral (serpentinite). Mostly from the Inner North Coast Ranges in northern CA. One confirmed collection from Sonoma Co.: 4.5 mi. NNW of Cazadero.	Out of range.
Chloropyron maritimum subsp. *palustre*	Point Reyes bird's-beak	1B.2	G4?T2	S2	None	None	annual herb (hemiparasitic)	0 - 10 m.	June - October	Marshes and swamps (coastal salt). Around San Francisco Bay and north throughout coastal Marin Co.; one occurrence near Petaluma and numerous from northern Bodega Bay, Sonoma Co. Then north from around Humboldt and Arcata bays, Humboldt Co.	No coastal habitat.
Chorizanthe cuspidata var. *cuspidata*	San Francisco Bay spineflower	1B.2	G2T1	S1	None	None	annual herb	3 - 215 m.	April - July (August)	Sandy areas of coastal bluff scrub, coastal dunes, coastal prairie, and coastal scrub. Around the San Francisco Bay area; Marin Co.: 1870 collection from Mt. Tamalpais, Point Reyes Peninsula, Dillon Beach, Bodega Bay N of Estero Americano Cr.	No coastal habitat.
Chorizanthe cuspidata var. *villosa*	Woolly headed spineflower	1B.2	G2T2	S2	None	None	annual herb	3 - 60 m.	May - July (August)	Sandy areas in coastal dunes, coastal prairie, and coastal scrub. Marin Co., around Pt. Reyes Peninsula; and north to Sonoma Co., mostly around northern Bodega Bay and some undocumented occurrences from Salt Point SP.	No coastal habitat.
Chorizanthe howellii	Howell's spineflower	1B.2	G1	S1	CT	FE	annual herb	0-35 m.	May - July	Sandy, often disturbed, areas of coastal prairie and coastal scrub. Coastal dunes, sandy slopes. Endemic to Mendocino Co. from the Ten Mile Dunes south to Glass Beach. One historical occurrence at Jug Handle SP.	Out of range. No habitat.

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Chorizanthe valida	Sonoma spineflower	1B.1	G1	S1	CE	FE	annual herb	10 - 305 m.	June - August	Sandy areas in coastal prairie. Mostly from Pt. Reyes Peninsula, but also reported from south of Petaluma in Marin Co. Then north to Sonoma Co. with only one specimen from near Sebastopol, otherwise all unvouchered occurrences: Fort Ross SP and southern Sonoma Valley.	No coastal habitat.
Cirsium andrewsii	Franciscan thistle	1B.2	G3	S3	None	None	perennial herb	0 - 150 m	March - July	Mesic, sometimes serpentinite in broadleafed upland forest, coastal bluff scrub, coastal prairie, and coastal scrub. Around the San Francisco Bay area; Marin Co.: Marin Headlands north to Dillon Beach including the Pt. Reyes Peninsula; Bodega Head, Sonoma Co.; one occurrence from Cleone, Mendocino Co.in 1938; and one 1934 occurrence from Trinidad, Humboldt Co. Other disjunct occurrences throughout CA – further taxonomic work warranted.	Not sufficient habitat.
Clarkia amoena subsp. *whitneyi*	Whitney's farewell-to-spring	1B.1	G5T1	S1	None	None	annual herb	10-100 m.	June - August	Coastal bluff scrub, coastal scrub. Coastal bluffs; often in rocky clay soil; in sun on slopes of road cuts. Known from Westport to Ft. Bragg, Mendocino Co., then north to Shelter Cover, southern Humboldt Co., and with several disjunct coastal locations south of San Francisco.	No coastal habitat.
Clarkia imbricata	Vine Hill clarkia	1B.1	G1	S1	CE	FE	annual herb	50 - 75 m.	June - August	Acidic sandy loam in chaparral and valley and foothill grassland. Sonoma Co. endemic from around the Vine Hill area near Forestville and Trenton.	Out of range. No habitat.
Collinsia corymbosa	round-headed Chinese-houses	1B.2	G1	S1	None	None	annual herb	0-20 m.	April - June	Coastal dunes, coastal prairie. Marin Co., Bolinas & Pt. Reyes Station; then north from Ten Mile Dunes, Fort Bragg, Mendocino Co., and one historical collection (~1900) from Eureka. (Confirmed determination but location vague and seemingly intermediate with *Collinsia heterophylla*.)	No coastal habitat.
Coptis laciniata	Oregon goldthread	4.2	G4	S3	None	None	perennial rhizomatous herb	0-1000 m.	March – April (vegetation : all year)	Meadows and seeps; North Coast coniferous forest moist streambanks and other mesic sites. Banks and floodplains of rivers in North Coast coniferous forests. Cutbanks of old skid roads. From north of Point Arena, Alder Cr., to Del Norte Co.	Out of range, but slightly. Potential habitat.
Cordylanthus tenuis subsp. *brunneus*	serpentine bird's-beak	4.3	G4G5 T3	S3	None	None	annual herb	475-915 m.	July - August	Usually serpentinite. Closed-cone coniferous forest, chaparral, cismontane woodland, along edge of a dirt road, non-serpentine, rocky (serpentine) summit. Mostly from southern Inner and Outer North Coast Ranges (Sebastopol eastward), but one disjunct coastal location from Gualala Ridge area, Timberwood Way, Mendocino Co.	Out of range and poor habitat.
Cordylanthus tenuis subsp. *capillaris*	Pennell's bird's-beak	1B.2	G4G5 T1	S1	CR	FE	annual herb (hemiparasitic)	45 - 305 m.	June - September	Serpentinite in closed-cone coniferous forests and chaparral. Sonoma Co. endemic mostly from around Occidental, but also occurrences from Windsor and Geyserville areas.	No habitat.
Cornus canadensis	bunchberry	2B.2	G5	S2	None	None	perennial rhizomatous herb	60-1920 m.	May - July	Bogs and fens, meadows and seeps, North Coast coniferous forest. Very rare and significantly disjunct in southern extent of range in Mendocino Co.: north of Russian Gulch SP under powerlines through pygmy forest, bog on Summers Lane, Fort Bragg, and other historical occurrences not rediscovered, likely extirpated. Then from few occurrences in the Klamath Range: Humboldt, Del Norte, and Siskiyou cos.	No boggy habitat and out of range.

Scientific Name	Common Name	CRPR	Global Rank	State Rank	CESA	FESA	Lifeform	Elevation	Blooming Period	Notes	Potential for Occurrence within Project Area
Cuscuta pacifica var. *papillata*	Mendocino dodder	1B.2	G5T1	S1	None	None	annual vine (parasitic)	0-50 m.	July - October	Coastal dunes (interdune depressions). Rediscovered at Point Arena in 2011. Many historical occurrences may be extirpated; need field surveys. Known to occur on *Gnaphalium*, *Silene*, and *Lupinus* spp. in Mendocino Co.; and on *Polycarpon tetraphyllum* and *Calystegia purpurata* subsp. *saxicola* with *Sanicula arctopoides* nearby in Sonoma Co. From Bodega Bay, Sonoma Co.; Gualala, Manchester/Pt Arena, and Fort Bragg, Mendocino Co. (northern extent).	No coastal habitat.
Cypripedium californicum	California lady's slipper	4.2	G4	S4	None	None	perennial rhizomatous herb	30-2750 m.	April - September	Seeps and streambanks, usually serpentinite. Bogs and fens, lower montane coniferous forest. Prefers shade and often grows with *Darlingtonia californica* and with incense cedar. Mostly from high elevations in Klamath Ranges, but also from around Mt. Tamalpais, Marin Co.; Occidental, The Cedars/Austin Cr. and vicinity, Sonoma Co. 1920 collection from Mendocino (extirpated?), inland near Ukiah, Leggett, Mendocino Co.; and Orick and high elevations in Humboldt Co.	No serpentine boggy habitat.
Cypripedium montanum	mountain lady's-slipper	4.2	G4	S4	None	None	perennial rhizomatous herb	185-2225 m.	March - August	Broadleafed upland forests, cismontane woodlands, lower montane coniferous forests, and North Coast coniferous forests. Around Cazadero, Lake Sonoma, and reports from Cloverdale, Sonoma Co.; eastern slope of Outer North Coast Ranges, Mendocino Co.; and north to the OR border at high elevations through Humboldt and Del Norte cos.	No habitat.
Delphinium bakeri	Baker's larkspur	1B.1	G1	S1	CE	FE	perennial herb	80-305 m.	March - May	Decomposed shale, often mesic sites in broadleafed upland forests, coastal scrub, and valley and foothill grasslands. Rare Sonoma Co. endemic mostly along Coleman Valley Rd, and 1980 collection from 0.1 mile west of Petrified Forest Road and Porter Creek Road junction. Other CalFlora occurrences dubious.	Out of range and no habitat.
Delphinium luteum	golden larkspur	1B.1	G1	S1	CE	FE	perennial herb	0-100 m.	March - May	Rocky sites in chaparral, coastal prairie, coastal scrub. Pt. Reyes, Tomales and north, along D St. SE of Petaluma, Marin Co.; around Bodega, Bodega Bay, and Salmon Creek, and a historical collection from near Graton, Sonoma Co. Plants from Marin Co. are apparently not hybrids with *D. decorum* subsp. *d.*; hybridizes with *D. nudicaule*.	No habitat.
Dirca occidentalis	western leatherwood	1B.2	G2	S2	None	None	perennial deciduous shrub	25-425 m.	January - March (April)	Mesic sites in broadleafed upland forests, closed-cone coniferous forests, chaparral, cismontane woodlands, North Coast coniferous forests, riparian forests and riparian woodlands. Mountain ranges around San Francisco Bay; hills along W slope above San Andreas Fault, Marin Co.; Bodega and Salmon Cr. watershed, Sonoma Co. at the northern extent.	Out of range.
Eleocharis parvula	dwarf spikerush	4.3	G5	S3	None	None	perennial herb	1-3020 m.	(April) June - August (Sept)	Marshes and swamps. Throughout CA. Petaluma, Bodega Bay, Sonoma Co., then north to Arcata Bay, Patrick's Point, and Orick. Possibly overlooked and undocumented from localities between Sonoma and Humboldt cos.	Unlikely, but could be considered.
Elymus californicus	California bottle-brush grass	4.3	G4	S4	None	None	perennial herb	15-470 m.	May – August (Nov)	Broadleafed upland forests, cismontane woodlands, North Coast coniferous forests, riparian woodlands. From Monterey Bay north to the Russian R. Throughout Marin Co.; from Bodega Bay to a few miles north of Jenner and inland to Occidental. Possibly threatened by fire suppression.	Out of range.
Erigeron biolettii	streamside daisy	3	G3?	S3?	None	None	perennial herb	30-1100 meters	June - October	Rocky, thin-soil areas in grasslands, meadow slopes, rocky gravels along streams in broadleafed upland forest, cismontane woodland, North Coast coniferous forest	Potential habitat.

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Scientific Name	Common Name	CRPR	Global Rank	State Rank	CESA	FESA	Lifeform	Elevation	Blooming Period	Notes	Potential for Occurrence within Project Area
Erigeron greenei	Greene's narrow-leaved daisy	1B.2	G3	S3	None	None	perennial herb	80 - 1005 m.	May - September	Chaparral (serpentinite or volcanic). Mostly Inner North Coast Ranges: Napa, Lake, and Trinity cos., but Sonoma Co. in the southern extent of range: Sebastopol, Guerneville, Cazadero, eastward at Mt St Helena, and north to east of Geyserville.	Out of range.
Erigeron serpentinus	serpentine daisy	1B.3	G2	S2	None	None	perennial herb	60 - 670 m.	May - August	Chaparral (serpentinite, seeps). Likely a Sonoma Co. endemic. From headlands north of mouth of Russian River at Jenner, and The Cedars along Porter Cr. and one confirmed disjunct voucher from Sonora (should be reviewed, seems doubtful).	Out of range.
Erigeron supplex	supple daisy	1B.2	G2	S2	None	None	perennial herb	10-50 m.	May - July	Coastal bluff scrub, coastal prairie. Usually in open rocky areas in grassy sites with short grasses. From Point Reyes; Gualala to Point Arena and then from Little River to Point Cabrillo, and from Glen Blair; with a few occurrences from west of Willits. A few occurrences from Humboldt Co., Orick and east of Eureka.	No coastal habitat.
Erysimum concinnum	bluff wallflower	1B.2	G3	S3	None	None	annual / perennial herb	0-185 m.	March - May	Coastal bluff scrub, coastal dunes, coastal prairie. Largest occurrence known from Pt. Reyes NS; possibly of hybrid origin. Some occurrences from Del Norte and Mendocino Counties are also of possible hybrid origin; further study is ongoing.	No coastal habitat.
Eriogonum cedrorum	The Cedars buckwheat	1B.3	G1	S1	None	None	perennial herb	365 - 550 m.	June - September	Serpentinite in closed-cone coniferous forest. Narrow endemic of Sonoma Co. from The Cedars.	Out of range.
Eriogonum luteolum var. *caninum*	Tiburon buckwheat	1B.2	G5T2	S2	None	None	perennial herb	0 - 700 m.	May - September	On serpentinite, sandy to gravelly sites in chaparral, cismontane woodlands, coastal prairie, and valley and foothill grasslands. In various locations around the San Francisco Bay; mostly from eastern Marin Co., but scattered locations throughout the county; near Petaluma in Sonoma Co., and north to one confirmed disjunct voucher from 1931 collection 6 mi W of Yorkville, Mendocino Co.	Out of range.
Eriogonum nervulosum	Snow Mountain buckwheat	1B.2	G2	S2	None	None	perennial rhizomatous herb	300 - 2105 m.	June - September	Chaparral (serpentinite). Mostly from inner North Coast Ranges in Lake Co., but also occurs in The Cedars, Sonoma Co.	Out of range.
Eriogonum ternatum	ternate buckwheat	4.3	G4	S4	None	None	perennial herb	305 - 2225 m.	June - August	Lower montane coniferous forest (serpentinite). Mostly from high elevations in the Klamath Ranges but also disjunct to the south from Sonoma Co., The Cedars.	No habitat.
Erysimum concinnum	bluff wallflower	1B.2	G3	S2	None	None	annual / perennial herb	0 - 185 m.	February - July	Coastal bluff scrub, coastal dunes, coastal prairie. From Marin Co.: Pt Reyes Peninsula; Sonoma Co.: Bodega Bay, Duncan's Mills (needs checking), and Salt Pont SP.; Mendocino Co.: Gualala, Elk, Mendocino to Cleone, and Hardy Cr.; Humboldt Co.: S of Mattole River mouth; and Del Norte Co.: Crescent City, and Tolowa Dunes.	No coastal habitat.
Erysimum franciscanum	San Francisco wallflower	4.2	G3	S3	None	None	perennial herb	0 - 550 m	March - June	Often serpentinite or granitic, sometimes roadsides in chaparral, coastal dunes, coastal scrub, and valley and foothill grasslands. Marin Co.: mostly southern, but also Pt Reyes Peninsula, and Estero Americano R.; Sonoma Co.: Bodega Bay, and around mouth of Russian River; and Schooner Gulch SB, Mendocino Co. (northernmost occurrence).	No habitat.
Erysimum menziesii	Menzies wallflower	1B.1	G1	S1	CE	FE	perennial herb	0-35 m.	March - June	Localized on coastal dunes and coastal strand. In remnant, open, partially stabilized dune habitat. Plants treated as subsp.; not validly published.	No coastal habitat.

Scientific Name	Common Name	CRPR	Global Rank	State Rank	CESA	FESA	Lifeform	Elevation	Blooming Period	Notes	Potential for Occurrence within Project Area
Erythronium revolutum	coast fawn lily	2B.2	G4	S2S3	None	None	perennial bulbiferous herb	0-1600 m.	March - August	Bogs and fens; broadleafed upland forests; North Coast coniferous forest. On timbered and brushy hillside; wet soil under redwoods. Shady and mesic glens. Sometimes associated with *Arbutus menziesii, Lithocarpus densiflorus, Quercus chrysolepis, and Pseudotsuga menziesii.* On rock outcrops and slopes in forests. Along rivers and in meadows. Known from one occurrence in Duncans Mills, Sonoma Co.; then north from Greenwood Ridge southeast of Elk and continuing north to Del Norte Co, and one disjunct occurrence from 1931 near St. Helena (possibly misidentified). Usually a couple miles from the coast.	Potential habitat.
Erythronium oregonum	giant fawn lily	2B.2	G5	S2	None	None	perennial herb	100-1150 m.	March - July	Often moist or damp soils in openings of cismontane woodland, firs, oaks, tanoak. Rocky areas, sometimes serpentine; meadows and seeps. Mostly from Humboldt Co. away from the coast but isolated occurrences in Bell Springs, northern Mendocino Co. and southeast of Hiouchi, Del Norte Co.	Out of range.
Fissidens pauperculus	Fissidens moss	1B.2	G3?	S2	None	None	moss	10 - 1024 m.	year-round	North Coast coniferous forest (damp coastal soil). Muir Beach, Marin Co.; along road on bare soil of steep bank in shade of redwoods near Jenner, Sonoma Co.; trailside soil bank in Montgomery Woods SNR, Mendocino Co.; and occasional from Ferndale to Prairie Cr. Redwoods SP., Humboldt Co.	Potential habitat.
Fritillaria liliacea	fragrant fritillary	1B.2	G2	S2	None	None	perennial bulbiferous herb	3 – 410 m.	February - April	Often serpentinite in cismontane woodland, coastal prairie, coastal scrub, valley and foothill grassland. From hills around San Francisco Bay area. Throughout northern Marin Co.; and north to Bodega, Camp Meeker, and E to Santa Rosa Mtns., Sonoma Co.	Out of range.
Fritillaria roderickii	Roderick's fritillary	1B.1	G1Q	S1	CE	None	perennial bulbiferous herb	15-400 m.	March - May	Coastal bluff scrub, coastal prairie, valley and foothill grassland. Grassy slopes, mesas. Usually found on heavy clay soils that stay wet through May and then dry by October. Often coastal, from Gualala to Manchester, Fort Bragg, and several occurrences in the Anderson Valley, Ukiah, and north of Orrs Springs.	No wet clay habitat on coastal bluff. Out of range.
Gilia capitata subsp. *chamissonis*	blue coast gilia	1B.1	G5T2	S2	None	None	annual herb	2-200 m.	April - July	Coastal dunes; coastal scrub. On disturbed Franciscan sage scrub on loose sandy soils. Growing with *Ericameria ericoides, Lupinus chamissonis, Erysimum franciscanum, Croton californicus, Camissonia cheiranthifolia, Phacelia distans*. From San Francisco Bay to Bodega Bay; Mendocino Headlands and Ten Mile Dunes; and Ferndale area in Humboldt Co.	No coastal habitat.
Gilia capitata subsp. *pacifica*	Pacific gilia	1B.2	G5T3T4	S2	None	None	annual herb	5-1330 m.	April - August	Coastal bluff scrub, openings in chaparral, coastal prairie, valley and foothill grassland. Steep cliffs, fields, and dry banks. From Jenner, Sonoma Co. north to the OR border along the coast.	No coastal habitat.
Gilia capitata subsp. *tomentosa*	woolly-headed gilia	1B.1	G5T2	S2	None	None	annual herb	- m.	May - July	Coastal bluff scrub, valley and foothill grassland, rocky outcrops on the coast. Locally abundant on serpentine outcrop and serpentine-derived loam on west-facing slopes in grassland/pastureland. Grows with *Linum perenne, Lupinus* spp. and *Avena barbata*. From Pt. Reyes to Stewart's Point, Sonoma Co.	No coastal habitat.

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Scientific Name	Common Name	CRPR	Global Rank	State Rank	CESA	FESA	Lifeform	Elevation	Blooming Period	Notes	Potential for Occurrence within Project Area
Gilia millefoliata	dark-eyed gilia	1B.2	G2	S2	None	None	annual herb	2-30 m.	April - July	Coastal dunes. Sandy, stabilized dune habitat. Sandy grassland between *Lupinus arboreus* shrubs dominated by nonnative grasses. Southern Marin Co, Pt Reyes Peninsula; Marin Co.; Bodega Bay, and near Timber Cove, Sonoma Co.; Mendocino and then Fort Bragg to Ten Mile R., Mendocino Co.; south of Mattole River mouth, then Eureka to Patricks Point, Humboldt Co.	No dune habitat.
Glehnia littoralis subsp. *leiocarpa*	American glehnia	4.2	G5T5	S3.2	None	None	perennial herb	0-20 m.	May - August	Coastal dunes, wet seeps on bluff faces, sandstone bluffs with iceplant, beach sand just above high tide. From northern Monterey Co. north to Del Norte Co. Dillon Beach, Marin Co.; Salt Point SP, Sonoma County; and Point Arena, Manchester SP near environmental campsites in driftwood, and Glass Beach, Mendocino Co.; then from Ferndale, Humboldt Co. to the OR border.	No coastal habitat.
Glyceria grandis	American manna grass	2B.3	G5	S2	None	None	perennial rhizomatous herb	15-1980 m.	June - August	Bogs and fens, wet meadows and seeps, marshes and swamps (streambanks and lake margins). Ditches streams and ponds in valleys and lower elevations in the mountains. Sometimes standing in water; margins of rivers. Only coastal collections from Garcia R. slough. Disjunct from high elevations.	No coastal marsh.
Hemizonia congesta subsp. *congesta*	white seaside tarplant	1B.2	G5T2T3	S2S3	None	None	annual herb	20-560 m.	April - November	Sometimes coastal scrub but often valley and foothill grasslands, grassy valleys and hills, sometimes on grassy slopes with thin clayish soils; often in fallow fields; sometimes on roadsides. Around the San Francisco Bay area; mostly from Marin (widespread) and Sonoma cos., from Jenner E to Santa Rosa plain; Glen Blair, Comptche, and Pudding Creek, Mendocino Co.; Cape Mendocino, Humboldt Co., and a 1921 collection from Klamath, southern Del Norte Co.	Unlikely, but should be considered given large meadow.
Hemizonia congesta subsp. *tracyi*	Tracy's tarplant	4.3	G5T3	S3.3	None	None	annual herb	120-1200 m.	May - October	Openings, sometimes serpentinite. Coastal prairie, lower montane coniferous forest, North Coast coniferous forest. From Booneville to northern Humboldt Co., with most occurrence from Arcata to Leggett.	Out of range.
Hesperevax sparsiflora var. *brevifolia*	short-leaved evax	1B.2	G4T3	S2S3	None	None	annual herb	0-215 m.	March - June	Sandy coastal bluffs; coastal dunes, coastal dune mat, and sandy openings in wet dune meadows. Coastal bluff scrub, rocky, grassy slopes. In areas of sparse vegetation cover in sandy substrate. From Pt Reyes Peninsula, Marin Co., and north to Cleone, Mendocino Co.; then Mattole R. mouth north to Arcata, Humboldt Co.; and several occurrences in northern Del Norte Co.	No coastal habitat.
Hesperocyparis pygmaea	pygmy cypress	1B.2	G1	S1	None	None	perennial evergreen tree	30-600 m.	(vegetation : all year)	Closed-cone coniferous forests, usually podzol-like soils or Blacklock soils in Mendocino cypress pygmy forests. Ridges above Salt Point SP, Sonoma Co.; from Gualala to Rockport, Mendocino Co., but mostly from old marine terraces between Navarro R. and Cleone.	No marine terraces or similar habitat.
Hesperolinon adenophyllum	glandular dwarf flax	1B.2	G3	S3	None	None	annual herb	150-1315 m.	May - August	Usually serpentinite, sometimes serpentine barrens in chaparral, serpentine scree on roadside, or burned areas. Chaparral, cismontane woodland, valley & foothill grassland. Mostly from valleys around Ukiah and Willits, Mendocino Co., and into Lake Co. Not known from >5 km west of Willits.	No habitat and out of range.

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Scientific Name	Common Name	CRPR	Global Rank	State Rank	CESA	FESA	Lifeform	Elevation	Blooming Period	Notes	Potential for Occurrence within Project Area
Horkelia marinensis	Point Reyes horkelia	1B.2	G2	S2	None	None	perennial herb	5-755 m.	May - September	Sandy sites in coastal dunes, coastal prairie, and coastal scrub. From Monterey north to Rockport, northern Mendocino Co, with a potentially dubious southern disjunct occurrence in the Irish Hills, coastal San Luis Obispo Co. Marin Co.: Muir Beach and mostly from Pt Reyes Peninsula; Sonoma Co.: only known from Bodega Head; Mendocino Co.: Gualala, then north from Jug Handle SP to Rockport.	No coastal habitat.
Horkelia tenuiloba	thin-lobed horkelia	1B.2	G2	S2	None	None	perennial herb	50-500 m.	May - July	Mesic openings or sandy sites in broadleafed upland forests, chaparral, and valley and foothill grassland. Wet meadows and marshy areas surrounded by *Pseudotsuga menziesii, Rhamnus californica, Baccharis pilularis*. Growing on sandy loam in coastal scrub. On sandstone in "pine barrens." Mostly ranging from southern Marin Co. to Anchor Bay, southern Mendocino Co. and inland east to western Napa Co.; also with several disjunct vouchers without supplemental determinations from Colusa Co., southern Monterey Co., and San Luis Obispo.	No habitat.
Hosackia gracilis	harlequin lotus	4.2	G3G4	S3	None	None	perennial rhizomatous herb	0-700 m.	March - July	Wetlands, roadsides, broadleafed upland forest, coastal bluff scrub, closed-cone coniferous forest, cismontane woodland, coastal prairie, coastal scrub, meadows and seeps, marshes and swamps, North Coast coniferous forest, valley and foothill grassland. Usually found in wetlands. Common and mostly coastal from Marin Co. to the OR border, with an absence in the King Range, Humboldt Co.	Potential habitat.
Iris longipetala	coast iris	4.2	G3	S3	None	None	perennial rhizomatous herb	0-600 m.	March - May	Mesic. Coastal prairie, lower montane coniferous forest, meadows and seeps. Primarily from Monterey Co. to Sonoma Co. Scattered throughout Marin Co.; from Bodega Bay to Jenner and E to Santa Rosa Mtns, also Salt Point SP, Sonoma Co.; then several northern occurrences: on roadcut on the side of a bluff, 0.25 miles north of Ten Mile River mouth; wet bluffs in Mendocino City; 4 mi SE of Punta Gorda, Lake Ridge, Humboldt Co.	No coastal habitat.
Juncus supiniformis	hair-leaved rush	2B.2	G5	S1	None	None	perennial rhizomatous herb	20-100 m.	April - June	Bogs and fens; freshwater marshes and swamps near the coast. Around pools, in ruts and ditches in podzol soils. One 1892 collection from Pt. Reyes, several collections from Mendocino to Fort Bragg area, two from Humboldt Co., and one from Del Norte Co.	No wetland habitat in marine terrace soils.
Kopsiopsis hookeri	small groundcone	2B.3	G5	S1S2	None	None	perennial rhizomatous herb (parasitic)	90-885 m.	April - August	North Coast coniferous forest. Open woods, shrubby places. Pygmy forest intergrading with redwood and Douglas-fir forests with sandy soils and flat aspect. Generally on *Gaultheria shallon*. Plants concentrated around the base and/or drip line of *Arctostaphylos columbiana*, but also in close proximity with other ericaceous species. May be parasitic on *Arctostaphylos*. Locally mesic areas, like areas with moss. Scattered locations from Marin to Del Norte cos.	Potential habitat.

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Scientific Name	Common Name	CRPR	Global Rank	State Rank	CESA	FESA	Lifeform	Elevation	Blooming Period	Notes	Potential for Occurrence within Project Area
Lasthenia californica subsp. *bakeri*	Baker's goldfields	1B.2	G3TH	SH	None	None	perennial herb	60-520 m.	April - October	Openings in closed-cone coniferous forest; coastal scrub; meadows and seeps; marshes and swamps. On windswept grassy hills; grazed areas. Early in the life of a plant the leaves may be wide and the plant prostrate; later the leaves become narrow and the plants' flowering stems turn upright. Pt. Reyes NS, Marin Co.; Bodega Bay, Sebastopol, and Salt Point SP, Sonoma Co.; along the Mendocino Co. coast from Gualala to Rockport; and one 1868 unconfirmed vouchered specimen from Eureka, Humboldt Co.	No coastal habitat.
Lasthenia californica subsp. *macrantha*	perennial goldfields	1B.2	G3T2	S2	None	None	perennial herb	5-520 m.	January - November	Coastal bluff scrub, coastal dunes, and coastal scrub. In clay soil on wind-swept ocean bluffs and coastal terraces, and in grassy patches and dried vernal pool beds. Mostly from Pt Reyes, Marin Co. north to Fort Bragg, Mendocino Co.; then few locations: Shelter Cove and Eureka, Humboldt Co.; and Hiouchi, Del Norte Co.	No coastal habitat.
Lasthenia conjugens	Contra Costa goldfields	1B.1	G1	S1	None	FE	annual herb	0-470 m.	March - June	Mesic sites in cismontane woodlands; alkaline playas; valley and foothill grasslands; vernal pools, swales, and low depressions. Extirpated from most of its range. Mostly eastern San Francisco Bay area. S of Petaluma, Sonoma Valley, Sonoma Co.; and one disjunct, possibly erroneous identification, from Manchester in 1937.	Out of range.
Lathyrus palustris	marsh pea	2B.2	G5	S2S3	None	None	perennial herb	1-100 m.	March - August	Bogs and fens; mesic sites (seasonally wet depressions) in clay loam soil of coastal prairies, coastal scrub, lower montane coniferous forests, and North Coast coniferous forests, seasonal seeps surrounded by redwood/Douglas-fir/tanoak forests; marshes and swamps, including swamps adjacent to tidewater. Sometimes at the edge of wet *Carex* marshes in transition to scrub and spruce forests. Only one Mendocino occurrence. Coastal and then at high elevations. From Fort Ross SHP, Sea Ranch area, Sonoma Co.; few occurrence from Gualala to Mendocino, Mendocino Co.; and more common northward: Shelter Cove, Eureka, Trinidad, Humboldt Co.; around Crescent City and inland, Del Norte Co.	Potential habitat.
Layia carnosa	beach layia	1B.1	G2	S2	CE	FE	annual herb	0-60 m.	March - July	Coastal dunes and sandy coastal scrub. From Monterey, Point Reyes, Petrolia, and Eureka area.	No coastal habitat.
Leptosiphon acicularis	bristly leptosiphon	4.2	G4?	S4?	None	None	annual herb	55 - 1500 m.	April - July	Chaparral, cismontane woodland, coastal prairie, valley and foothill grassland. Throughout eastern Marin Co.; eastern Sonoma Co., but also from Fort Ross and Bodega; mostly inland valleys in Mendocino Co. but also from Big River, Mendocino Headlands SP, and Hendy Woods SP along Navarro R.; inland/eastern Humboldt Co. and Orick.	Potential habitat.
Leptosiphon grandiflorus	large-flowered leptosiphon	4.2	G3G4	S3S4	None	None	annual herb	5 - 1220 m.	April - August	Usually sandy areas in coastal bluff scrub, closed-cone coniferous forest, cismontane woodlands, coastal dunes, coastal prairies, coastal scrub, valley and foothill grasslands. Mostly Pt Reyes Peninsula but also Mt Tamalpais, Marin Co.; Valley Ford, near Cazadero, Sonoma Co. Ranges further N but in inner North Coast Ranges.	Out of range.
Leptosiphon jepsonii	Jepson's leptosiphon	1B.1	G2	S2	None	None	annual herb	100 - 500 m.	March - May	Usually volcanic substrate in chaparral, cismontane woodlands, and valley and foothill grasslands. Eastern Sonoma Co., but also from Cazadero. Then disjunct in Mendocino Co. near Branscomb from an unconfirmed voucher.	Out of range, poor habitat.

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Leptosiphon latisectus	broad-lobed leptosiphon	4.3	G4	S4	None	None	annual herb	170 - 1500 m.	April - June	Broadleafed upland forests and cismontane woodlands. One occurrence from Marin Co.: Pt Reyes NS; eastern Sonoma Co. and one coastal occurrence from 2 mi N of Fort Ross; inland valleys of Mendocino Co. and one near-coastal occurrence in Glen Blair; southeastern Humboldt Co., and one confirmed specimen from 8 mi S of Crescent City, Del Norte Co.	Potential occurrence.
Leptosiphon rosaceus	rose leptosiphon	1B.1	G1	S1	None	None	annual herb	0 - 100 m.	April - June	Coastal bluff scrub. Pt. Reyes Peninsula, Valley Ford, Marin Co.; and one northern occurrence along Hwy 1 in Timber Cove, Sonoma Co.	No coastal habitat.
Lessingia arachnoidea	Crystal Springs lessingia	1B.2	G2	S2	None	None	annual herb	60 - 200 m.	July - October	Serpentinite, often roadsides in cismontane woodlands, coastal scrub, and valley and foothill grasslands. Restricted to Camp Meeker area, Sonoma Co.	Out of range.
Lilium maritimum	coast lily	1B.1	G2	S2	None	None	perennial bulbiferous herb	5-475 m.	May - August	Broadleafed upland forests, closed-cone coniferous forests, coastal prairies, coastal scrub, freshwater marshes and swamps. Historically in sandy soil, often on raised hummocks or bogs; today mostly on roadsides or roadside ditches. Sometimes growing with *Veratrum fimbriatum, Lithocarpus, Pinus muricata, Vaccinium*, Gaultheria *shallon, Pteridium*, and *Morella*. Pt Reyes Peninsula, Marin Co.; one inland occurrence near Vine Hill/Sebastopol otherwise coastal Sonoma Co. from Fort Ross to Sea Ranch; Gualala to Inglenook, Mendocino Co.; and northern occurrences from Trinidad to Prairie Cr. Redwoods SP (needs confirmation, no collections)	Potential occurrence.
Lessingia hololeuca	woolly-headed lessingia	3	G3?	S3?	None	None	annual herb	15 - 305 m.	June - October	Clay, serpentinite in broadleafed upland forests, coastal scrub, lower montane coniferous forests, and valley and foothill grasslands. Throughout eastern Marin Co.; around serpentine of Camp Meeker and Occidental, Petaluma, and near Sugarloaf Ridge SP, Sonoma Co.	Out of range.
Lilium rubescens	redwood lily	4.2	G3	S3	None	None	perennial bulbiferous herb	30-1910 m.	April - September	Sometimes serpentinite, sometimes roadsides. Broadleafed upland forest, chaparral, lower montane coniferous forest, North Coast coniferous forest, upper montane coniferous forest. Santa Rosa Mtns., Sebastopol, around Austin Cr., Sonoma Co.; Havens Neck and north throughout Mendocino Co.; then throughout Humboldt and Del Norte cos.	Unlikely, but potential for occurrence.
Limnanthes bakeri	Baker's meadow foam	1B.1	G1	S1	CR	None	annual herb	175-910 m.	April - May	Meadows and seeps, freshwater marshes and swamps, vernally mesic areas in valley and foothill grassland, vernal pools. Known from valley around Willits.	Out of range.
Listera cordata	heart-leaved twayblade	4.2	G5	S4	None	None	perennial herb	5-1370 m.	February - July	Bogs and fens, lower montane coniferous forest, North Coast coniferous forest. Grows in patches from thin runners in moss and moist micro-climates such as patches of *Goodyera, Calypso*, and *Viola*. On thick duff of bishop pine-redwood forest in Point Arena, Mendocino Co.; then N to OR border. Mostly from Humboldt and Del Norte cos.	Potential habitat.
Lupinus milo-bakeri	*Milo Baker's lupine*	1B.1	G1Q	S1	CT	None	annual herb	395-430 m.	June - September	Often along roadsides in cismontane woodland. Valley and foothill grasslands. Mostly from Covelo area but also Longvale where it was purposefully introduced on CalTrans property along Hwy 101.	No habitat and out of range.
Lupinus sericatus	Cobb Mountain lupine	1B.2	G2?	S2?	None	None	perennial herb	275 - 1525 m.	March - June	Broadleafed upland forests, chaparral, cismontane woodlands, and lower montane coniferous forests. Mostly Inner North Coast Ranges from Mayacmas Range but several collections from Rockpile Rd. W of Lake Sonoma.	Out of range.

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Scientific Name	Common Name	CRPR	Global Rank	State Rank	CESA	FESA	Lifeform	Elevation	Blooming Period	Notes	Potential for Occurrence within Project Area
Lupinus tidestromii	Tidestrom's lupine	1B.1	G1	S1	CE	FE	perennial herb	0 - 100 m.	April - June	Coastal dunes. Pt Reyes Peninsula, Dillon Beach, Marin Co.; Bodega Bay, mouth of Russian R, Sonoma Co.; and a 1932 confirmed specimen from Samoa Dunes, Humboldt Co. (needs further work).	No coastal habitat.
Lycopodium clavatum	running-pine	4.1	G5	S3	None	None	perennial rhizomatous herb	45-1225 m.	June - August	Marshes & swamps, North Coast coniferous forests (mesic). Sometimes associated with pygmy forest or podzol soils. Two locations from Sonoma Co., The Sea Ranch; skid trail S of Gualala in forest; east of Mendocino and Fort Bragg, Mendocino Co.; throughout northern Humboldt Co.; and near Crescent City, Del Norte Co.	Potential habitat.
Micropus amphibolus	Mt. Diablo cottonweed	3.2	G3G4	S3S4	None	None	annual herb	45 - 825 m.	March - May	Rocky areas in broadleafed upland forests, chaparral, cismontane woodlands, and valley and foothill grasslands. Throughout eastern Marin Co.; The Cedars, 4 mi W of Healdsburg, Santa Rosa Mtns., Sonoma Co.; ~ 11 mi W of Willits, 5 mi E of Ukiah, Mendocino Co.	Out of range.
Microseris borealis	northern microseris	2B.1	G5	S1	None	None	perennial herb	1000-2000 m.	June - September	Bogs and fens, lower montane coniferous forest, meadows and seeps/mesic. Occurs almost always under natural conditions in wetlands. One 1866 record from an unspecified location in Mendocino Co., likely from town of Mendocino and likely extirpated., and then several occurrences ~15 mi. east of Eureka, Humboldt. Co.	Out of range.
Microseris paludosa	marsh microseris	1B.2	G2	S2	None	None	perennial herb	5-300 m.	April - July	Closed-cone coniferous forests, cismontane woodlands, coastal scrub, valley and foothill grasslands; vernal pools. Known from northern San Luis Obispo Co. to Point Arena. Throughout Marin Co.; Salt Pont, Annapolis, around Windsor and in the Santa Rosa Plain, Sonoma Co.; 1968 collection from Point Arena (3.2 km to N, between Hwy. 1 and beach) is the northernmost occurrence, Mendocino Co.	Potential occurrence.
Monardella viridis	green monardella	4.3	S3	G3	None	None	perennial rhizomatous herb	100 - 1010 m.	June - September	Broadleafed upland forests, chaparral, and cismontane woodlands. Mostly from E Sonoma Co., but also from The Cedars. Also from Lake, Napa, and SE Mendocino cos.	Out of range.
Mitellastra caulescens	leafy-stemmed miterwort	4.2	G5	S4	None	None	perennial rhizomatous herb	5-1700 m.	April - October	Mesic sites in broadleafed upland forests, lower montane coniferous forests, meadows and seeps, North Coast coniferous forests. Moist alluvial soil under alder; mesic streamside and streambank habitat. Sides of roads in floodplains. South from Mallo Pass, between Manchester and Elk, Mendocino Co. and north to the OR border.	Out of range.
Montia howellii	Howell's monita	2B.2	G3G4	S3	None	None	annual herb	0-835 m.	February - May	Moist open ground, vernally mesic sites, sometimes roadsides. Meadows and seeps, north coast coniferous forest, vernal pools. From southern Humboldt Co. north to Orick.	Out of range.
Navarretia leucocephala subsp. *bakeri*	Baker's navarretia	1B1	G4T2	S2	None	None	annual herb	5-1740 m.	April - July	Wet areas in cismontane woodland, lower montane coniferous forest, meadows and seeps, valley and foothill grassland, and vernal pools. Known from Santa Rosa and other locations (Longvale and Willits) primarily along or east of Hwy 101.	Out of range.
Oenothera wolfii	Wolf's evening-primrose	1B.1	G1	S1	None	None	perennial herb	3-800 m.	May - October	Sandy, usually mesic sites in coastal bluff scrub, coastal dunes, coastal prairie, and lower montane coniferous forests. Along roads on vertical cutbanks and in grassy median. On disturbed sterile soil; upper stabilized dunes; rocky slopes protected above strand; vertical cliffs above the ocean. Abundant in Ten Mile dunes and known from one 1964 collection ~3 mi. south of Pt. Arena along Hwy 1 in grassy field.	No coastal habitat.

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Scientific Name	Common Name	CRPR	Global Rank	State Rank	CESA	FESA	Lifeform	Elevation	Blooming Period	Notes	Potential for Occurrence within Project Area
Packera bolanderi var. *bolanderi*	seacoast ragwort	2B.2	G4T4	S2S3	None	None	perennial rhizomatous herb	30-650 m.	February - July	Coastal scrub, North Coast coniferous forests. In loose, rocky, poorly consolidated siltstone and mudstone. Associated with old growth redwood, Douglas-fir, tanoak, maple, dogwood, wild ginger, salal. Steep slopes in dry, sunny woods. Sandy stream banks, roadsides, rocky banks, old quarries. From Mendocino/Fort Bragg area, central Humboldt Co., and Del Norte Co.	Out of range.
Perideridia gairdneri subsp. *gairdneri*	Gairdner's yampah	4.2	G5T4	S4	None	None	perennial herb	0-610 m.	June - October	Vernally mesic sites in grasslands and swales, broadleafed upland forests, chaparral, coastal prairies, valley and foothill grasslands, vernal pools. Around Mt. Tamalpais and Pt. Reyes Peninsula, Marin Co.; mostly from the Santa Rosa Plain and Santa Rosa Mtns. but also from Salt Point SP, Sonoma Co.; Pt. Arena and Glen Blair, Mendocino Co.; and Fortuna and high elevations in Humboldt Co.	Potential habitat in meadow.
Phacelia argentea	sand dune phacelia	1B.1	G2	S1	None	None	perennial herb	3-25 m.	June - August	In open sand above high tide, partly stabilized sand dunes, coastal bluffs. Two unvouchered records from Jug Handle SNR and Salt Point, one misidentified voucher from mouth of Ten Mile River in 1956. Most occurrences from north of Crescent City.	No coastal habitat.
Phacelia insularis var. *continentis*	North Coast phacelia	1B.2	G2T1	S1	None	None	annual herb	10-170 m.	March - May	Sandy, sometimes rocky, sites in coastal bluff scrub; open maritime bluffs; coastal dunes. Rocky, thin soil with native and non-native grasses and forbs. Sandy pastureland and grazed coastal prairie.	No coastal habitat.
Pinus contorta subsp. *bolanderi*	Bolander's beach pine	1B.2	G5T2	S2	None	None	perennial evergreen tree	75-250 m.	(vegetation : all year)	Closed-cone coniferous forests with podzol-like soils. Associated with Mendocino cypress and bishop pine, and Mendocino pygmy cypress forests. Mainly from marine terraces of Navarro R. to the Ten Mile R. but one voucher from Manchester town and a report from Salt Point SP. Also 2 records from Humboldt Co.: Patrick's Point and Samoa Dunes.	Out of range.
Piperia candida	white-flowered rein orchid	1B.2	G3?	S2	None	None	perennial herb	30-1310 m.	March - September	Forest and chaparral openings. Sometimes serpentinite. Broadleafed upland forest, lower montane coniferous forest, North Coast coniferous forest. Shady, rocky areas, gravel bars. In the redwood region north of San Francisco, known from Cazadero, Sonoma Co., north to Del Norte Co. at various elevations.	Potential habitat.
Piperia leptopetala	narrow-petaled rein orchid	4.3	G4	S4	None	None	perennial herb	380 - 2225 m.	May - July	Cismontane woodlands, lower montane coniferous forests, upper montane coniferous forests. Only in The Cedars, Sonoma Co. in the Outer North Coast Ranges.	Out of range.
Pityopus californicus	California pinefoot	4.2	G4G5	S4	None	None	perennial herb (achlorophyllous)	15-2225 m.	March - August	Mesic. Broadleafed upland forest, lower montane coniferous forest, North Coast coniferous forest, upper montane coniferous forest. Under redwoods, tanoak/Douglas fir forests. Increasingly common further north. Around Mt. Tamalpais, Marin Co.; Bohemian Grove, E of Fort Ross, Sonoma Co.; Gualala, Iverson Rd. then frequent east of Mendocino and Fort Bragg, Mendocino Co. and north to Del Norte Co.	Potential habitat.
Pleuropogon hooverianus	North Coast semaphore grass	1B.1	G2	S2	CT	None	perennial rhizomatous herb	10-671 m.	April - June	Open and mesic areas of North Coast coniferous and broadleafed upland forests (oak/madrone); grassy flats in the shade of redwoods. Meadows and seeps. Wet grassy, usually shady areas, sometimes in freshwater marshes and often associated with forest environments. In stagnant water of highway ditches. Eastern Marin Co.; Occidental and Santa Rosa Mtns., Sonoma Co.; inland Mendocino Co. ~ at least 10 miles from the coast.	Out of range.

Scientific Name	Common Name	CRPR	Global Rank	State Rank	CESA	FESA	Lifeform	Elevation	Blooming Period	Notes	Potential for Occurrence within Project Area
Pleuropogon refractus	nodding semaphore grass	4.2	G4	S4	None	None	perennial rhizomatous herb	0-1600 m.	March - August	Mesic; open wet meadows, in wet areas along roads and streamsides. Lower montane coniferous forest, meadows and seeps, North Coast coniferous forest, riparian forest. Mostly from Ferndale to Crescent City along the coast and inland to high elevations, and then two disjunct populations along road cuts in alder riparian forest in Russian Gulch, Mendocino Co. and Bolinas, Marin Co.	Low potential for occurrence.
Polemonium carneum	royal sky pilot	2B.2	G3G4	S2	None	None	perennial herb	0-1830 m.	April - September	Coastal prairie, coastal scrub, lower montane coniferous forest. Often collected from moist places in brushy areas or from edges of thickets. From San Francisco Bay area; east of Bodega Bay; Humboldt Co. south of Ferndale and Big Lagoon; then Del Norte Co. and into the Klamath Ranges.	Out of range and poor habitat.
Potamogeton epihydrus	ribbon leaf pondweed	2B.2	G5	S2.2?	None	None	perennial rhizomatous herb	369-2172 m.	June - September	Shallow freshwater marshes and swamps. Along the marshy edges of streams. Known from Willits, Laytonville, and Covelo.	Out of range and poor habitat.
Puccinellia pumila	dwarf alkali grass	2B.2	G4?	SH	None	None	perennial herb	1-10 m.	July	Coastal salt marshes and swamps; meadows and seeps, mineral spring meadows. Unconfirmed record (no date) from Fort Bragg. Salt marsh at the mouth of the Eel River is the only confirmed coastal location in CA.	Out of range and poor habitat.
Ramalina thrausta	angel's hair lichen	2B.1	G5	S2?	None	None	fruticose lichen (epiphytic)	75-430 m.		In northern CA it is usually found on dead twigs, and has been found on *Alnus rubra*, *Calocedrus decurrens*, *Pseudotsuga menziesii*, *Quercus garryana*, and *Rubus spectabilis*. Most collections from Del Norte Co. One collection from Sonoma Co. where it grows on and among dangling mats of *Ramalina menziesii* and *Usnea* spp. Similar to *Alectoria sarmentosa*, *A. vancouverensis*, and *R. menziesii*.	Potential habitat.
Rhynchospora alba	white beaked-rush	2B.2	G5	S2	None	None	perennial rhizomatous herb	60-2040 m.	July - August	Sphagnum bogs and fens (sometimes in Mendocino pygmy forests); meadows and seeps; marshes and swamps (freshwater). Sometimes in low, wet swales immediately surrounding grasslands. Pitkin Marsh, Sonoma Co.; and Albion to Inglenook, Mendocino Co.	No habitat.
Ribes victoris	Victor's gooseberry	4.3	G3G4	S3S4	None	None	perennial deciduous shrub	100 - 750 m.	March - April	Mesic, shady sites in broadleafed upland forests, and chaparral. SE Marin Co. and Dillon Beach; Cazadero, Santa Rosa Mtns., Lake Sonoma, Sonoma Co.	Out of range.
Romanzoffia tracyi	Tracy's romanzoffia	2B.3	G4	S2	None	None	perennial herb	15-30 m.	March - June	Rocky coastal bluff scrub, coastal scrub, moist grassy nooks on ocean bluffs, offshore rocks. From Cape Mendocino north to Del Norte Co.	Out of range.
Sanguisorba officinalis	great burnet	2B.2	G5?	S2	None	None	perennial rhizomatous herb	60-1400 m.	July - October	Bogs and fens; broadleafed upland forests; meadows and seeps; marshes and swamps (marshy streams); North Coast coniferous forests; riparian forests. Serpentine seepage areas and along stream borders. South from Albion to Fort Bragg, around Laytonville, Mendocino Co.; high elevations around Dinsmores, Humboldt Co.; and various elevations Del Norte Co.	Out of range.
Sidalcea calycosa subsp. *rhizomata*	Point Reyes checkerbloom	1B.2	G5T2	S2	None	None	perennial rhizomatous herb	3-75 m.	April – September	Freshwater marshes and swamps near the coast. Moist slopes from seeps and ephemeral streams, most areas quite marshy. Mt. Tamalpais area, then mostly from Pt Reyes Peninsula, Marin Co.; Santa Rosa Plain, Duncans Mills, and coastal at Stewarts Pt. and The Sea Ranch, Sonoma Co.; north and coastal to Albion, Mendocino Co.	No coastal habitat in northern part of range.
Sidalcea hickmanii ssp. viridis	Marin checkerbloom	1B.1	G3TH	SH	None	None	perennial herb	50 - 430 m.	May - June	Chaparral (serpentinite). Around Mt. Tamalpais, also Drakes Beach, Pt Reyes NS; Bodega Bay and Jenner, Sonoma Co.	Out of range.

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Scientific Name	Common Name	CRPR	Global Rank	State Rank	CESA	FESA	Lifeform	Elevation	Blooming Period	Notes	Potential for Occurrence within Project Area
Sidalcea malachroides	maple-leaved checkerbloom	4.2	G3	S3	None	None	perennial herb	0-730 m.	March - August	Broadleafed upland forests; coastal prairie, coastal scrub, North Coast coniferous forest, riparian woodland. Woodlands and clearings near the coast, often in disturbed areas. Sometimes along floodplains. From The Sea Ranch, Sonoma Co., north to Del Norte Co. Usually not far from the coast.	Potential habitat.
Sidalcea malviflora subsp. *patula*	Siskiyou checkerbloom	1B.2	G5T2	S2	None	None	perennial rhizomatous herb	15-880 m.	May - August	Coastal bluff scrub; coastal prairie; broadleafed upland forests, open areas of North Coast coniferous forest. Pastures, grassy landings, and roadsides. Only 1 Mendocino occurrence 2 mi. south of Albion in roadside ditch and then mostly from southern Humboldt Co. north to the Oregon border, coastal and inland.	Out of range.
Sidalcea malviflora subsp. *purpurea*	purple-stemmed checkerbloom	1B.2	G5T1	S1	None	None	perennial rhizomatous herb	15-85 m.	May - June	Broadleafed upland forests; coastal prairie; grassy hills. From coastal San Mateo Co. north to Fort Bragg, Mendocino Co.	Potential occurrence.
Sisyrinchium hitchcockii	Hitchcock's blue-eyed grass	1B.1	G2	S1	None	None	perennial rhizomatous herb	not given	June	Openings in cismontane woodlands; valley and foothill grassland. Known in CA from only one occurrence 3 mi east of Cape Mendocino, otherwise mainly from OR around Eugene.	Out of range.
Stellaria littoralis	beach starwort	4.2	G3	S3	None	None	perennial rhizomatous herb	5-40 m.	March - July	Bogs and fens, coastal bluff scrub, coastal dunes, coastal scrub, marshes and swamps. Frequent on Pt. Reyes Peninsula, Marin Co., at Bodega Pt. in dense vegetation of *Juncus lescurii, Mimulus guttatus*. In coyote brush in dunes at Manchester State Park. Reported from Ten Mile dunes. Coastal bluffs near Trinidad, Humboldt Co.	No coastal habitat.
Streptanthus barbiger	bearded jewelflower	4.2	G3	S3	None	None	annual herb	150 - 1070 m.	May - July	Chaparral (serpentinite). Bands of serpentine from Occidental to Austin Cr. to The Cedars, Sonoma Co.; between Booneville and Hopland, Mendocino Co.	No habitat.
Streptanthus glandulosus ssp. hoffmanii	Hoffman's bristly jewelflower	1B.3	G4T2	S2	None	None	annual herb	120 - 475 m.	March - July	Rocky sites in chaparral, cismontane woodland, valley and foothill grasslands (often serpentinite). Around The Cedars and Cazadero, Sonoma Co.; between Booneville and Hopland, and one disjunct population E of Elk on Cliff Ridge, Mendocino Co.	No habitat.
Streptanthus morrisonii subsp. *kruckebergii*	Krukeberg's jewel-flower	1B.2	G2T1	S1	None	None	perennial herb	215 - 1035 m.	April - June	Cismontane woodland (serpentinite). From Inner Coast Ranges, Lake and Napa cos., Mayacmaa Range in Sonoma Col. In Outer Coast Ranges restricted to Austin Cr watershed, Sonoma Co.	Out of range and no habitat.
Streptanthus morrisonii subsp. *morrisonii (and elatus)*	Morrison's jewel-flower	1B.2	G2T1?	S1?	None	None	perennial herb	120 - 585 m.	May, August, September	Chaparral (serpentinite, rocky, talus). From Inner Coast Ranges, Lake and Napa cos., Mayacmaa Range in Sonoma Col. In Outer Coast Ranges restricted to Austin Cr watershed, Sonoma Co.	No habitat and out of range.
Toxicoscordion fontanum	marsh zigadenus	4.2	G3	S3	None	None	perennial bulbiferous herb	15-1000 m.	April - July	Vernally mesic, often serpentinite. Chaparral, cismontane woodland, lower montane coniferous forests, meadows and seeps, marshes and swamps. One coastal record from Ross Cr., south of Moat Cr.	Potential, but unlikely.
Tracyina rostrata	beaked tracyina	1B.2	G2	S2	None	None	annual herb	90 - 790 m.	May - June	Chaparral, cismontane woodland, and valley & foothill grassland. Mostly in valleys east of outer coast ranges, but one occurrence from NE of Lake Sonoma.	Out of range.
Trifolium amoenum	two-fork clover	1B1	G1	S1	None	FE	annual herb	5 – 415 m.	April – July	Coastal bluff scrub, valley and foothill grassland (sometimes serpentinite), roadsides, low rich fields. From counties around the SF Bay area. Marin Co.; so. Sonoma Co. to the Russian River.	Out of range.

Scientific Name	Common Name	CRPR	Global Rank	State Rank	CESA	FESA	Lifeform	Elevation	Blooming Period	Notes	Potential for Occurrence within Project Area
Trifolium buckwestiorum	Santa Cruz clover	1B.1	G2	S2	None	None	annual herb	105-610 m.	April - October	Broad-leafed upland forests, cismontane woodlands, coastal prairie. Moist grasslands. Disturbed sites on roadbed in redwood forest; Sparsely vegetated, gravelly, hardpacked, somewhat barren flats or gentle inclines, roadbeds or former roadbeds. Flat open areas with sun exposure, seasonal moisture, and gravelly, poor soils. Shallow depressions that collect water in rain. Common associates include *Juncus bufonius*, *Soliva sessilis*, *Danthonia californica*, and *Bromus hordeaceus*. From Monterey; Santa Cruz; collected from Bodega Bay and reported from The Cedars in Sonoma Co; northern occurrence in Mendocino Co., most collections from ~5 miles up Garcia River.	Potential occurrence.
Trifolium hydrophilum	saline clover	1B.1	G2	S2	None	None	annual herb	0 - 300 m.	April - June	Marshes and swamps, valley and foothill grassland (mesic, alkaline), vernal pools. In counties around SF Bay area and beyond. In Outer North Coast Ranges in Sonoma Col., Santa Rosa Plain.	Out of range.
Trifolium trichocalyx	Monterey clover	1B.1	G1	S1	CE	FE	annual herb	30-240 m.	April - June	Closed-cone coniferous forest (sandy, openings, burned areas). Discovered in Big River Forest in 2011. Previously known from only two occurrences from the central portion of the Monterey Peninsula. "Plants growing in shaded, moist soil of seasonal logging road graded 5 years prior. North-facing slope within redwood/Douglas fir/tanoak forest" in grass around road in pine wood." from label (JEPS111487).	Out of range but should be considered given the relatively recent discoveries of northernmost occurrences.
Triquetrella californica	coastal triquetrella	1B.2	G1	S1	None	None	moss	10-100 m.		On soil in coastal bluffs scrub and coastal scrub. Marin Co., and Mendocino Co., Fort Bragg area.	No coastal habitat.
Usnea longissima	Methuselah's beard lichen	4.2	G4	S4	None	None	fruticose lichen (epiphytic)	50-1460 m.	year-round	On tree branches; usually on old growth hardwoods and conifers in broadleafed upland forest and North Coast coniferous forest.	Potential habitat.
Veratrum fimbriatum	fringed false-hellebore	4.3	G3	S3	None	None	perennial herb	3-300 m.	July - September	Wet areas in coastal scrub and North Coast coniferous forests, meadows and seeps, bogs and fens. Restricted to coastal Sonoma and Mendocino Counties.	Potential habitat.
Viola adunca	Western dog violet	Not ranked	None	None	None	None	perennial herb		April-August	Yellow pine forest, red fir forest, lodgepole forest, redwood forest, mixed evergreen forest, subalpine forest, alpine fell-fields, wetland-riparian. Common and widespread on open sea bluffs to red fir forest.	Potential habitat.
Viola palustris	alpine marsh violet	2B.2	G5	S1S2	None	None	perennial rhizomatous herb	0-150 m.	March - August	Coastal bogs and fens; mesic coastal scrub. Swampy, shrubby places in coastal scrub or coastal bogs. Carpeting the ground in shady wet places but flowering rarely. Sometimes growing among Carex, or among brush at edges of swamps. Freshwater marsh on deep peat substrate (4-5'). Very few locations on the Mendocino Coast: Iverson Rd near Gualala and around Fort Bragg; several locations in Humboldt Co.; and then Del Norte Co.	Probably lacking habitat but occurring nearby (within 1 mile)

Special-Status Plant Communities Occurring in Coastal Mendocino County. A partial list of vegetation alliances occurring in coastal Mendocino County is derived from the California Department of Fish and Wildlife's "List of Vegetation Alliances and Associations," (2018). See previous tables for an explanation of the Global and State Ranking.

Primary Lifeform	Alliance Common Name	Alliance Scientific Name	Alliance Global Rank	Alliance State Rank
Trees				
	Box-elder forest	Acer negundo	G5	S2
	Grand fir forest	Abies grandis	G4	S2
	Bigleaf maple forest	Acer macrophyllum	G4	S3
	California buckeye groves	Aesculus californica	G3	S3
	White alder groves	Alnus rhombifolia	G4	S4
	Red alder forest	Alnus rubra	G5	S4
	Madrone forest	Arbutus menziesii	G4	S3
	Incense cedar forest	Calocedrus decurrens	G4	S3
	Oregon ash groves	Fraxinus latifolia	G4	S3
	Monterey cypress stands	Hesperocyparis macrocarpa	G1	S1
	Mendocino pygmy cypress woodland	Hesperocyparis pigmaea	G1	S1
	Sargent cypress woodland	Hesperocyparis sargentii	G3	S3
	California walnut groves	Juglans californica	G3	S3
	Hinds's walnut and related stands	Juglans hindsii and Hybrids	G1	S1
	Tanoak forest	Notholithocarpus densiflorus	G4	S3
	Sitka spruce forest	Picea sitchensis	G5	S2
	Knobcone pine forest	Pinus attenuata	G4	S4
	Beach pine forest	Pinus contorta subsp. contorta	G5	S3
	Jeffrey pine forest	Pinus jeffreyi	G4	S4
	Sugar pine forest	Pinus lambertiana	G4	S3
	Ponderosa pine forest	Pinus ponderosa	G5	S4
	Mixed conifer forest	Pinus ponderosa – Calocedrus decurrens	G4	S4
	Ponderosa pine – Douglas fir forest	Pinus ponderosa – Pseudotsuga menziesii	G4	S4
	Foothill pine woodland	Pinus sabiniana	G4	S4
	Fremont cottonwood forest	Populus fremontii	G4	S3
	Black cottonwood forest	Populus trichocarpa	G5	S3
	Douglas fir forest	Pseudotsuga menziesii	G5	S4
	Douglas fir – incense cedar forest	Pseudotsuga menziesii – Calocedrus decurrens	G3	S3
	Douglas fir – tanoak forest	Pseudotsuga menziesii – Notholithocarpus densiflorus	G3	S3
	Mixed oak forest	Quercus (agrifolia, douglasii, garryana, kelloggii, lobata, wislizeni)	G4	S4
	Coast live oak woodland	Quercus agrifolia	G5	S4
	Canyon live oak forest	Quercus chrysolepis (tree)	G5	S5
	Blue oak woodland	Quercus douglasii	G4	S4
	Oregon white oak woodland	Quercus garryana (tree)	G4	S3
	California black oak forest	Quercus kelloggii	G4	S4
	Valley oak woodland	Quercus lobata	G3	S3
	Shreve oak forests	Quercus parvula var. shrevei	G2	S2
	Interior live oak woodland	Quercus wislizeni (tree)	G4	S4
	Red willow thickets	Salix laevigata	G3	S3
	Shining willow groves	Salix lucida (S. lasiandra)	G4	S3
	Redwood forest	Sequoia sempervirens	G3	S3
	Western hemlock forest	Tsuga heterophylla	G5	S2
	California bay forest	Umbellularia californica	G4	S3
Shrubs				
	Chamise chaparral	Adenostoma fasciculatum	G5	S5
	Sitka alder thickets	Alnus viridis	G5	S3?
	Hoary, common, and Stanford manzanita chaparral	Arctostaphylos (canescens, manzanita, stanfordiana)	G3	S3
	Glossy leaf manzanita chaparral	Arctostaphylos (nummularia, sensitiva)	G2G3	S2S3
	Stands of Baker manzanita	Arctostaphylos bakeri	G1	S1
	Eastwood manzanita chaparral	Arctostaphylos glandulosa	G4	S4
	Hooker's manzanita chaparral	Arctostaphylos hookeri	G2	S2
	Mount Tamalpais manzanita chaparral	Arctostaphylos montana	G2	S2
	Whiteleaf manzanita chaparral	Arctostaphylos viscida	G4	S4
	California sagebrush scrub	Artemisia californica	G5	S5

Primary Lifeform	Alliance Common Name	Alliance Scientific Name	Alliance Global Rank	Alliance State Rank
	California sagebrush – California buckwheat scrub	Artemisia californica – Eriogonum fasciculatum	G4	S4
	Coyote brush scrub	Baccharis pilularis	G5	S5
	Mulefat thickets	Baccharis salicifolia	G4	S4
	Hairy leaf - woolly leaf ceanothus chaparral	Ceanothus (oliganthus, tomentosus)	G3	S3
	Wedge leaf ceanothus chaparral, Buck brush chaparral	Ceanothus cuneatus	G4	S4
	Deer brush chaparral	Ceanothus integerrimus	G4	S4
	Blue blossom chaparral	Ceanothus thyrsiflorus	G4	S4
	Tobacco brush or snow bush chaparral	Ceanothus velutinus	G5	S4
	Wart-stemmed ceanothus chaparral	Ceanothus verrucosus	G2	S2
	Birch leaf mountain mahogany chaparral	Cercocarpus montanus (C. betuloides)	G5	S4
	Golden chinquapin thickets	Chrysolepis chrysophylla	G2	S2
	Red osier thickets	Cornus sericea	G4	S3?
	Hazelnut scrub	Corylus cornuta var. californica	G3	S2?
	Bush monkeyflower scrub	Diplacus aurantiacus	G3	S3?
	California yerba santa scrub	Eriodictyon californicum	G4	S4
	California buckwheat scrub	Eriogonum fasciculatum	G5	S5
	California coffee berry scrub	Frangula californica	G4	S4
	Coastal silk tassel scrub	Garrya elliptica	G3?	S3?
	Ocean spray brush	Holodiscus discolor	G4	S3
	Deer weed scrub	Lotus scoparius	G5	S5
	Silver bush lupine scrub	Lupinus albifrons	G4	S4
	Yellow bush lupine scrub	Lupinus arboreus	G4	S4
	Silver dune lupine – mock heather scrub	Lupinus chamissonis – Ericameria ericoides	G3	S3
	Wax myrtle scrub	Morella californica	G3	S3
	Shrub tanoak chaparral	Notholithocarpus densiflorus var. echinoides	G3	S3
	Bitter cherry thickets	Prunus emarginata	G4	S4
	Choke cherry thickets	Prunus virginiana	G4	S2?
	Scrub oak chaparral	Quercus berberidifolia	G4	S4
	Scrub oak – chamise chaparral	Quercus berberidifolia – Adenostoma fasciculatum	G4	S4
	Canyon live oak chaparral	Quercus chrysolepis (shrub)	G3	S3
	Leather oak chaparral	Quercus durata	G4	S4
	Brewer oak scrub	Quercus garryana (shrub)	G4	S4
	Sadler oak or deer oak brush fields	Quercus sadleriana	G3	S3
	Sonoran live oak scrub	Quercus turbinella	G4	S1
	Huckleberry oak chaparral	Quercus vacciniifolia	G4	S4
	Interior live oak chaparral	Quercus wislizeni (shrub)	G4	S4
	Western Labrador-tea thickets	Rhododendron columbianum	G4	S2?
	Western azalea patches	Rhododendron occidentale	G3	S2?
	California rose briar patches	Rosa californica	G3	S3
	Coastal brambles	Rubus (parviflorus, spectabilis, ursinus)	G4	S3
	Sandbar willow thickets	Salix exigua	G5	S4
	Coastal dune willow thickets	Salix hookeriana	G4	S3
	Arroyo willow thickets	Salix lasiolepis	G4	S4
	Sitka willow thickets	Salix sitchensis	G4	S3?
	Blue elderberry stands	Sambucus nigra	G3	S3
	Poison oak scrub	Toxicodendron diversilobum	G4	S4
	Dwarf bilberry meadows and mats	Vaccinium cespitosum	G4?	S3?
	Bog blueberry wet meadows	Vaccinium uliginosum	G4	S3
Herbs				
	Dune mat	Abronia latifolia – Ambrosia chamissonis	G3	S3
	Water foxtail meadows	Alopecurus geniculatus	G3?	S3?
	Western ragweed meadows	Ambrosia psilostachya	G4	S4?
	Fiddleneck - Phacelia Fields	Amsinckia (menziesii, tessellata) – Phacelia spp.	G4	S4
	Pacific silverweed marshes	Argentina egedii	G4	S2
	Wild tarragon patches	Artemisia dracunculus	G4	S4
	Mosquito fern mats	Azolla (filiculoides, microphylla)	G5	S5
	Salt marsh bulrush marshes	Bolboschoenus maritimus	G4	S3
	California brome – blue wildrye prairie	Bromus carinatus – Elymus glaucus	G3	S3
	Bluejoint reed grass meadows	Calamagrostis canadensis	G5	S3
	Pacific reed grass meadows	Calamagrostis nutkaensis	G4	S2

Primary Lifeform	Alliance Common Name	Alliance Scientific Name	Alliance Global Rank	Alliance State Rank
	Small camas meadows	Camassia quamash	G4?	S3?
	Water sedge and lakeshore sedge meadows	Carex (aquatilis, lenticularis)	G5	S3
	Sand dune sedge swaths	Carex (pansa, praegracilis)	G4?	S3?
	Beaked sedge and blister sedge meadows	Carex (utriculata, vesicaria)	G5	S4
	White-root beds	Carex barbarae	G2?	S2?
	Dense sedge marshes	Carex densa	G2?	S2?
	Star sedge fens	Carex echinata	G4?	S3?
	Slender sedge meadows	Carex lasiocarpa	G5?	S3?
	Woodland sedge fens	Carex luzulina	G3	S2?
	Small-winged sedge meadows	Carex microptera	G4	S2?
	Nebraska sedge meadows	Carex nebrascensis	G5	S4
	Torrent sedge patches	Carex nudata	G3	S3
	Slough sedge swards	Carex obnupta	G4	S3
	Twotooth sedge seeps	Carex serratodens	G3	S3?
	Short-beaked sedge meadows	Carex simulata	G4	S3
	Tar plant fields	Centromadia (pungens)	G2	S2
	Raccoon's tail mats	Ceratophyllum demersum Aquatic	G5	S4
	Sand-aster and perennial buckwheat fields	Corethrogyne filaginifolia – Eriogonum (elongatum, nudum)	G4	S4
	Alkali weed – salt grass playas and sinks	Cressa truxillensis – Distichlis spicata	G2	S2
	California oat grass prairie	Danthonia californica	G4	S3
	Tufted hair grass meadows	Deschampsia cespitosa	G5	S4?
	Salt grass flats	Distichlis spicata	GU	S4
	Live-forever – lichen/moss sparse herbaceous rock outcrop	Dudleya cymosa – Dudleya lanceolata – Lichen/Moss	G4	S4
	Greene's live-forever – live-forever species succulent scrub	Dudleya greenei – Dudleya spp. Succulent Scrub	G1	S1
	Needle spike rush stands	Eleocharis acicularis	G2	S2
	Pale spike rush marshes	Eleocharis macrostachya	G4	S4
	Few-flowered spike rush marshes	Eleocharis quinqueflora	G4	S4
	Squirreltail patches	Elymus (elymoides, multisetus)	G4	S4?
	California button-celery patches	Eryngium aristulatum	G2	S2
	California poppy – lupine fields	Eschscholzia (californica) – Lupinus (nanus)	G4	S4
	Idaho fescue grassland	Festuca idahoensis	G4	S3?
	Red fescue grassland	Festuca rubra	G4	S3?
	Alkali heath marsh	Frankenia salina	G4	S3
	Manna grass meadows	Glyceria (elata, striata)	G4	S3?
	Northwest manna grass marshes	Glyceria xoccidentalis	G3?	S3?
	Gum plant patches	Grindelia (camporum, stricta)	G2G3	S2S3
	Goldenaster patches	Heterotheca (oregona, sessiliflora)	G3	S3
	Meadow barley patches	Hordeum brachyantherum	G2	S2
	Mats of floating pennywort	Hydrocotyle (ranunculoides, umbellata)	G4	S3?
	Western blue flag patches	Iris missouriensis	G5	S4
	Quillwort beds	Isoetes (bolanderi, echinospora, howellii, nuttallii, occidentalis)	G3	S3?
	Iris-leaf rush seeps	Juncus (oxymeris, xiphioides)	G2?	S2?
	Baltic and Mexican rush marshes	Juncus arcticus (var. balticus, mexicanus)	G5	S4
	Soft rush marshes	Juncus effusus	G4	S4?
	Salt rush swales	Juncus lescurii	G3	S2?
	Sierra rush marshes	Juncus nevadensis	G3?	S3?
	Western rush marshes	Juncus patens	G4?	S4?
	California goldfields – dwarf plantain – small fescue flower fields	Lasthenia californica – Plantago erecta – Vulpia microstachys	G4	S4
	Smooth goldfields vernal pool bottoms	Lasthenia glaberrima	G2	S2
	Duckweed blooms	Lemna (minor) and Relatives	G5	S4?
	Giant wild rye grassland	Leymus condensatus	G3	S3
	Sea lyme grass patches	Leymus mollis	G4	S2
	Spanish clover fields	Lotus unifoliolatus (Acmison americanus)	G4?	S4?
	Common monkey flower seeps	Mimulus (guttatus)	G4?	S3?
	Monolopia – leafy-stemmed tickseed fields	Monolopia (lanceolata) – Coreopsis (calliopsidea)	G3	S3
	Water blinks – annual checkerbloom vernal pools	Montia fontana – Sidalcea calycosa	G2	S2
	Pullup muhly meadows	Muhlenbergia filiformis	G4?	S4?
	Deer grass beds	Muhlenbergia rigens	G3	S2?
	Needle grass - melic grass grassland	Nassella spp. – Melica spp.	G4	S4
	Yellow pond-lily mats	Nuphar lutea	G5	S3?

Primary Lifeform	Alliance Common Name	Alliance Scientific Name	Alliance Global Rank	Alliance State Rank
	Water-parsley marsh	Oenanthe sarmentosa	G4	S2?
	Popcorn flower fields	Plagiobothrys nothofulvus	G4	S4
	Curly blue grass grassland	Poa secunda	G4	S3?
	Smartweed – cocklebur patches	Polygonum lapathifolium – Xanthium strumarium	G5	S5
	Ditch-grass or widgeon-grass mats	Ruppia (cirrhosa, maritima)	G4?	S2
	Pickleweed mats	Sarcocornia pacifica (Salicornia depressa)	G4	S3
	Pink saxifrage patches	Saxifraga nidifica	G4?	S3?
	Hardstem and California bulrush marshes	Schoenoplectus (acutus, californicus)	GU	S3S4
	American bulrush marsh	Schoenoplectus americanus	G5	S3
	Small-fruited bulrush marsh	Scirpus microcarpus	G4	S2
	Coast Range stonecrop draperies	Sedum spathulifolium	G4?	S4?
	Bushy spikemoss mats	Selaginella bigelovii	G4	S3
	Herb-rich meadows	Senecio triangularis	G4	S4
	Western sea-purslane marshes	Sesuvium verrucosum	G3?	S2
	Canada goldenrod patches	Solidago canadensis	G4?	S4?
	Mats of bur-reed leaves	Sparganium (angustifolium)	G4	S3?
	California cordgrass marsh	Spartina foliosa	G3	S3
	Saltmarsh sand-spurrey	Spergularia marina	G3?	S3?
	Floating mats of weak manna grass	Torreyochloa pallida	G3	S3?
	Western false asphodel – California bog asphodel fens	Triantha occidentalis – Narthecium californicum	G2?	S2?
	Long-stalk clover meadows	Trifolium longipes	G3?	S3?
	White-tip clover swales	Trifolium variegatum	G3?	S3?
	Cattail marshes	Typha (angustifolia, domingensis, latifolia)	G5	S5

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Plant List

Group	Family	Taxon	Common Name	Native
Ferns & Allies				
	Dennstaedtiaceae			
		Pteridium aquilinum	Western brackenfern	t
	Dryopteridaceae			
		Polystichum munitum	Western sword fern	t
	Equisetaceae			
		Equisetum arvense	Common horsetail	t
		Equisetum hyemale ssp. affine	Giant scouring rush	t
	Polypodiaceae			
		Polypodium californicum	California polypody	t
		Polypodium glycyrrhiza	Licorice fern	t
	Pteridaceae			
		Adiantum aleuticum	Five finger maidenhair	t
	Woodsiaceae			
		Athyrium filix-femina var. cyclosorum	Western lady fern	t
Conifers				
	Cupressaceae			
		Sequoia sempervirens	Coast redwood	t
	Pinaceae			
		Pseudotsuga menziesii	Douglas fir	t
		Toxicodendron diversilobum	Poison oak	t
Dicots				
	Apiaceae			
		Conium maculatum	Poison hemlock	f
		Foeniculum vulgare	Fennel	f
		Heracleum maximum	Common cowparsnip	t
		Osmorhiza berteroi	Sweetcicely	t
		Sanicula crassicaulis	Pacific sanicle	t
		Torilis arvensis	Field hedge parsley	f
	Araliaceae			
		Aralia californica	California spikenard	t
		Hedera helix	English ivy	f
	Aristolochiaceae			
		Asarum caudatum	Creeping wild ginger	t
	Asteraceae			
		Adenocaulon bicolor	Trail plant	t
		Artemisia douglasiana	California mugwort	t
		Baccharis pilularis	Coyote brush	t
		Carduus pycnocephalus	Italian thistle	f
		Cirsium vulgare	Bullthistle	f
		Conyza canadensis var. canadensis	Canadian horseweed	t
		Euchiton sphaericus	Tropical creeping cudweed	f
		Gamochaeta ustulata	Featherweed	t
		Hypochaeris radicata	Hairy cats ear	f
		Leucanthemum vulgare	Oxe eye daisy	f
		Madia gracilis	Gumweed	t
		Psilocarphus brevissimus var. brevissimus	Woolly heads	t
		Silybum marianum	Milk thistle	f

Group	Family	Taxon	Common Name	Native
		Sonchus asper	Spiny sowthistle	f
	Berberidaceae			
		Achlys californica	California deer foot	t
		Vancouveria planipetala	Inside out flower	t
	Betulaceae			
		Alnus rubra	Red alder	t
		Corylus cornuta	Beaked hazelnut	t
	Boraginaceae			
		Myosotis latifolia	Wide leaved forget me not	f
		Phacelia bolanderi	Bolander's phacelia	t
	Brassicaceae			
		Cardamine californica	Bitter cress	t
		Cardamine hirsuta	Hairy bitter cress	f
		Nasturtium officinale	Watercress	t
		Raphanus sativus	Jointed charlock	f
	Caprifoliaceae			
		Lonicera hispidula	Pink honeysuckle	t
	Caryophyllaceae			
		Cerastium glomeratum	Large mouse ears	f
		Silene gallica	Common catchfly	f
		Spergularia rubra	Purple sand spurry	f
		Stellaria media	Chickweed	f
	Chenopodiaceae			
		Dysphania botrys	Jerusalem oak goosefoot	f
	Convolvulaceae			
		Calystegia purpurata ssp. purpurata	Smooth western morning glory	t
	Cucurbitaceae			
		Marah fabacea	California man-root	t
	Datiscaceae			
		Datisca glomerata	Durango root	t
	Dipsacaceae			
		Dipsacus fullonum	Wild teasel	f
	Ericaceae			
		Arbutus menziesii	Madrono	t
		Arctostaphylos columbiana	Redwood manzanita	t
		Gaultheria shallon	Salal	
		Rhododendron macrophyllum	Rhododendron	t
		Vaccinium ovatum	Evergreen huckleberry	t
		Vaccinium parvifolium	Red bilberry, red huckleberry	t
	Fabaceae			
		Acmispon americanus var. americanus	Spanish lotus	t
		Acmispon brachycarpus	Short podded lotus	t
		Genista monspessulana	French broom	f
		Lathyrus torreyi	Redwood pea	t
		Lathyrus vestitus	Common pacific pea	t
		Lotus corniculatus	Bird's foot trefoil	f
		Medicago polymorpha	California burclover	f
		Trifolium campestre	Hop clover	f
		Trifolium willdenovii	Tomcat clover	t

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Group	Family	Taxon	Common Name	Native
		Vicia sativa ssp. nigra	Smaller common vetch	f
	Fagaceae			
		Chrysolepis chrysophylla	Golden chinquapin	t
		Notholithocarpus densiflorus var. densiflorus	tanoak	t
	Gentianaceae			
		Centaurium tenuiflorum	Slender centaury	f
	Geraniaceae			
		Geranium dissectum	Wild geranium	f
	Hydrangeaceae			
		Whipplea modesta	Modesty	t
	Lamiaceae			
		Melissa officinalis	Lemon balm	f
		Mentha pulegium	Pennyroyal	f
		Mentha spicata	Spearmint	f
		Prunella vulgaris	Selfheal	t
		Stachys chamissonis	Hedge nettle	t
		Stachys rigida	rough hedgenettle	t
	Lauraceae			
		Umbellularia californica	California bay	t
	Linaceae			
		Linum bienne	Flax	f
	Myrtaceae			
		Morella californica	Wax-myrtle	t
	Montiaceae			
		Claytonia sibirica	Candy flower	t
	Oleaceae			
		Fraxinus latifolia	Oregon ash	t
	Onagraceae			
		Epilobium ciliatum ssp. ciliatum	Willow herb	t
	Oxalidaceae			
		Oxalis oregana	Redwood sorrel	t
	Papaveraceae			
		Eschscholzia californica	California poppy	t
	Phrymaceae			
		Mimulus guttatus	Yellow monkey flower	t
	Plantaginaceae			
		Plantago lanceolata	Ribwort	f
		Veronica americana	American brooklime	t
	Polemoniaceae			
		Collomia heterophylla	Varied leaved collomia	t
	Polygonaceae			
		Polygonum aviculare	Prostrate knotweed	f
		Rumex acetosella	Sheep sorrel	f
		Rumex conglomeratus	Green dock	f
	Rhamnaceae			
		Ceanothus thyrsiflorus	Blueblossom	t
	Rosaceae			
		Fragaria vesca	Wild strawberry	t

Group	Family	Taxon	Common Name	Native
		Malus pumila	Paradise apple	f
		Rosa californica	California wild rose	t
		Rubus armeniacus	Himalayan blackberry	f
		Rubus leucodermis	White bark raspberry	t
		Rubus parviflorus	Thimbleberry	t
		Rubus ursinus	California blackberry	t
	Rubiaceae			
		Galium aparine	Cleavers	t
		Sherardia arvensis	Field madder	f
	Salicaceae			
		Salix sitchensis	Coulter willow	t
	Sapindaceae			
		Acer macrophyllum	Bigleaf maple	t
	Scrophulariaceae			
		Verbascum thapsus	Woolly mullein	f
	Simaroubaceae			
	Solanaceae			
		Solanum americanum	White nightshade	t
	Urticaceae			
		Urtica dioica	Stinging nettle	t
	Violaceae			
		Viola glabella	Stream violet	t
		Viola sempervirens	Redwood violet	t
Monocots				
	Cyperaceae			
		Carex aquatilis var. dives	Sitka sedge	t
		Carex harfordii	Monterey sedge	t
		Carex leptopoda	Slender-footed sedge	t
		Carex nudata	Torrent sedge	t
		Carex obnupta	Slough sedge	t
		Cyperus eragrostis	Tall cyperus	t
		Scirpus microcarpus	Mountain bog bulrush	t
	Iridaceae			
		Iris douglasiana	Douglas iris	t
	Juncaceae			
		Juncus bufonius	Common toad rush	t
		Juncus effusus ssp. pacificus	Pacific rush	t
		Juncus occidentalis	Slender juncus	t
		Juncus patens	Rush	t
		Juncus phaeocephalus	Brown headed rush	t
	Liliaceae			
		Lilium pardalinum	California tiger lily	t
		Scoliopus bigelovii	Slink pod	t
	Melanthiaceae			
		Veratrum fimbriatum	Fringed corn-lily	t
	Poaceae			
		Aira caryophyllea	Silvery hairgrass	f
		Anthoxanthum occidentale	California sweet grass	t
		Avena fatua	Wildoats	f

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Group	Family	Taxon	Common Name	Native
		Briza maxima	Rattlesnake grass	f
		Briza minor	Little rattlesnake grass	f
		Bromus carinatus var. carinatus	California brome	t
		Bromus hordeaceus	Soft chess	f
		Bromus laevipes	Narrow flowered brome	t
		Dactylis glomerata	Orchardgrass	f
		Deschampsia elongata	Hairgrass	t
		Festuca perennis	Italian rye grass	f
		Festuca subuliflora	Coast range fescue	t
		Holcus lanatus	Common velvetgrass	f
		Hordeum brachyantherum	Meadow barley	t
		Polypogon monspeliensis	Annual beard grass	f
		Rytidosperma penicillatum	Purple awned Wallaby Gras	f
	Ruscaceae			
		Maianthemum racemosum	Feathery false lily of the valley	t
		Maianthemum stellatum	Starry false lily of the valley	t

Biological Findings: Operations proposed under this THP do not have a reasonable potential to join with the impacts of other projects to cause significant cumulative adverse biological impact. This is due to the limited impacts of light selection harvesting on the FPA stream protection zones, protection measures for plants and listed species built into Section II of the plan, requirements to survey for current and future listed species and protection of any species that occur on or near the plan and within the BAA during timber operations.

D. RECREATION ASSESSMENT -

Past and Future Activities.

The THP area is privately held timber property that is closed to general public access. However, public recreation activities are sometimes allowed that are compatible with the company's management goals. Portions of the landowner's property are utilized occasionally by local residents for hiking, riding, bird watching, picnicking, bicycling, hunting, and other recreational purposes. All of this activity occurs either as a result of trespass or by permit issued by the company. The Gualala River that is accessible by the public is downstream from the proposed harvest area and is utilized for swimming, fishing, drift boat fishing, canoeing and kayaking. The THP area is behind locked gates and public access is not allowed without a permit. Based on the location of the plan no impacts to recreational use are expected to occur.

Findings: The assessment area for recreation resources includes the THP area, plus the area within 300 feet of the THP boundaries. The assessment area as described seems appropriate for an assessment of potential significant effects to the recreational resources which may occur in the vicinity of the plan area. This area is private rural forested property. On such a property, there is an expectation that timber operations will occur periodically. This land is not open to the public for recreational use and is behind locked gates. Access during falling operations may have to be tightly controlled for safety purposes due to the presence of open gates as logging crews enter and leave the property, but nothing else proposed in this THP will significantly affect recreational opportunities. Conventional logging operations are not known to have caused any significant adverse impacts to recreation resources in the area in the past, therefore, none are anticipated from this THP, either singly or cumulatively.

E. VISUAL ASSESSMENT -

Past and Future Activities -Two selection harvests have occurred on this area within the last forty years and it is anticipated that selection harvesting will continue at ten-twenty year intervals except for the even aged unit which will not be entered again for about 60 years.

No portion of this THP should be visible from the river or from public roads. Since there is a no-cut buffer adjacent to the river the actual logging will be unnoticeable. Just past the end of county road 501 after crossing the green bridge the selection logging may be visible from a private road system.. The density of the leave stand (80% canopy) for the first 120 feet adjacent to the no harvest zone which is adjacent to the river means that the harvest will be so light as to be invisible from outside the plan boundaries except on this private road system and even then the very light selection harvest will not be visually offensive.

There will be no visual impact on public using the Gualala River or public roads and only a slight impact on a handful of adjacent landowners from tree removal.
Clearcutting by its very nature creates a visual impact if it is placed where it can be viewed. The even aged unit in this plan is not adjacent to other landowners and is screened by a minimum of 600 hundred feet of dense forest to the closest landowner. Also, the orientation of this unit is such that it will be invisible to any adjacent landowners or to the public. It will not be visible to anyone on public roads or at public recreation areas.

The visual impacts that will result as a result of harvesting and from this THP however will be of short duration and not cumulative with other impacts.

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Finding: Given the stated selection silviculture methods proposed for the plan there will be no discernable visual change to the timbered hillslopes, river corridor, or timbered skyline in the selection portions of the plan. The clearcut unit will also be invisible to the public and therefore cannot combine with other impacts to create a visual cumulative effect.

F. TRAFFIC ASSESSMENT -

Past Activities.

The roads listed at the beginning of this Section under Traffic Assessment Areas have a long history of log hauling use going back to the 1940's. Since the advent of the log truck appurtenant public haul roads have seen continuous annual use in the transportation of forest products to the present day.

Vehicular Traffic Impacts:

The assessment area for traffic is the private road system west of the THP to county road 501 and from there to Old State Hwy and then to Hwy 1. See appurtenant road map in section II. These roads have historically been used as haul routes for timber and for other agricultural purposes. Annual harvest of timber from timberland owners in both Mendocino and Sonoma counties has decreased in the last two decades and consequently the log truck traffic has also decreased on the major highways. Tourist traffic and resident traffic has likely increased over the same period. County Road 501 has been the main route for log hauling from the northern half of the landowners property for over 60 years and the same route was used to remove logs by rail as far back as 100 years ago. The log truck traffic coming off of this ownership has been relatively steady for several decades and will probably remain at similar levels for the foreseeable future.
Local log truck traffic created by this project added to local traffic of other types is not expected to create a significant adverse cumulative impact to traffic on the public roads.
The log truck flow off the plan area will enter public roads from one location once they leave the GRT's property. Logs leaving GRT will enter onto county road 501 (county paved) west of the Green Bridge and will head west to Hwy 1 at the town of Gualala. This public road has received extensive log truck annually over the last six decades. Harvesting of this THP will not alter or measurable change the annual log flow off the property or within the greater Gualala River subbasin.

Finding: This project will not significantly add to the annual truck traffic that leaves the property each harvest season. Local log truck traffic created by this project added to local traffic of other types is not expected to create a significant adverse cumulative impact to traffic on local public roads.

G. NOISE ASSESSMENT-

There are half a dozen residences within a few hundred feet of the selection unit of this THP. Noise from this area may also be noticeable from the river which is used by kayakers, sunbathers and fisherman but will be muffled by at least a half of a mile of dense forest. Each area will be impacted during falling, skidding and hauling. The noise impacts from the logging these units on their respective areas will be of short duration (estimated to be about two to four weeks). There will also be noise from log truck traffic on County road 501 during operations. Log truck traffic noise is a common annual occurrence on all of the roads to be used for this THP and since the annual harvest from this landowner is relatively consistent there is no additive cumulative effect from this noise resulting from this harvest plan.

The noise impacts that will result as a result of harvesting and from this THP however will be of short duration and not cumulative with other impacts. Harvesting and truck noise is not anticipated to be any more prevalent than what has occurred in past years. After harvest, the area will return to its normal quiet state until the next entry many years down the road.

Finding: No significant and/or cumulative impacts related to noise will occur as a result of this operation.

H. Global Warming- Climate Change and Forestry Practice

1. Climate Change in General.

The vast majority of climate scientists have concluded that the earth's climate is currently warming at a rate that is unprecedented in human history. Their conclusions are based on temperature data, samples of carbon dioxide (C02) content in prehistoric ice and sediment, and climate models. The evidence of global climate change is undeniable except for a few fringe scientists.

The scientific view that has gained greatest acceptance in current public policy is that extraordinary emissions of greenhouse gases (GHG) from human activities are promoting warming of the earth's atmosphere.

While scientific inquiry continues, public policies favor the view that global warming is occurring and is driven by extraordinary GHG emissions from human activities. In response, the State of California has enacted legislation and policies designed to reduce greenhouse gas emissions and to increase energy efficiency (AB 1493, 2002; AB 32, 2006; Gov. Schwarzenegger Executive Order S-3-05). The Executive Order established greenhouse gas emission targets using 1990 thresholds, and established the California Climate Action Team to coordinate the State's efforts to reduce and report on progress of those efforts and on impacts of global warming to the State.

Carbon dioxide (CO_2) is considered the greenhouse gas (GHG) that has the greatest effect on the dynamic of global warming due to the fact that it composes the vast majority of the releases by human activities. There are two basic ways carbon emissions are reduced. First is efficiency, where technology or conservation reduces carbon emissions through the use of less energy (electricity, fuel, heat, etc.) to accomplish an activity. Second is storage, which can be accomplished through geologic or terrestrial sequestration.

Forest activities can result in emissions through harvesting, wildfire, pest mortality and other natural and anthropogenic events. However, forestry is a net sink for carbon, the primary greenhouse gas. Plants absorb CO_2 from the air, and use the carbon as a building block of plant tissue through the process of photosynthesis. Worldwide forests store approximately 2,000 billion tons (Gt) +/- 500 of CO_2 (National Energy Technology Laboratory, 2000). An acre of mature redwood can store between 600-700 ton/ac of CO_2, which is the highest of any forest type on Earth. Though redwood forests can store the largest amounts of GHGs per acre of any forest type, the expanse of this forest type is not significant on a global level. The most recent draft Greenhouse Gas Inventory shows the forestry sector to be a net sink with emissions of 6.1 MMT CO_2 EQ. and emissions reductions of 21 MMT CO_2 EQ (Bemis, 2006).

The forest sector offers the ability to reduce emissions through a suite of possible activities: 1) substitute wood products for more energy-intensive products, 2) reduce demand for energy in growing timber, harvesting, and wood processing, 3) reduce biomass burning (wildfires), 4) afforest marginal croplands, 5) reduce conversion of forestland to nonforest use, 6) improve forest management, 7) reduce harvest, 8) increase agro-forestry, 8) plant trees in urban areas, 9) other combinations (Joyce and Nungesser, 2000). This proposed THP uses several of the activities which are considered to have the effect of reducing the overall forest emissions and improving the storage of GHGs. The harvest will add to the carbon stored in wood products, while at the same time increase the rate of carbon storage by maintaining a healthy, fast-growing forest. Forest management may result in a reduced risk for wildfire, and will maintain maximum sustained productivity of quality forest products. By maintaining timber

management there is a reduced risk of deforestation through conversion of the land to non-forest uses.

2. CEQA Analysis Related to Climate Change

The California Global Warming Solutions Act of 2006 (AB 32) is California's legislative effort aimed at reducing GHG emissions. Pursuant to AB 32, CARB must develop an implementation program and adopt control measures to achieve the maximum technologically feasible and cost-effective GHG reductions. AB 32 requires CARB to prepare a Scoping Plan to achieve reductions in GHG emissions in California. On June 26, 2008 CARB staff presented the initial draft of the AB 32 Scoping Plan for Board review. The Scoping Plan was first considered by the Board in 2008 and must be updated every five years. CARB has updated the Scoping Plan in 2014 (First Update) and again in 2017 (2017 Scoping Plan). Details regarding the latest update are outlined below.

2017 Scoping Plan Update extended the goals of AB 32 and set a 2030 goal of a 40 percent emissions reduction below 1990 levels. The 2017 Scoping Plan incorporates, coordinates, and leverages many existing and ongoing efforts and identifies new policies and actions to accomplish the State's climate goals. It builds upon the successful framework established by the Initial Scoping Plan and First Update, while identifying new, technologically feasible, and cost-effective strategies to ensure that California meets its GHG reduction targets in a way that promotes and rewards innovation, continues to foster economic growth, and delivers improvements to the environment and public health, including in disadvantaged communities. It also includes policies to require direct GHG reductions at some of the State's largest stationary sources and mobile sources. These policies include the use of lower GHG fuels, efficiency regulations, and the Cap-and-Trade Program, which constrains and reduces emissions at covered sources.

What are the key focus areas in the 2017 Scoping Plan? - CARB plans to focus on several topics, including enhancing industrial efficiency, transportation, securing water supplies, clean air, putting waste resources to beneficial use, and supporting resilient agriculture and natural and working lands.

What is the status of AB 32 implementation? - The California Global Warming Solutions Act of 2006 (AB 32) has been implemented effectively with a suite of complementary strategies that serve as a model going forward. California is on target for meeting the 2020 GHG emission reduction goal. Many of the GHG reduction measures (e.g., Low Carbon Fuel Standard, Advanced Clean Car standards, and Cap-and-Trade) have been adopted over the last several years and implementation activities are ongoing. California is seeing real reductions to put the state on track for reducing GHG emissions to achieve the AB 32 goal of getting back to 1990 levels by 2020.

In addition to the 2017 Scoping Plan, the California Forest Carbon Plan completed in May of 2018 presents an assessment of forest health across California based on the best currently available information. This plan provides a description of anticipated future conditions given the ongoing and expected impacts of climate change on forested ecosystems and lays out a set of forest management goals to move the state's forests towards a more ecologically resilient state. These goals include:

1. Enhance: Expand and improve forest management to enhance forest health and resilience, resulting in enhanced long-term carbon sequestration and storage potential.

2. Protect: Increase protection of California's forested lands and reduce conversion to non-forest uses, resulting in a more stable forested land base.

3. Innovate: Pursue innovations in wood products and biomass utilization in a manner that reduces or offsets GHG emissions; promotes land stewardship; and strengthens rural economies and communities.

The Forest Carbon Plan provides guidance and input to the Natural and Working Lands Implementation Plan described in the California's 2017 Climate Change Scoping Plan. The Forest Carbon Plan describes a significant deficit in forest management in California, both on private lands and nonfederal public forestlands. To address the forest health and resiliency needs on a state-wide basis on nonfederal lands, the plan states forest treatments need to increase to 500,000 acres per year to make an ecologically significant difference at the landscape scale. The plan further describes the treatments to include those that generate revenue from harvest materials, such as commercial thinning and regeneration harvests.

3. The Project:

The proposed project will result directly and indirectly in carbon sequestration and temporary, insignificant C02 emissions. Carbon sequestration is achieved through a repeating cycle of harvesting and growing of trees that remove C02 from the atmosphere and store carbon in tree fiber. When a tree is harvested, most of the carbon-filled tree fibers become lumber that is sequestered in buildings while a new rotation of trees is planted and grown. To the extent these wood building products replace the demand for new concrete or steel building components; they reduce substantial C02 emissions that are associated with the manufacture of cement and steel. Some of the tree fibers such as branches and tops are left in the forest where they are sometimes burned to reduce fire hazard. However, the vast majority of this material is left to decay and will emit C02 overtime; but it also supplements the forest soils and forest duff layer where carbon is stored and serves as a substrate and nutrient for more tree growth.

Using the CALFIRE GHG calculator, it is estimated that GHG sequestration for this project will be between 207 and 230 metric tons of CO2 per acre over the 100 year planning horizon depending on the silviculture. This sequestration total includes emissions from site preparation, non biological emissions associated with harvesting and non biological emissions associated with milling. GHG emissions associated with this project are insignificant relative to global CO2 emissions that are thought to affect climate. There is virtually no opportunity to reduce these emissions in a manner that would meaningfully benefit the climate because they are already miniscule. (U.S.E.P.A. 2005). An acre of managed forest is entered with equipment once every 10-20 years in selection silviculture and once every 60 years or more in even-aged management with emissions measured in hours of equipment operation over that time period. Few if any other land uses can match the low intensity of CO2 emissions over space and time that are associated with commercial forestry. In urban areas of California, a typical California household will operate one or more vehicles every day and the demands of that household will induce a variety of additional CO2 emissions for other forms of commerce, power production, and consumption. In rural areas, even a typical farm acre in California will be subject to equipment operation for several hours or days every year– not once every 10 to 60 years.

The insignificant GHG effects of the Proposed Project are further diminished by the mitigating effects of carbon sequestered in the lumber produced from harvest. It is estimated that at the end of 100 years, a

weighted average of 47 percent of the solid wood products manufactured from the log are still in use, and if the wood in stable storage in a landfill is included, that weighted average over the 100-year period is 76% percent (US Dept of Energy- I605(b) Tables). It is reasonable to expect similar numbers for the proposed project. The 100-year permanency period is the same as that used by the California Climate Action Registry for its analysis of a permanent carbon offset. Accordingly, for every metric ton of C02 emissions attributed to the operation of timber harvesting and hauling equipment, 13.7 metric tons of C02 will be sequestered in the wood products produced from the harvest.

4. State Setting and Area of Assessment.

The assessment area for climate effects is the California timberland ownership of the Plan Submitter and the public transportation routes for the delivery of the logs to the manufacturing centers. Because the use and disposition of manufactured wood products is not under the control of the Plan Submitter after it is delivered to the primary manufacturing center, the direct GHG emissions of manufacturing activities are not estimated here. However, qualitative consideration of the carbon cycle in wood products is addressed as a cumulative effect.

There are 16.6 million acres of productive public and private timberland (statutorily available for harvest) in California (California Department of Forestry 2003). The Plan Submitter owns 29,000 acres in Sonoma and Mendocino counties. This represents 0.17% of the total timberland, and 0.4% of the 7.3 million acres of the private timberlands in the state. This proposed timber harvesting plan includes 141 acres that are actually being harvested which represent only 0.000019% of the total private timberland in the state.

Since 1990 (the State of California's benchmark for achieving GHG reductions) the forest products industry has implemented a significant reduction in harvest levels and the number of sawmills operating in the state. Since record keeping started in 1978, timber harvest peaked in 1988 at 4,670 million board feet and has continued to decline. In 1997 California harvested 2,400 million board feet and by 2018, the harvest level had dropped to 1,580 million board feet (SBE Harvest Tables).

5. Carbon Sequestration, Emissions, and Land Use Resulting from Intensive Forest Management

Forestlands are, in general, a carbon sink where C02 is captured and fixed by the process of photosynthesis, which removes carbon from the atmosphere and sequesters carbon in wood fiber (OFRI 2006, U.S.E.P.A. 2005). In California, forests in the North Coast, Cascade Northeast and North Sierra regions were estimated to produce a net benefit of 7.2 million metric tons of C02 equivalents removed from the atmosphere each year (California Energy Commission 2004). Growing forests sequester and store more carbon over time until growth stagnates as trees reach a mature age. Older trees sequester carbon through new growth at a declining rate, but they remain pools of stored carbon until they decay through decline, death, or consumptive use.

Managed commercial forests make a significant contribution to the sequestration of carbon and mitigation of GHG (IPCC 2007; Mader 2007; OFRI 2006; U.S.E.P.A. 2005). Several studies have documented a positive net effect of carbon sequestration by commercial timberlands where forests are grown, harvested, and processed into wood products (James et al. 2007; Perez-Garcia et al. 2005; Lippke et al. 2004). Even when C02 emissions from timberland management, timber harvest, and forest products uses are considered, the long-term, sustainable, and

intensive management of commercial timberlands to produce wood products generates a net carbon sequestration benefit that mitigates GHG (Id). These studies investigated timber harvest at various rotation ages relative to no harvest and perpetual old growth stands. They found that intensive forest management with a rotation of 50 years or less can produce net positive carbon sequestration benefits because carbon is sequestered through repeated cycles of tree growth while a substantial percentage of harvested and milled wood is sequestered for decades or centuries in buildings. Life cycle assessment studies have shown that wood products have a much smaller carbon footprint compared to other building material. Not only is carbon sequestered by trees, but it may be stored for long periods of time in wood products. It is estimated that at the end of 100 years, a weighted average of 47 percent of the solid wood products manufactured from the log are still in use, and if the wood in stable storage in a landfill is included, that weighted average over the 100-year period is 76% percent (US Dept of Energy- I605(b) Tables).

The net sequestration benefits of an intensively managed forest are further enhanced by the effects of substitution. When wood products are used for building materials in lieu of concrete or steel, C02 emissions are reduced because there is less demand for steel and concrete, which are manufactured with large C02 emissions as a byproduct (IPCC 2007; Mader 2007; OFRI 2006; Perez-Garcia et al. 2005; Lippke et al. 2004). Further, to the extent that harvested wood is not incorporated into fixed building components, wood residues may be used as fuel for energy production in lieu of fossil fuels (Id). When wood residues are used in this way, there is no increase in C02 emissions from their combustion because the same emissions will result from the oxidation and decay of wood residue. However, more significant C02 emissions from the burning of fossil fuels such as coal or oil can be avoided when wood residue is burned to create heat and generate electricity.

The proposed project is one of numerous pasts, present, and future timber harvest projects on the Plan Submitter's ownership that combines to produce substantial net carbon sequestration benefits over time. These timberlands are sustainably managed in accordance with California law such that the harvest of timber through past, present, and future projects will not exceed the long term tree growth of the California timberlands. Timber harvests are conducted in small patches across the ownership and promptly replanted to begin a new cycle of tree growth and carbon sequestration. Harvested timber is converted to wood products that sequester carbon as building materials. To some degree, these building products substitute for C02 intensive steel and cement building components.

The cumulative beneficial effects of the proposed project as part of the Plan Submitter's intensive forest management are expected to sustain the current timber production land use and reduce the risk of wildfire, which are, in turn, beneficial impacts on GHG emissions and carbon sequestration. Land use conversion from forestry to other uses has a negative impact on GHG (OFRI 2006). In addition, catastrophic wildfires are enormous emitters of C02 and often reduce or destroy the carrying capacity of forest soils to regenerate growing forests (Id). Both of these adverse impacts to GHG are prevented with successful intensive management of forestland for timber production. The project and similar, past, present, and future projects on the Plan Submitter's timberlands are essential to successful intensive forest management that prevents land use conversion.

6. Effects of Climate Change on Timberlands

Regardless of the benefits that the project and similar past, present, and future projects will have on diminishing GHG emissions and promoting carbon sequestration, climate change is likely to occur. The rate and direction of

climate change remains very uncertain (IPCC 2007). It is a certainty that the earth's climate has changed in the past with variable cooling and warming trends, but no models exist to reliably predict the rate and direction of climate change or the regional or localized effects on temperatures, precipitation, growing seasons, drought, vegetation, and wildlife (IPCC 2007).

In the face of uncertainty, the impacts of climate change must be assessed in terms of the resilience of the Plan Submitters timberlands should climate changes occur. There are several indications that these timberlands have been and continue to be resilient. After more than a century of timber harvest, most of which occurred without the benefits of modern forest practices regulations and best management practices, these timberlands remain among the most productive forest lands in the world. A key tree species on these timberlands is the California redwood *(Sequoia sempervirons),* which is the epitome of resilience, having persisted for millennia in the coastal climate of northern California. The redwood tree is not expected to be threatened by pests that might be advantaged by global warming, and it is expected to persist at the southern end of its range even if climate change brings higher temperatures and less precipitation (Battle 2006). The redwood tree also benefits from coppice regeneration, which means that it regenerates from the stump after a tree has been harvested. As such, much of the living root system of redwood trees persists and the genetic diversity of each individual tree is preserved on the landscape as cut trees are replaced by genetically identical sprouts that grow from the same root system. For the same reason, the regeneration and growth of redwood forests after harvest occurs quickly and with more certainty because young trees have the benefit of mature root systems. The resilience of these lasting forests is also supplemented by required planting of seedlings to promote healthy stocking levels on every harvested area.

In addition to redwood, these timberlands grow hearty and resilient species such as Douglas-fir, a species that thrives in open stands following even age harvest. Douglas-fir grows in a variety of climates throughout western North America and is believed to have rapidly colonized areas that are now vast forestlands following the end of the last Ice Age. Through its substantial and continuous investment in reforestation and productive regeneration of forest stands, the Plan Submitter has a strong incentive to nurture healthy and resilient forest stands on its property.

In summary, both the IPCC and U.S. EPA have recognized the positive effects that forests and forest products have on the world's climate. The above qualitative discussion demonstrates that the proposed project as presented and mitigated, in combination with past, present, and reasonably foreseeable probable future projects will not cause, or add to significant cumulative GHG impacts within the assessment area. Following is a project specific quantitative analysis which further demonstrates the proposed operations will result in a net sequestration of green house gases.

Finding: It is the RPF's opinion that after having performed the Cumulative Impacts Assessment for climate change, it has been determined that the proposed project as presented and mitigated, in combination with past, present, and reasonably foreseeable future projects will not cause, or add to significant cumulative impacts within the assessment area.

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California's Forest Resources: Forest Inventory and Analysis, 2001–2010 USDA published February 2016

Project Specific Greenhouse Gas Analysis

Elk THP Summary (single tree selection/tractor)			Years until Carbon Stocks are Recouped from Initial Harvest (Includes Carbon in Live Trees, Harvested Wood Products, and Landfill)
	Beginning Stocks	Ending Stocks	
Emissions Source/Sink/Reservoir	Metric Tonnes CO2 Equivalent Per Acre Basis		9 Years
Live Trees (Conifers and Hardwoods)	378.57	471.29	
Wood Products		147.69	
Site Preparation Emissions		0.00	
Non-biological emissions associated with harvesting		-7.16	
Non-biological emissions associated with milling		-2.60	
Sum of Net Emissions/Sequestration over Identified Harvest Cycles (CO2 metric tonnes)		230.64	
Project Summary			
Project Acres	Step 17- Insert the acres that are part of the harvest area.	117	
Total Project Sequestration over defined Harvesting Periods (CO2 metric tonnes)		26,985	

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Elk THP Selection/Tractor Project Carbon Accounting: Inventory, Growth, and Harvest

This worksheet addresses the sequestation and emissions associated with the project area's balance of harvest, inventory, and growth plus any emissions associated with site preparation. Complete the input for Steps 0- 8 on this worksheet.

Forest Type				Harvest Periods	Inventory		Growth Rates		Harvest Volume	
Multipliers to Estimate Carbon Tonnes per MBF (Sampson, 2002)				Time of Harvest (years from project approval)	Conifer Live Tree Volume (MBF/Acre) - Prior to Harvest	Hardwood Live Tree Volume (BA square feet/Acre) - Prior to Harvest	Conifer Growth Rate BF/Acre/Year	Hardwood Growth Rate BA/Acre/Year	Conifer Harvest Volume (MBF/acre)	Hardwood Harvested / Treated Basal Area (BA/Acre)
Forest Type	Identify the approximate percentage of conifers by volume within the harvest plan. Must sum to	Multiplier from Cubic Feet (merchantable) to Total Biomass	Pounds Carbon per Cubic Foot	**Step 1.** Enter the anticipated future harvest entries. The re-entry cycles should be supported by management plan, if available.	**Step 2.** Enter the estimated conifer inventory (mbf/acre) present in project area prior to harvest.	**Step 3.** Enter the estimated hardwood inventory (basal area per acre) present in project area prior to harvest.	**Step 4.** Enter the average annual periodic growth of conifers between harvests based on estimated growth in management plan, if available. Must be entered for each harvest cycle identified in	**Step 5.** Insert average annual periodic growth of hardwoods between harvests based on estimated growth in management plan, if available.	**Step 6.** Enter the estimated conifer harvested per acre at current and future entries. The estimate should be based on projections from the management plan. If	**Step 7.** Enter estimated hardwood basal area harvested/treated per acre
Douglas-fir	10%	1,675	14.36	0	60	10	1000	0.1	13	0
Redwood	90%	1,675	13.42	15	62	11.5	1000	0.1	13	0
Pines	0%	2.254	12.14	30	64	13	1000	0.1	13	0
True firs	0%	2.254	11.18	45	66	14.5	1000	0.1	13	0
Hardwoods		2.214	11.76	60	68	16	1000	0.1	13	0
Conversion of Board Feet to Cubic Feet	0.165	Pounds per Metric Tonne	2.204	75	70	17.5	1000	0.1	13	0
Multipliers to Estimate Total Carbon Tonnes per MBF	Conifer	1.69		90	72	19	1000	0.1	13	0
	Hardwoods	1.95		105	74	20.5	1000	0.1	13	0
Multipliers to Estimate Merchantable Carbon Tonnes per MBF	Conifer	1.01		0	0	0	0	0	0	0
	Hardwoods	0.88		0	0	0	0	0	0	0

User must enter harvest cycles to 100 years and/or at least three entry cycles.

Harvest Periods	Inventory Conversion to Carbon (prior to harvest)		Inventory Conversion to Carbon Dioxide Equivalent (prior to harvest)		Site Preparation	
	Conifer Live Tree Tonnes (C/acre)	Hardwood Live Trees Tonnes (C/acre)	Conifer Live Tree Tonnes (CO_2 equivalent/acre)	Hardwood Live Tree Tonnes (CO_2 equivalent/acre)	**Step 8.** Enter the value (in bold) for each harvest cycel that best reflects the site preparation activities, as averaged across the project area:	
from above (Time of Harvest as years from project approval)	**Computed:** MBF * Conifer Multiplier from Step 0.	**Computed:** BA*Volume/Basal Area Ration (to convert to MBF) * Hardwood Multiplier from Step 0.	**Computed:** Conversion of carbon to CO_2 (3.67 tonnes CO2 per 1 tonne Carbon)	**Computed:** Conversion of carbon to CO_2 (3.67 tonnes CO2 per 1 tonne Carbon)	**Heavy- 50% or more of the project area is covered with brush and removed as part of site preparation or stumps are removed (mobile emissions estimated at .429 metric tonnes CO2e per acre, biological emissions estimated at 2 metric tonnes CO2e per acre)** **Medium - >25% <50% of the project area is covered with brush and removed as part of site preparation (mobile emissions estimated at .202 metric tonnes CO2e per acre, biological emissions estimated at 1 metric tonne per acre).** **Light - 25% or less of the project area is covered with brush and is removed as part of site preparation (mobile emissions estimated at .09 metric tonnes CO2e per acre, biological emissions estimated at .5 metric tonnes per acre).** None - No site preparation is conducted.	
0	102	1	373	5	None	0
15	105	2	386	6	None	0
30	108	2	398	7	None	0
45	112	2	411	8	None	0
60	115	2	423	9	none	0
75	119	3	435	9	None	0
90	122	3	448	10	None	0
105	125	3	460	11	None	0
0	0	0	0	0	None	0
	Difference between ending stocks and beginning stocks		87	5.83	Sum of emissions (Metric Tonnes CO2e) per acre	0

Project Carbon Accounting: Harvesting Emissions

This worksheet addresses the non-biological emissions associated with the project area's harvesting activities. Complete the input for Steps 9- 14 on this worksheet.

Harvest Periods	Falling Operations	Production per Day	Emissions Associated with Yarders and Loaders			Emissions Associated with Tractors and Skidders			Emissions Associated with Helicopters			Landing Saws	Trucking Emissions		
from inventory, Growth, and Harvest Page (Time of Harvest as years from project approval)	**Assumption:** ((.25 gallons gasoline per MBF harvested * 5.33 (pounds carbon per gallon))/2205(conversion to metric tonnes)* mbf per acre harvested	MBF (all species) Yarded Delivered to Landing	**Assumption:**(((35 gallons diesel per day per piece of equipment * 6.12 pounds carbon / gallon)/2205 to convert to metric tonnes carbon)* 3.67 to convert to metric tonnes CO2 equivalent)/Production per Day			**Assumption:** (((55 gallons diesel per day per piece of equipment * 6.12 pounds carbon / gallon)/2205 to convert to metric tonnes carbon)* 3.67 to convert to metric tonnes CO2 equivalent)/Production per Day			**Assumption:** (((200 gallons jet fuel per day per piece of equipment * 5 pounds carbon / gallon)/2205 to convert to metric tonnes carbon)* 3.67 to convert to metric tonnes CO2 equivalent)/Production per Day			**Assumption:** (((.16 gallons gasoline per MBF * 5.33 (pounds carbon per gallon))/2205(conversion to metric tonnes)* 3.67 to convert to metric tonnes CO2 equivalent)/mbf per acre harvested. Applies to all species whether harvested or not.	**Assumption:** Round Trip Hours/Load average (from below, to compute the mbf/hour) /((6 gallons diesel/hour * 6.12 pounds carbon/gallon)/2205 (conversion to metric tonnes carbon))*3.67 (conversion to metric tonnes carbon dioxide equivalent)		
	Computed. Metric Tonnes CO2 equivalent per mbf harvested Applies to all species whether harvested or treated	**Step 9.** Enter the estimated volume delivered to the landing in a day.	**Step 10.** Enter number of pieces of equipment in use per day for each harvest entry	**Computed.** Yarders and Loaders CO2 equivalent/mbf (metric tonnes)	**Computed.** Yarders and Loaders CO2 equivalent per Acre Harvested (metric tonnes)	**Step 11.** Enter number of pieces of equipment in use per day for each harvest entry	**Computed.** Tractor and skidder CO2 equivalent/mbf (metric tonnes)	**Computed.** Tractors and Skidders CO2 equivalent per Acre Harvested (metric tonnes)	**Step 12.** Enter number of pieces of equipment in use per day for each harvest entry	**Computed.** Helicopter CO2 equivalent/mbf (metric tonnes)	**Computed.** Helicopters CO2 equivalent per Acre Harvested (metric tonnes)	**Computed.** Landing Saws CO2 equivalent per Acre Harvested (metric tonnes)	**Steps 13 and 14 below**		**Computed.** Estimated Metric Tonnes CO2e per harvested acre for each harvesting period.
0	(0.03)	45	1	-0.01	-0.10	3	-0.04	-0.49	0	0.00	0.00	-0.02	**Step 13.** Enter Estimated Load Average: MBF/Truck	6	-0.259787755
15	(0.03)	45	1	-0.01	-0.10	3	-0.04	-0.49	0	0.00	0.00	-0.02			-0.259787755
30	(0.03)	45	1	-0.01	-0.10	3	-0.04	-0.49	0	0.00	0.00	-0.02	**Step 14.** Enter Estimated Round Trip Haul in Hours	6	-0.259787755
45	(0.03)	45	1	-0.01	-0.10	3	-0.04	-0.49	0	0.00	0.00	-0.02			-0.259787755
60	(0.03)	45	1	-0.01	-0.10	3	-0.04	-0.49	0	0.00	0.00	-0.02			-0.259787755
75	(0.03)	45	1	-0.01	-0.10	3	-0.04	-0.49	0	0.00	0.00	-0.02			-0.259787755
90	(0.03)	45	1	-0.01	-0.10	3	-0.04	-0.49	0	0.00	0.00	-0.02			-0.259787755
105	(0.03)	45	1	-0.01	-0.10	3	-0.04	-0.49	0	0.00	0.00	-0.02			-0.259787755
0	-	0	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0.00			0
0	-	0	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0.00			0
Sum Emissions	**-0.23**				**-0.82**			**-3.88**			**0.00**	**-0.15**			**-2.08**

Project Carbon Accounting: Harvested Wood Products and Processing Emissions

This worksheet addresses the non-biological emissions associated with the project area's harvesting activities. Complete the input for Steps 15- 16 on this worksheet.

Harvest Periods	Quantity of Forest Carbon Delivered to Mills				Non-Biological Emissions Associated with Mills	Quantity of Forest Carbon Remaining Immediately After Milling (Mill Efficiency)		Long-Term Sequestration in Wood Products	
	Conifer Percentage Delivered to Mills	Hardwood Percentage Delivered to Mills	Conifer CO2e Delivered to Mills / Acre	Hardwood CO2 equivalent Delivered to Mills / Acre	**Assumption.** 20 kw/hour (mill energy use) /(40mbf lumber processed/hour) *(.05 metric tonnes/kw hour) * mbf processed	**Computed.** Remaining CO2 equivalent after Milling Efficiency for Conifers	**Computed.** Remaining CO2 equivalent after Milling Efficiency for Hardwoods	**Computed.** CO2 Equivalent Tonnes in Conifer Wood Products in Use-100 Year Weighted Average / Acre and Landfill	**Computed.** CO2 Equivalent Tonnes in Hardwood Wood Products in Use-100 Year Weighted Average / Acre
from Inventory, Growth, and Harvest Page (Time of Harvest as years from project approval)	**Step 15.** Insert the percentage of conifer trees harvested that are subsequently delivered to sawmills	**Step 16.** Insert the percentage of hardwoods harvested or treated that are subsequently delivered to sawmills	**Computed:** The merchantable portion determined by the conversion factors (Sampson, 2002) on the Inventory, Growth, and Harvest worksheet. This is multiplied by the percent delivered to mills to reflect the carbon delivered to mills.	**Computed:** The merchantable portion determined by the conversion factors (Sampson, 2002) on the Inventory, Growth, and Harvest worksheet. This is multiplied by the percent delivered to mills to reflect the carbon delivered to mills.	**Calculated.** **The CO2e associated with processing the logs at the mill**	The difference between carbon delivered to mills and carbon remaining after milling is assumed to be emitted immediately		**Estimate.** The weighted average carbon remaining in use at year 100 is 46.3%	**Estimate.** The weighted average carbon remaining in use at year 100 is 23.0%
						The efficiency rating from mills in California is 0.67 (DOE 1605b) for conifers	The efficiency rating from mills in California is .5 (DOE 1605b) for hardwoods	**Estimate.** The carbon in landfills at year 100 is 29.8% of the initial carbon produced in wood products.	**Estimate.** The carbon in landfills at year 100 is 29.8% of the initial carbon produced in wood products.
0	100%	0%	48.28	0.00	-0.33	32.34	0.00	24.61	0.00
15	100%	0%	48.28	0.00	-0.33	32.34	0.00	24.61	0.00
30	100%	0%	48.28	0.00	-0.33	32.34	0.00	24.61	0.00
45	100%	0%	48.28	0.00	-0.33	32.34	0.00	24.61	0.00
60	100%	0%	48.28	0.00	-0.33	32.34	0.00	24.61	0.00
75	100%	0%	48.28	0.00	-0.33	32.34	0.00	24.61	0.00
90	100%	0%	48.28	0.00	-0.33	32.34	0.00	24.61	0.00
105	100%	0%	48.28	0.00	-0.33	32.34	0.00	24.61	0.00
0	0%	0%	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0	0%	0%	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0	0%	0%	0.00	0.00	0.00	0.00	0.00	0.00	0.00
		Sum of emissions associate with processing of lumber			-2.60	Sum of CO2 equivalent in wood products		147.69	0.00

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Years	Conifer													Hardwood												Total				
	Starting Inventory (MBF/Acre)	Starting Inventory (CO2-e Tonnes/Acre)	Harvest (MBF/Acre)	Annual Inventory Estimate (MBF/acre)	Estimated CO2 equivalent in Inventory (Metric Tonnes/A	Estimated CO2 equivalent harvested in total tree	Portion of Harvest Delivered to Mill	Amount CO2 equivalent transferred to the mill (bole portion	In Use Decay Curve of Wood Products (Conifer) (%)	CO2 -e in in-use harvested wood products (Metric Tonnes/Acre)	Fraction of CO2 equivalent remaining in landfills (%)	CO2 -e in Landfills (Metric Tonnes/Acre)	Combined CO2-e in Landfills and In-use (Metric	Starting Inventory (BA/Acre)	Starting Inventory CO2-e (Metric Tonnes/Acre)	Harvest (BA/Acre)	Annual Inventory (BA/acre)	Estimated CO2 equivalent in Inventory (Metric Tonnes/A	Estimated CO2 equivalent harvested in total tree	Portion of Harvest Delivered to Mill (%)	Amount CO2 equivalent transferred to the mill (bole portion	In Use Decay Curve of Wood Products (Conifer) (Metric Tonnes/A	CO2 -e in in-use harvested wood products (Metric Tonnes/Acre)	Fraction of CO2 equivalent remaining in landfills (%)	CO2 -e in Landfills (Metric Tonnes/Acre)	Combined CO2-e in Landfills and In-use (Metric	CO2-e in Standing Inventories (Metric Tonnes/Acre)	CO2-e in Harvested Wood Products (Metric Tonnes/Acre)	CO2-e in Inventories and In Harvested Wood Products (Metric	Initial CO2-e in Forest	Years in Which Project Sequestration Exceed Initial CO2-e	Number of Years for Growth and Harvested Wood Products
Pre-harvest	60	373	13	47	292	81	100%	48	0.68	33	0.02	0.87	33.46	10	5	-	10	5	-	0%	-	0.57	-	-	-	-	302.35	33.46	331	379	101	9
1			-	48	299	-		-	0.64	31	0.04	1.69	32.44			-	10	5	-		-	0.53	-	0.02	-	-	308.67	32.44	338		101	
2			-	49	305	-		-	0.60	29	0.05	2.46	31.52			-	10	5	-		-	0.49	-	0.03	-	-	314.99	31.52	342		101	
3			-	50	311	-		-	0.57	28	0.07	3.23	30.85			-	10	6	-		-	0.46	-	0.05	-	-	321.31	30.85	347		101	
4			-	51	317	-		-	0.55	26	0.08	3.91	30.22			-	10	6	-		-	0.44	-	0.06	-	-	327.63	30.22	353		101	
5			-	52	323	-		-	0.52	25	0.09	4.54	29.69			-	11	6	-		-	0.41	-	0.07	-	-	333.95	29.69	359		101	
6			-	53	330	-		-	0.50	24	0.11	5.17	29.21			-	11	6	-		-	0.39	-	0.08	-	-	340.27	29.21	365		101	
7			-	54	336	-		-	0.48	23	0.12	5.74	28.82			-	11	6	-		-	0.37	-	0.09	-	-	346.59	28.82	370		101	
8			-	55	342	-		-	0.46	22	0.13	6.26	28.39			-	11	6	-		-	0.35	-	0.10	-	-	352.91	28.39	376		101	
9			-	56	348	-		-	0.44	21	0.14	6.81	28.05			-	11	6	-		-	0.33	-	0.11	-	-	359.23	28.05	382		9	
10			-	57	355	-		-	0.42	20	0.15	7.29	27.76			-	11	6	-		-	0.32	-	0.12	-	-	365.55	27.76	388		10	
11			-	58	361	-		-	0.41	20	0.16	7.77	27.65			-	11	6	-		-	0.32	-	0.12	-	-	371.87	27.65	394		11	
12			-	59	367	-		-	0.40	19	0.17	8.21	27.50			-	11	6	-		-	0.32	-	0.12	-	-	378.19	27.50	400		12	
13			-	60	373	-		-	0.39	19	0.18	8.59	27.30			-	11	6	-		-	0.32	-	0.12	-	-	384.51	27.30	407		13	
14			-	61	379	-		-	0.38	18	0.19	9.03	27.14			-	11	6	-		-	0.32	-	0.12	-	-	390.83	27.14	413		14	
15			13	49	305	81		48	0.36	50	0.19	10.23	60.34			-	12	6	-		-	0.26	-	0.14	-	-	316.29	60.34	371		101	
16			-	50	311	-		-	0.36	48	0.20	11.44	59.33			-	12	6	-		-	0.26	-	0.14	-	-	322.61	59.33	377		101	
17			-	51	317	-		-	0.35	46	0.21	12.55	58.37			-	12	6	-		-	0.26	-	0.14	-	-	328.93	58.37	382		17	
18			-	52	323	-		-	0.34	44	0.22	13.61	57.59			-	12	6	-		-	0.26	-	0.14	-	-	335.25	57.59	387		18	
19			-	53	330	-		-	0.33	42	0.22	14.63	56.92			-	12	6	-		-	0.26	-	0.14	-	-	341.57	56.92	393		19	
20			-	54	336	-		-	0.32	41	0.23	15.54	56.29			-	12	6	-		-	0.22	-	0.16	-	-	347.89	56.29	398		20	
21			-	55	342	-		-	0.32	39	0.23	16.46	55.80			-	12	6	-		-	0.22	-	0.16	-	-	354.21	55.80	404		21	
22			-	56	348	-		-	0.31	38	0.24	17.28	55.35			-	12	7	-		-	0.22	-	0.16	-	-	360.53	55.35	410		22	
23			-	57	355	-		-	0.30	37	0.25	18.10	54.91			-	12	7	-		-	0.22	-	0.16	-	-	366.85	54.91	416		23	
24			-	58	361	-		-	0.30	36	0.25	18.86	54.51			-	12	7	-		-	0.22	-	0.16	-	-	373.17	54.51	422		24	
25			-	59	367	-		-	0.29	35	0.26	19.60	54.17			-	13	7	-		-	0.19	-	0.17	-	-	379.49	54.17	428		25	
26			-	60	373	-		-	0.29	34	0.26	20.28	54.00			-	13	7	-		-	0.19	-	0.17	-	-	385.81	54.00	434		26	
27			-	61	379	-		-	0.28	33	0.26	20.95	53.84			-	13	7	-		-	0.19	-	0.17	-	-	392.13	53.84	440		27	
28			-	62	386	-		-	0.28	32	0.27	21.53	53.58			-	13	7	-		-	0.19	-	0.17	-	-	398.45	53.58	446		28	
29			-	63	392	-		-	0.27	31	0.27	22.16	53.36			-	13	7	-		-	0.19	-	0.17	-	-	404.77	53.36	452		29	
30			13	51	317	81		48	0.27	63	0.28	23.56	86.51			-	13	7	-		-	0.17	-	0.18	-	-	330.23	86.51	411		30	
31			-	52	323	-		-	0.26	61	0.28	24.96	85.49			-	13	7	-		-	0.17	-	0.18	-	-	336.55	85.49	418		31	
32			-	53	330	-		-	0.26	58	0.28	26.26	84.51			-	13	7	-		-	0.17	-	0.18	-	-	342.87	84.51	421		32	
33			-	54	336	-		-	0.25	56	0.29	27.47	83.68			-	13	7	-		-	0.17	-	0.18	-	-	349.19	83.68	427		33	
34			-	55	342	-		-	0.25	54	0.29	28.68	83.00			-	13	7	-		-	0.17	-	0.18	-	-	355.51	83.00	432		34	
35			-	56	348	-		-	0.25	53	0.29	29.74	82.31			-	14	7	-		-	0.15	-	0.19	-	-	361.83	82.31	438		35	
36			-	57	355	-		-	0.24	51	0.30	30.85	81.83			-	14	7	-		-	0.15	-	0.19	-	-	368.15	81.83	444		36	
37			-	58	361	-		-	0.24	50	0.30	31.81	81.34			-	14	7	-		-	0.15	-	0.19	-	-	374.47	81.34	449		37	
38			-	59	367	-		-	0.23	48	0.30	32.78	80.86			-	14	7	-		-	0.15	-	0.19	-	-	380.79	80.86	455		38	
39			-	60	373	-		-	0.23	47	0.31	33.70	80.43			-	14	7	-		-	0.15	-	0.19	-	-	387.11	80.43	461		39	
40			-	61	379	-		-	0.23	45	0.31	34.57	80.04			-	14	8	-		-	0.13	-	0.19	-	-	393.43	80.04	467		40	
41			-	62	386	-		-	0.22	44	0.31	35.34	79.82			-	14	8	-		-	0.13	-	0.19	-	-	399.75	79.82	473		41	
42			-	63	392	-		-	0.22	43	0.32	36.16	79.65			-	14	8	-		-	0.13	-	0.19	-	-	406.07	79.65	479		42	
43			-	64	398	-		-	0.22	42	0.32	36.88	79.38			-	14	8	-		-	0.13	-	0.19	-	-	412.39	79.38	485		43	
44			-	65	404	-		-	0.21	41	0.32	37.61	79.10			-	14	8	-		-	0.13	-	0.19	-	-	418.71	79.10	491		44	
45			13	53	330	81		48	0.21	73	0.32	39.15	112.24			-	15	8	-		-	0.12	-	0.20	-	-	344.17	112.24	450		45	
46			-	54	336	-		-	0.21	71	0.33	40.65	111.18			-	15	8	-		-	0.12	-	0.20	-	-	350.49	111.18	455		46	
47			-	55	342	-		-	0.20	68	0.33	42.10	110.21			-	15	8	-		-	0.12	-	0.20	-	-	356.81	110.21	460		47	
48			-	56	348	-		-	0.20	66	0.33	43.40	109.34			-	15	8	-		-	0.12	-	0.20	-	-	363.13	109.34	466		48	
49			-	57	355	-		-	0.20	64	0.33	44.70	108.62			-	15	8	-		-	0.12	-	0.20	-	-	369.45	108.62	471		49	
50			-	58	361	-		-	0.20	62	0.33	45.77	107.80			-	15	8	-		-	0.11	-	0.20	-	-	375.77	107.80	477		50	
51			-	59	367	-		-	0.19	60	0.33	46.88	107.20			-	15	8	-		-	0.11	-	0.20	-	-	382.09	107.20	482		51	
52			-	60	373	-		-	0.19	59	0.33	47.84	106.60			-	15	8	-		-	0.11	-	0.20	-	-	388.41	106.60	488		52	
53			-	61	379	-		-	0.19	57	0.33	48.81	106.00			-	15	8	-		-	0.11	-	0.20	-	-	394.73	106.00	494		53	
54			-	62	386	-		-	0.19	56	0.34	50.26	105.98			-	15	8	-		-	0.11	-	0.20	-	-	401.05	105.98	500		54	
55			-	63	392	-		-	0.18	54	0.34	51.12	105.48			-	16	8	-		-	0.10	-	0.20	-	-	407.37	105.48	506		55	
56			-	64	398	-		-	0.18	53	0.34	51.90	105.15			-	16	8	-		-	0.10	-	0.20	-	-	413.69	105.15	512		56	
57			-	65	404	-		-	0.18	52	0.34	52.72	104.87			-	16	8	-		-	0.10	-	0.20	-	-	420.01	104.87	518		57	
58			-	66	411	-		-	0.18	51	0.34	53.44	104.50			-	16	8	-		-	0.10	-	0.20	-	-	426.33	104.50	524		58	
59			-	67	417	-		-	0.18	50	0.35	54.65	104.60			-	16	9	-		-	0.10	-	0.20	-	-	432.65	104.60	530		59	
60			13	55	342	81		48	0.17	81	0.35	56.19	137.63			-	16	9	-		-	0.09	-	0.21	-	-	358.11	137.63	488		60	
61			-	56	348	-		-	0.17	79	0.35	57.69	136.47			-	16	9	-		-	0.09	-	0.21	-	-	364.43	136.47	493		61	
62			-	57	355	-		-	0.17	76	0.35	59.14	135.39			-	16	9	-		-	0.09	-	0.21	-	-	370.75	135.39	499		62	
63			-	58	361	-		-	0.17	74	0.35	60.44	134.42			-	16	9	-		-	0.09	-	0.21	-	-	377.07	134.42	504		63	
64			-	59	367	-		-	0.16	72	0.36	62.13	133.98			-	16	9	-		-	0.09	-	0.21	-	-	383.39	133.98	510		64	
65			-	60	373	-		-	0.16	70	0.36	63.19	133.05			-	17	9	-		-	0.08	-	0.21	-	-	389.71	133.05	515		65	
66			-	61	379	-		-	0.16	68	0.36	64.30	132.36			-	17	9	-		-	0.08	-	0.21	-	-	396.03	132.36	521		66	
67			-	62	386	-		-	0.16	66	0.36	65.27	131.68			-	17	9	-		-	0.08	-	0.21	-	-	402.35	131.68	526		67	
68			-	63	392	-		-	0.16	65	0.36	66.23	130.99			-	17	9	-		-	0.08	-	0.21	-	-	408.67	130.99	532		68	
69			-	64	398	-		-	0.15	63	0.37	68.07	131.27			-	17	9	-		-	0.08	-	0.21	-	-	414.99	131.27	536		69	
70			-	65	404	-		-	0.15	62	0.37	68.94	130.68			-	17	9	-		-	0.07	-	0.21	-	-	421.31	130.68	544		70	
71			-	66	411	-		-	0.15	61	0.37	69.71	130.28			-	17	9	-		-	0.07	-	0.21	-	-	427.63	130.28	550		71	
72			-	67	417	-		-	0.15	59	0.37	70.53	129.92			-	17	9	-		-	0.07	-	0.21	-	-	433.95	129.92	556		72	
73			-	68	423	-		-	0.15	58	0.37	71.26	129.47			-	17	9	-		-	0.07	-	0.21	-	-	440.27	129.47	562		73	

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Years	Conifer													Hardwood												Total					
	Starting Inventory (MBF/Acre)	Starting Inventory (CO2-e Tonnes/Acre)	Harvest (MBF/Acre)	Annual Inventory Estimate (MBF/acre)	Estimated CO2 equivalent in Inventory (Metric Tonnes/A	Estimated CO2 equivalent harvested in total tree	Portion of Harvest Delivered to Mill	Amount CO2 equivalent transferred to the mill (bole portion	In Use Decay Curve of Wood Products (Conifer) (%)	CO2 -e in in-use harvested wood products (Metric Tonnes/Acre)	Fraction of CO2 equivalent remaining in landfills (%)	CO2 -e in Landfills (Metric Tonnes/Acre)	Combined CO2-e in Landfills and In-use (Metric	Starting Inventory (BA/Acre)	Starting Inventory CO2-e (Metric Tonnes/Acre)	Harvest (BA/Acre)	Annual Inventory (BA/acre)	Estimated CO2 equivalent in Inventory (Metric Tonnes/A	Estimated CO2 equivalent harvested in total tree	Portion of Harvest Delivered to Mill (%)	Amount CO2 equivalent transferred to the mill (bole portion	In Use Decay Curve of Wood Products (Conifer) (Metric Tonnes/A	CO2 -e in in-use harvested wood products (Metric Tonnes/Acre)	Fraction of CO2 equivalent remaining in landfills (%)	CO2 -e in Landfills (Metric Tonnes/Acre)	Combined CO2-e in Landfills and In-use (Metric	CO2-e in Standing Inventories (Metric Tonnes/Acre)	CO2-e in Harvested Wood Products (Metric Tonnes/Acre)	CO2-e in Inventories and in Harvested Wood Products (Metric	Initial CO2-e in Forest	Years in Which Project Sequestration Exceed Initial CO2-e	Number of Years for Growth and Harvested Wood Products
74			-	69	429	-		-	0.15	57	0.38	72.80	129.83			-	17	9	-		-	0.07	-	0.21	-	-	446.69	129.83	568		74	
75			13	57	355	81		48	0.15	88	0.38	74.34	162.79			-	18	9	-		-	0.07	-	0.21	-	-	372.05	162.79	527		75	
76			-	55	361	-		-	0.14	86	0.38	75.84	161.54			-	18	9	-		-	0.07	-	0.21	-	-	378.37	161.54	532		76	
77			-	59	367	-		-	0.14	83	0.38	77.29	160.39			-	16	9	-		-	0.07	-	0.21	-	-	384.69	160.39	537		77	
78			-	60	373	-		-	0.14	81	0.38	78.59	159.34			-	18	10	-		-	0.07	-	0.21	-	-	391.01	159.34	542		78	
79			-	61	379	-		-	0.14	79	0.38	80.57	159.12			-	18	10	-		-	0.07	-	0.21	-	-	397.33	159.12	548		79	
80			-	62	386	-		-	0.14	76	0.38	81.63	158.10			-	18	10	-		-	0.06	-	0.21	-	-	403.65	158.10	553		80	
81			-	63	392	-		-	0.14	75	0.38	82.74	157.35			-	18	10	-		-	0.06	-	0.21	-	-	409.97	157.35	559		81	
82			-	64	398	-		-	0.13	73	0.38	83.71	156.60			-	18	10	-		-	0.06	-	0.21	-	-	416.29	156.60	564		82	
83			-	65	404	-		-	0.13	71	0.38	84.68	155.84			-	18	10	-		-	0.06	-	0.21	-	-	422.61	155.84	570		83	
84			-	66	411	-		-	0.13	70	0.39	86.85	156.39			-	18	10	-		-	0.06	-	0.21	-	-	428.93	156.39	577		84	
85			-	67	417	-		-	0.13	68	0.39	87.72	155.74			-	19	10	-		-	0.06	-	0.22	-	-	435.25	155.74	582		85	
86			-	68	423	-		-	0.13	67	0.39	88.49	155.27			-	19	10	-		-	0.06	-	0.22	-	-	441.57	155.27	588		86	
87			-	69	429	-		-	0.13	66	0.39	89.31	154.86			-	19	10	-		-	0.06	-	0.22	-	-	447.89	154.86	594		87	
88			-	70	435	-		-	0.13	64	0.39	90.03	154.35			-	19	10	-		-	0.06	-	0.22	-	-	454.21	154.35	600		88	
89			-	71	442	-		-	0.13	63	0.40	91.87	154.95			-	19	10	-		-	0.06	-	0.22	-	-	460.53	154.95	607		89	
90			13	59	367	81		48	0.12	94	0.40	93.41	187.84			-	19	10	-		-	0.05	-	0.22	-	-	386.99	187.84	565		90	
91			-	60	373	-		-	0.12	92	0.40	94.91	186.53			-	19	10	-		-	0.05	-	0.22	-	-	392.31	186.53	570		91	
92			-	61	379	-		-	0.12	89	0.40	96.36	185.31			-	19	10	-		-	0.05	-	0.22	-	-	398.63	185.31	575		92	
93			-	62	386	-		-	0.12	87	0.40	97.66	184.20			-	19	10	-		-	0.05	-	0.22	-	-	404.95	184.20	580		93	
94			-	63	392	-		-	0.12	84	0.40	99.88	184.14			-	19	10	-		-	0.05	-	0.22	-	-	411.27	184.14	586		94	
95			-	64	398	-		-	0.12	82	0.40	100.94	183.06			-	20	10	-		-	0.05	-	0.22	-	-	417.59	183.06	592		95	
96			-	65	404	-		-	0.12	80	0.40	102.06	182.26			-	20	11	-		-	0.05	-	0.22	-	-	423.91	182.26	597		96	
97			-	66	411	-		-	0.12	78	0.40	103.02	181.46			-	20	11	-		-	0.05	-	0.22	-	-	430.23	181.46	603		97	
98			-	67	417	-		-	0.11	77	0.40	103.99	180.66			-	20	11	-		-	0.05	-	0.22	-	-	436.55	180.66	608		98	
99			-	68	423	-		-	0.11	75	0.41	106.40	181.40			-	20	11	-		-	0.05	-	0.22	-	-	442.87	181.40	615		99	
100			-	69	429	-		-	0.11	73	0.41	107.27	180.70			-	20	11	-		-	0.05	-	0.22	-	-	449.19	180.70	621		100	
																										-	-				

Elk THP Summary (clearcut/tractor)			Years until Carbon Stocks are Recouped from Initial Harvest (Includes Carbon in Live Trees, Harvested Wood Products, and Landfill)
	Beginning Stocks	Ending Stocks	
Emissions Source/Sink/Reservoir	Metric Tonnes CO2 Equivalent Per Acre Basis		40 Years
Live Trees (Conifers and Hardwoods)	233.29	248.82	
Wood Products		202.08	
Site Preparation Emissions		0.00	
Non-biological emissions associated with harvesting		-7.23	
Non-biological emissions associated with milling		-2.61	
Sum of Net Emissions/Sequestration over Identified Harvest Cycles (CO2 metric tonnes)		207.77	
Project Summary			
Project Acres	Step 17- Insert the acres that are part of the harvest area.	24	
Total Project Sequestration over defined Harvesting Periods (CO2 metric tonnes)		4,986	

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Elk THP Clearcut/Tractor Project Carbon Accounting: Inventory, Growth, and Harvest

This worksheet addresses the sequestation and emissions associated with the project area's balance of harvest, inventory, and growth plus any emissions associated with site preparation. Complete the input for Steps 0- 8 on this worksheet.

Forest Type				Harvest Periods	Inventory		Growth Rates		Harvest Volume	
Multipliers to Estimate Carbon Tonnes per MBF (Sampson, 2002)				Time of Harvest (years from project approval)	Conifer Live Tree Volume (MBF/Acre) - Prior to Harvest	Hardwood Live Tree Volume (BA square feet/Acre) - Prior to Harvest	Conifer Growth Rate BF/Acre/Year	Hardwood Growth Rate BA/Acre/Year	Conifer Harvest Volume (MBF/acre)	Hardwood Harvested / Treated Basal Area (BA/Acre)
Forest Type	Identify the approximate percentage of conifers by volume within the harvest plan. Must sum to	Multiplier from Cubic Feet (merchantable) to Total Biomass	Pounds Carbon per Cubic Foot	**Step 1.** Enter the anticipated future harvest entries. The re-entry cycles should be supported by management plan, if available.	**Step 2.** Enter the estimated conifer inventory (mbf/acre) present in project area prior to harvest.	**Step 3.** Enter the estimated hardwood inventory (basal area per acre) present in project area prior to harvest.	**Step 4.** Enter the average annual periodic growth of conifers between harvests based on estimated growth in management plan, if available. Must be entered for each harvest cycle identified in	**Step 5.** Insert average annual periodic growth of hardwoods between harvests based on estimated growth in management plan, if available.	**Step 6.** Enter the estimated conifer harvested per acre at current and future entries. The estimate should be based on projections from the management plan, if	**Step 7.** Enter estimated hardwood basal area harvested/treated per acre
Douglas-fir	40%	1.675	14.38	0	32.5	50	600	0.5	32	40
Redwood	60%	1.675	13.42	60	38.5	40	600	0.5	36.5	32.5
Pines	0%	2.254	12.14	120	36	37.5	600	0.5	36	32.5
True firs	0%	2.254	11.18	0	0	0	0	0	0	0
Hardwoods		2.214	11.76	0	0	0	0	0	0	0
		Pounds per Metric Tonne		0	0	0	0	0	0	0
Conversion of Board Feet to Cubic Feet	0.165		2.204	0	0	0	0	0	0	0
Multipliers to Estimate Total Carbon Tonnes per MBF	Conifer	1.73		0	0	0	0	0	0	0
	Hardwoods	1.95		0	0	0	0	0	0	0
Multipliers to Estimate Merchantable Carbon Tonnes per MBF	Conifer	1.03		0	0	0	0	0	0	0
	Hardwoods	0.88		0	0	0	0	0	0	0

User must enter harvest cycles to 100 years and/or at least three entry cycles.

Harvest Periods	Inventory Conversion to Carbon (prior to harvest)		Inventory Conversion to Carbon Dioxide Equivalent (prior to harvest)		Site Preparation	
	Conifer Live Tree Tonnes (C/acre)	Hardwood Live Trees Tonnes (C/acre)	Conifer Live Tree Tonnes (CO_2 equivalent/acre)	Hardwood Live Tree Tonnes (CO_2 equivalent/acre)	**Step 8.** Enter the value (in bold) for each harvest cycel that best reflects the site preparation activities, as averaged across the project area:	
from above (Time of Harvest as years from project approval)	**Computed:** MBF * Conifer Multiplier from Step 0.	**Computed:** BA*Volume/Basal Area Ration (to convert to MBF) * Hardwood Multiplier from Step 0.	**Computed:** Conversion of carbon to CO_2 (3.67 tonnes CO2 per 1 tonne Carbon)	**Computed:** Conversion of carbon to CO_2 (3.67 tonnes CO2 per 1 tonne Carbon)	**Heavy- 50% or more of the project area is covered with brush and removed as part of site preparation or stumps are removed (mobile emissions estimated at .429 metric tonnes CO2e per acre, biological emissions estimated at 2 metric tonnes CO2e per acre)** **Medium - >25% <50% of the project area is covered with brush and removed as part of site preparation (mobile emissions estimated at .202 metric tonnes CO2e per acre, biological emissions estimated at 1 metric tonne per acre).** **Light - 25% or less of the project area is covered with brush and is removed as part of site preparation (mobile emissions estimated at .09 metric tonnes CO2e per acre, biological emissions estimated at .5 metric tonnes per acre).** None - No site preparation is conducted.	
0	56	7	206	27	None	0
60	63	6	232	21	None	0
120	62	5	229	20	None	0
0	0	0	0	0	None	0
0	0	0	0	0	none	0
0	0	0	0	0	None	0
0	0	0	0	0	None	0
0	0	0	0	0	None	0
0	0	0	0	0	None	0
	Difference between ending stocks and beginning stocks		22	-6.71	Sum of emissions (Metric Tonnes CO2e) per acre	0

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Project Carbon Accounting: Harvested Wood Products and Processing Emissions

This worksheet addresses the non-biological emissions associated with the project area's harvesting activities. Complete the input for Steps 15- 16 on this worksheet.

Harvest Periods	Quantity of Forest Carbon Delivered to Mills				Non-Biological Emissions Associated with Mills	Quantity of Forest Carbon Remaining Immediately After Milling (Mill Efficiency)		Long-Term Sequestration in Wood Products	
	Conifer Percentage Delivered to Mills	Hardwood Percentage Delivered to Mills	Conifer CO2e Delivered to Mills / Acre	Hardwood CO2 equivalent Delivered to Mills / Acre	**Assumption.** 20 kw/hour (mill energy use) /(40mbf lumber processed/hour) *(.05 metric tonnes/kw hour) * mbf processed	**Computed.** Remaining CO2 equivalent after Milling Efficiency for Conifers	**Computed.** Remaining CO2 equivalent after Milling Efficiency for Hardwoods	**Computed.** CO2 Equivalent Tonnes in Conifer Wood Products in Use-100 Year Weighted Average / Acre and Landfill	**Computed.** CO2 Equivalent Tonnes in Hardwood Wood Products in Use-100 Year Weighted Average / Acre
from Inventory, Growth, and Harvest Page (Time of Harvest as years from project approval)	**Step 15.** Insert the percentage of conifer trees harvested that are subsequently delivered to sawmills	**Step 16.** Insert the percentage of hardwoods harvested or treated that are subsequently delivered to sawmills	**Computed:** The merchantable portion determined by the conversion factors (Sampson, 2002) on the Inventory, Growth, and Harvest worksheet. This is multiplied by the percent delivered to mills to reflect the carbon delivered to mills.	**Computed:** The merchantable portion determined by the conversion factors (Sampson, 2002) on the Inventory, Growth, and Harvest worksheet. This is multiplied by the percent delivered to mills to reflect the carbon delivered to mills.	**Calculated.** **The CO2e associated with processing the logs at the mill**	The difference between carbon delivered to mills and carbon remaining after milling is assumed to be emitted immediately		**Estimate.** The weighted average carbon remaining in use at year 100 is 46.3%	**Estimate.** The weighted average carbon remaining in use at year 100 is 23.0%
						The efficiency rating from mills in California is 0.67 (DOE 1605b) for conifers	The efficiency rating from mills in California is .5 (DOE 1605b) for hardwoods	**Estimate.** The carbon in landfills at year 100 is 29.8% of the initial carbon produced in wood products.	**Estimate.** The carbon in landfills at year 100 is 29.8% of the initial carbon produced in wood products.
0	100%	0%	121.36	0.00	-0.80	81.31	0.00	61.88	0.00
60	100%	0%	138.43	0.00	-0.91	92.75	0.00	70.58	0.00
120	100%	0%	136.54	0.00	-0.90	91.48	0.00	69.62	0.00
0	100%	0%	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0	100%	0%	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0	100%	0%	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0	100%	0%	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0	100%	0%	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0	0%	0%	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0	0%	0%	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0	0%	0%	0.00	0.00	0.00	0.00	0.00	0.00	0.00
		Sum of emissions associate with processing of lumber			-2.61	Sum of CO2 equivalent in wood products		202.08	0.00

Project Carbon Accounting: Harvesting Emissions

This worksheet addresses the non-biological emissions associated with the project area's harvesting activities. Complete the input for Steps 9- 14 on this worksheet.

Harvest Periods	Falling Operations	Production per Day	Emissions Associated with Yarders and Loaders			Emissions Associated with Tractors and Skidders			Emissions Associated with Helicopters			Landing Saws	Trucking Emissions		
from Inventory, Growth, and Harvest Page (Time of Harvest as years from project approval)	**Assumption:** ((.25 gallons gasoline per MBF harvested * 5.33 (pounds carbon per gallon))/2205(conversion to metric tonnes)* mbf per acre harvested	MBF (all species) Yarded Delivered to Landing	**Assumption:**(((35 gallons diesel per day per piece of equipment * 6.12 pounds carbon / gallon)/2205 to convert to metric tonnes carbon)* 3.67 to convert to metric tonnes CO2 equivalent)/Production per Day			**Assumption:** (((55 gallons diesel per day per piece of equipment * 6.12 pounds carbon / gallon)/2205 to convert to metric tonnes carbon)* 3.67 to convert to metric tonnes CO2 equivalent)/Production per Day			**Assumption:** (((200 gallons jet fuel per day per piece of equipment * 5 pounds carbon / gallon)/2205 to convert to metric tonnes carbon)* 3.67 to convert to metric tonnes CO2 equivalent)/Production per Day			**Assumption:** (((.16 gallons gasoline per MBF * 5.33 (pounds carbon per gallon))/2205(conversion to metric tonnes)* 3.67 to convert to metric tonnes CO2 equivalent)/mbf per acre harvested. Applies to all species whether harvested or not.	**Assumption:** Round Trip Hours/Load average (from below, to compute the mbf/hour) /((6 gallons diesel/hour * 6.12 pounds carbon/gallon)/2205 (conversion to metric tonnes carbon))*3.67 (conversion to metric tonnes carbon dioxide equivalent)		
	Computed. Metric Tonnes CO2 equivalent per mbf harvested Applies to all species whether harvested or treated	**Step 9.** Enter the estimated volume delivered to the landing in a day.	**Step 10.** Enter number of pieces of equipment in use per day for each harvest entry	**Computed.** Yarders and Loaders CO2 equivalient/mbf (metric tonnes)	**Computed.** Yarders and Loaders CO2 equivalent per Acre Harvested (metric tonnes)	**Step 11.** Enter number of pieces of equipment in use per day for each harvest entry	**Computed.** Tractor and skidder CO2 equivalient/mbf (metric tonnes)	**Computed.** Tractors and Skidders CO2 equivalent per Acre Harvested (metric tonnes)	**Step 12.** Enter number of pieces of equipment in use per day for each harvest entry	**Computed.** Helicopter CO2 equivalient/mbf (metric tonnes)	**Computed.** Helicopters CO2 equivalent per Acre Harvested (metric tonnes)	**Computed.** Landing Saws CO2 equivalent per Acre Harvested (metric tonnes)	**Steps 13 and 14 below**		**Computed.** Estimated Metric Tonnes CO2e per harvested acre for each harvesting period.
0	(0.08)	45	1	-0.01	-0.25	3	-0.04	-1.20	0	0.00	0.00	-0.05	**Step 13.** Enter Estimated Load Average: MBF/Truck	5	-0.639477551
60	(0.09)	45	1	-0.01	-0.29	3	-0.04	-1.36	0	0.00	0.00	-0.06			-0.729404082
120	(0.09)	45	1	-0.01	-0.29	3	-0.04	-1.34	0	0.00	0.00	-0.05	**Step 14.** Enter Estimated Round Trip Haul In Hours	6	-0.719412245
0	-	0	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0.00			0
0	-	0	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0.00			0
0	-	0	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0.00			0
0	-	0	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0.00			0
0	-	0	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0.00			0
0	-	0	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0.00			0
0	-	0	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0.00			0
Sum Emissions	**-0.25**				**-0.83**			**-3.90**			**0.00**	**-0.16**			**-2.09**

Years	Conifer													Hardwood												Total				
	Starting Inventory (MBF/Acre)	Starting Inventory (CO2-e Tonnes/Acre)	Harvest (MBF/Acre)	Annual Inventory Estimate (MBF/acre)	Estimated CO2 equivalent in Inventory (Metric Tonnes/A	Estimated CO2 equivalent harvested in total tree	Portion of Harvest Delivered to Mill	Amount CO2 equivalent transferred to the mill (bole portion	In Use Decay Curve of Wood Products (Conifer) (%)	CO2 -e in In-use harvested wood products (Metric Tonnes/Acre)	Fraction of CO2 equivalent remaining in landfills (%)	CO2 -e in Landfills (Metric Tonnes/Acre)	Combined CO2-e in Landfills and In-use (Metric	Starting Inventory (BA/Acre)	Starting Inventory CO2-e (Metric Tonnes/Acre)	Harvest (BA/Acre)	Annual Inventory (BA/acre)	Estimated CO2 equivalent in Inventory (Metric Tonnes/A	Estimated CO2 equivalent harvested in total tree	Portion of Harvest Delivered to Mill (%)	Amount CO2 equivalent transferred to the mill (bole portion	In Use Decay Curve of Wood Products (Conifer) (Metric Tonnes/A	CO2 -e in in-use harvested wood products (Metric Tonnes/Acre)	Fraction of CO2 equivalent remaining in landfills (%)	CO2 -e in Landfills (Metric Tonnes/Acre)	Combined CO2-e in Landfills and In-use (Metric	CO2-e in Standing Inventories (Metric Tonnes/Acre)	CO2-e in Harvested Wood Products (Metric Tonnes/Acre)	CO2-e in Inventories and in Harvested Wood Products (Metric	Initial CO2-e in Forest	Years in Which Project Sequestration Exceed Initial CO2-e	Number of Years for Growth and Harvested Wood Products
Pre-harvest	33	206	32	1	3	203	100%	121	0.68	82	0.02	2.18	84.11	50	27	40	10	5	21	0%	-	0.57	-	-	-	-	13.18	84.11	93	233	101	40
1			-	1	7	-		-	0.64	77	0.04	4.25	81.56			-	11	6	-		-	0.53	-	0.02	-	-	17.49	81.56	94		101	
2			-	2	11	-		-	0.60	73	0.05	6.19	79.25			-	11	6	-		-	0.49	-	0.03	-	-	21.80	79.25	95		101	
3			-	2	15	-		-	0.57	69	0.07	8.13	77.55			-	12	6	-		-	0.46	-	0.05	-	-	26.11	77.55	98		101	
4			-	3	18	-		-	0.55	66	0.08	9.83	75.97			-	12	6	-		-	0.44	-	0.06	-	-	30.42	75.97	101		101	
5			-	4	22	-		-	0.52	63	0.09	11.41	74.64			-	13	7	-		-	0.41	-	0.07	-	-	34.73	74.64	104		101	
6			-	4	26	-		-	0.50	60	0.11	12.89	73.43			-	13	7	-		-	0.39	-	0.08	-	-	39.05	73.43	106		101	
7			-	5	30	-		-	0.48	58	0.12	14.44	72.45			-	14	7	-		-	0.37	-	0.09	-	-	43.36	72.45	110		101	
8			-	5	34	-		-	0.46	56	0.13	15.78	71.36			-	14	8	-		-	0.35	-	0.10	-	-	47.67	71.36	113		101	
9			-	6	37	-		-	0.44	53	0.14	17.11	70.51			-	15	8	-		-	0.33	-	0.11	-	-	51.98	70.51	116		101	
10			-	7	41	-		-	0.42	51	0.15	18.33	69.78			-	15	8	-		-	0.32	-	0.12	-	-	56.29	69.78	119		101	
11			-	7	45	-		-	0.41	50	0.16	19.54	69.52			-	16	8	-		-	0.32	-	0.12	-	-	60.60	69.52	123		101	
12			-	8	49	-		-	0.40	48	0.17	20.63	69.13			-	16	9	-		-	0.32	-	0.12	-	-	64.92	69.13	127		101	
13			-	8	53	-		-	0.39	47	0.18	21.80	68.62			-	17	9	-		-	0.32	-	0.12	-	-	69.23	68.62	130		101	
14			-	9	57	-		-	0.38	46	0.19	22.70	68.23			-	17	9	-		-	0.32	-	0.12	-	-	73.54	68.23	134		101	
15			-	10	60	-		-	0.36	44	0.19	23.54	67.60			-	18	9	-		-	0.26	-	0.14	-	-	77.85	67.60	137		101	
16			-	10	64	-		-	0.36	43	0.20	24.52	67.60			-	18	10	-		-	0.26	-	0.14	-	-	82.16	67.60	141		101	
17			-	11	68	-		-	0.35	42	0.21	25.37	67.48			-	19	10	-		-	0.26	-	0.14	-	-	86.47	67.48	145		101	
18			-	11	72	-		-	0.34	41	0.22	26.09	67.24			-	19	10	-		-	0.26	-	0.14	-	-	90.79	67.24	149		101	
19			-	12	76	-		-	0.33	40	0.22	26.94	67.11			-	20	10	-		-	0.26	-	0.14	-	-	95.10	67.11	153		101	
20			-	13	79	-		-	0.32	39	0.23	27.67	66.87			-	20	11	-		-	0.22	-	0.16	-	-	99.41	66.87	157		101	
21			-	13	83	-		-	0.32	38	0.23	28.40	66.85			-	21	11	-		-	0.22	-	0.16	-	-	103.72	66.85	161		101	
22			-	14	87	-		-	0.31	38	0.24	29.01	66.70			-	21	11	-		-	0.22	-	0.16	-	-	108.03	66.70	165		101	
23			-	14	91	-		-	0.30	37	0.25	29.73	66.68			-	22	12	-		-	0.22	-	0.16	-	-	112.34	66.68	169		101	
24			-	15	95	-		-	0.30	36	0.25	30.34	66.53			-	22	12	-		-	0.22	-	0.16	-	-	116.66	66.53	173		101	
25			-	15	98	-		-	0.29	35	0.26	30.95	66.39			-	23	12	-		-	0.19	-	0.17	-	-	120.97	66.39	177		101	
26			-	16	102	-		-	0.29	35	0.26	31.43	66.24			-	23	12	-		-	0.19	-	0.17	-	-	125.28	66.24	181		101	
27			-	17	106	-		-	0.28	34	0.26	32.04	66.22			-	24	13	-		-	0.19	-	0.17	-	-	129.59	66.22	185		101	
28			-	17	110	-		-	0.28	34	0.27	32.53	66.07			-	24	13	-		-	0.19	-	0.17	-	-	133.90	66.07	189		101	
29			-	18	114	-		-	0.27	33	0.27	33.01	65.93			-	25	13	-		-	0.19	-	0.17	-	-	138.21	65.93	193		101	
30			-	19	118	-		-	0.27	32	0.28	33.50	65.78			-	25	13	-		-	0.17	-	0.18	-	-	142.52	65.78	197		101	
31			-	19	121	-		-	0.26	32	0.28	33.96	65.76			-	26	14	-		-	0.17	-	0.18	-	-	146.84	65.76	201		101	
32			-	20	125	-		-	0.26	31	0.28	34.47	65.73			-	26	14	-		-	0.17	-	0.18	-	-	151.15	65.73	205		101	
33			-	20	129	-		-	0.25	31	0.29	34.83	65.59			-	27	14	-		-	0.17	-	0.18	-	-	155.46	65.59	209		101	
34			-	21	133	-		-	0.25	30	0.29	35.32	65.56			-	27	14	-		-	0.17	-	0.18	-	-	159.77	65.56	213		101	
35			-	22	137	-		-	0.25	30	0.29	35.68	65.42			-	28	15	-		-	0.15	-	0.19	-	-	164.08	65.42	217		101	
36			-	22	140	-		-	0.24	29	0.30	36.17	65.44			-	28	15	-		-	0.15	-	0.19	-	-	168.39	65.44	221		101	
37			-	23	144	-		-	0.24	29	0.30	36.53	65.34			-	29	15	-		-	0.15	-	0.19	-	-	172.71	65.34	225		101	
38			-	23	148	-		-	0.23	28	0.30	36.89	65.25			-	29	16	-		-	0.15	-	0.19	-	-	177.02	65.25	229		101	
39			-	24	152	-		-	0.23	28	0.31	37.26	65.15			-	30	16	-		-	0.15	-	0.19	-	-	181.33	65.15	233		101	
40			-	25	156	-		-	0.23	27	0.31	37.62	65.05			-	30	16	-		-	0.13	-	0.19	-	-	185.64	65.05	237		40	
41			-	25	159	-		-	0.22	27	0.31	37.87	64.91			-	31	16	-		-	0.13	-	0.19	-	-	189.95	64.91	241		41	
42			-	26	163	-		-	0.22	27	0.32	38.23	64.88			-	31	17	-		-	0.13	-	0.19	-	-	194.26	64.88	245		42	
43			-	26	167	-		-	0.22	26	0.32	38.59	64.86			-	32	17	-		-	0.13	-	0.19	-	-	198.58	64.86	249		43	
44			-	27	171	-		-	0.21	26	0.32	38.84	64.71			-	32	17	-		-	0.13	-	0.19	-	-	202.89	64.71	253		44	
45			-	28	175	-		-	0.21	25	0.32	39.20	64.69			-	33	17	-		-	0.12	-	0.20	-	-	207.20	64.69	257		45	
46			-	28	179	-		-	0.21	25	0.33	39.44	64.59			-	33	18	-		-	0.12	-	0.20	-	-	211.51	64.59	261		46	
47			-	29	182	-		-	0.20	25	0.33	39.81	64.61			-	34	18	-		-	0.12	-	0.20	-	-	215.82	64.61	265		47	
48			-	29	186	-		-	0.20	24	0.33	40.05	64.52			-	34	18	-		-	0.12	-	0.20	-	-	220.13	64.52	269		48	
49			-	30	190	-		-	0.20	24	0.33	40.29	64.42			-	35	19	-		-	0.12	-	0.20	-	-	224.45	64.42	273		49	
50			-	31	194	-		-	0.20	24	0.33	40.29	64.08			-	35	19	-		-	0.11	-	0.20	-	-	228.76	64.08	277		50	
51			-	31	198	-		-	0.19	23	0.33	40.29	63.79			-	36	19	-		-	0.11	-	0.20	-	-	233.07	63.79	280		51	
52			-	32	201	-		-	0.19	23	0.33	40.29	63.50			-	36	19	-		-	0.11	-	0.20	-	-	237.38	63.50	284		52	
53			-	32	205	-		-	0.19	23	0.33	40.29	63.21			-	37	20	-		-	0.11	-	0.20	-	-	241.69	63.21	288		53	
54			-	33	209	-		-	0.19	23	0.34	41.63	64.25			-	37	20	-		-	0.11	-	0.20	-	-	246.00	64.25	293		54	
55			-	34	213	-		-	0.18	22	0.34	41.63	63.96			-	38	20	-		-	0.10	-	0.20	-	-	250.32	63.96	297		55	
56			-	34	217	-		-	0.18	22	0.34	41.63	63.69			-	38	20	-		-	0.10	-	0.20	-	-	254.63	63.69	301		56	
57			-	35	220	-		-	0.18	22	0.34	41.63	63.43			-	39	21	-		-	0.10	-	0.20	-	-	258.94	63.43	305		57	
58			-	35	224	-		-	0.18	22	0.34	41.63	63.16			-	39	21	-		-	0.10	-	0.20	-	-	263.25	63.16	308		58	
59			-	36	228	-		-	0.18	21	0.35	42.84	64.10			-	40	21	-		-	0.10	-	0.20	-	-	267.56	64.10	313		59	
60			37	-	-	232		138	0.17	114	0.35	45.33	159.77			33	6	4	17		-	0.09	-	0.21	-	-	7.50	159.77	164		101	
61			-	1	4	-		-	0.17	109	0.35	47.69	156.60			-	6	4	-		-	0.09	-	0.21	-	-	11.81	156.60	165		101	
62			-	1	8	-		-	0.17	104	0.35	49.90	153.70			-	9	5	-		-	0.09	-	0.21	-	-	16.12	153.70	166		101	
63			-	2	11	-		-	0.17	99	0.35	52.12	151.49			-	9	5	-		-	0.09	-	0.21	-	-	20.43	151.49	168		101	
64			-	2	15	-		-	0.16	95	0.36	55.03	150.40			-	10	5	-		-	0.09	-	0.21	-	-	24.75	150.40	171		101	
65			-	3	19	-		-	0.16	92	0.36	56.83	148.61			-	10	5	-		-	0.08	-	0.21	-	-	29.06	148.61	173		101	
66			-	4	23	-		-	0.16	88	0.36	58.62	147.01			-	11	6	-		-	0.08	-	0.21	-	-	33.37	147.01	176		101	
67			-	4	27	-		-	0.16	85	0.36	60.29	145.68			-	11	6	-		-	0.08	-	0.21	-	-	37.68	145.68	178		101	
68			-	5	30	-		-	0.16	82	0.36	61.81	144.22			-	12	6	-		-	0.08	-	0.21	-	-	41.99	144.22	181		101	
69			-	5	34	-		-	0.15	80	0.37	64.30	144.00			-	12	6	-		-	0.08	-	0.21	-	-	46.30	144.00	185		101	
70			-	6	38	-		-	0.15	77	0.37	65.69	142.95			-	13	7	-		-	0.07	-	0.21	-	-	50.62	142.95	188		101	
71			-	7	42	-		-	0.15	75	0.37	67.07	142.45			-	13	7	-		-	0.07	-	0.21	-	-	54.93	142.45	191		101	
72			-	7	46	-		-	0.15	73	0.37	68.32	141.81			-	14	7	-		-	0.07	-	0.21	-	-	59.24	141.81	195		101	
73			-	8	50	-		-	0.15	72	0.37	69.42	141.04			-	14	8	-		-	0.07	-	0.21	-	-	63.55	141.04	198		101	

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Years	Conifer													Hardwood												Total					
	Starting Inventory (MBF/Acre)	Starting Inventory (CO2-e Tonnes/Acre)	Harvest (MBF/Acre)	Annual Inventory Estimate (MBF/acre)	Estimated CO2 equivalent in Inventory (Metric Tonnes/A	Estimated CO2 equivalent harvested in total tree	Portion of Harvest Delivered to Mill	Amount CO2 equivalent transferred to the mill (bole portion	In Use Decay Curve of Wood Products (Conifer) (%)	CO2 -e in in-use harvested wood products (Metric Tonnes/Acre)	Fraction of CO2 equivalent remaining in landfills (%)	CO2 -e in Landfills (Metric Tonnes/Acre)	Combined CO2-e in Landfills and In-use (Metric	Starting Inventory (BA/Acre)	Starting Inventory CO2-e (Metric Tonnes/Acre)	Harvest (BA/Acre)	Annual Inventory (BA/acre)	Estimated CO2 equivalent in Inventory (Metric Tonnes/A	Estimated CO2 equivalent harvested in total tree	Portion of Harvest Delivered to Mill (%)	Amount CO2 equivalent transferred to the mill (bole portion	In Use Decay Curve of Wood Products (Conifer) (Metric Tonnes/A	CO2 -e in in-use harvested wood products (Metric Tonnes/Acre)	Fraction of CO2 equivalent remaining in landfills (%)	CO2 -e in Landfills (Metric Tonnes/Acre)	Combined CO2-e in Landfills and In-use (Metric	CO2-e in Standing Inventories (Metric Tonnes/Acre)	CO2-e in Harvested Wood Products (Metric Tonnes/Acre)	CO2-e in Inventories and In Harvested Wood Products (Metric	Initial CO2-e in Forest	Years in Which Project Sequestration Exceed Initial CO2-e	Number of Years for Growth and Harvested Wood Products
74			-	8	53	-		-	0.15	70	0.38	71.52	141.25			-	15	8	-		-	0.07	-	0.21	-	-	67.86	141.25	202		101	
75			-	9	57	-		-	0.15	68	0.38	72.49	140.34			-	15	8	-		-	0.07	-	0.21	-	-	72.17	140.34	206		101	
76			-	10	61	-		-	0.14	67	0.38	73.60	140.14			-	16	8	-		-	0.07	-	0.21	-	-	76.49	140.14	209		101	
77			-	10	65	-		-	0.14	65	0.38	74.57	139.62			-	16	9	-		-	0.07	-	0.21	-	-	80.80	139.62	213		101	
78			-	11	69	-		-	0.14	64	0.38	75.40	139.35			-	17	9	-		-	0.07	-	0.21	-	-	85.11	139.35	217		101	
79			-	11	72	-		-	0.14	63	0.38	77.09	139.76			-	17	9	-		-	0.07	-	0.21	-	-	89.42	139.76	221		101	
80			-	12	76	-		-	0.14	61	0.38	77.92	139.26			-	18	9	-		-	0.06	-	0.21	-	-	93.73	139.26	225		101	
81			-	13	80	-		-	0.14	60	0.38	78.75	139.07			-	18	10	-		-	0.06	-	0.21	-	-	98.04	139.07	229		101	
82			-	13	84	-		-	0.13	59	0.38	79.45	138.73			-	19	10	-		-	0.06	-	0.21	-	-	102.36	138.73	233		101	
83			-	14	88	-		-	0.13	58	0.38	80.28	138.53			-	19	10	-		-	0.06	-	0.21	-	-	106.67	138.53	236		83	
84			-	14	91	-		-	0.13	57	0.39	81.82	139.05			-	20	10	-		-	0.06	-	0.21	-	-	110.98	139.05	241		84	
85			-	15	95	-		-	0.13	56	0.39	82.51	138.71			-	20	11	-		-	0.06	-	0.22	-	-	115.29	138.71	245		85	
86			-	16	99	-		-	0.13	55	0.39	83.06	138.40			-	21	11	-		-	0.06	-	0.22	-	-	119.60	138.40	248		86	
87			-	16	103	-		-	0.13	54	0.39	83.76	138.23			-	21	11	-		-	0.06	-	0.22	-	-	123.91	138.23	252		87	
88			-	17	107	-		-	0.13	54	0.39	84.31	137.91			-	22	12	-		-	0.06	-	0.22	-	-	128.23	137.91	256		88	
89			-	17	111	-		-	0.13	53	0.40	85.59	138.33			-	22	12	-		-	0.06	-	0.22	-	-	132.54	138.33	261		89	
90			-	18	114	-		-	0.12	52	0.40	86.15	138.02			-	23	12	-		-	0.05	-	0.22	-	-	136.85	138.02	264		90	
91			-	19	118	-		-	0.12	51	0.40	86.70	137.82			-	23	12	-		-	0.05	-	0.22	-	-	141.16	137.82	268		91	
92			-	19	122	-		-	0.12	50	0.40	87.25	137.62			-	24	13	-		-	0.05	-	0.22	-	-	145.47	137.62	272		92	
93			-	20	126	-		-	0.12	50	0.40	87.67	137.29			-	24	13	-		-	0.05	-	0.22	-	-	149.78	137.29	276		93	
94			-	20	130	-		-	0.12	49	0.40	88.83	137.70			-	25	13	-		-	0.05	-	0.22	-	-	154.10	137.70	280		94	
95			-	21	133	-		-	0.12	48	0.40	89.24	137.36			-	25	13	-		-	0.05	-	0.22	-	-	158.41	137.36	284		95	
96			-	22	137	-		-	0.12	47	0.40	89.80	137.27			-	26	14	-		-	0.05	-	0.22	-	-	162.72	137.27	288		96	
97			-	22	141	-		-	0.12	47	0.40	90.21	137.03			-	26	14	-		-	0.05	-	0.22	-	-	167.03	137.03	292		97	
98			-	23	145	-		-	0.11	46	0.40	90.63	136.80			-	27	14	-		-	0.05	-	0.22	-	-	171.34	136.80	296		98	
99			-	23	149	-		-	0.11	46	0.41	91.65	137.18			-	27	14	-		-	0.05	-	0.22	-	-	175.65	137.18	300		99	
100			-	24	152	-		-	0.11	45	0.41	92.07	136.95			-	28	15	-		-	0.05	-	0.22	-	-	179.96	136.95	304		100	
																										-	-				

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H. Wildfire Risk and Assessment

1. Fire hazard severity zoning – The following Public Resources Codes directs the State for determining areas of financial responsibility in preventing and suppressing fires and the classification of fire hazard severity of those lands.

> **4125.** (a) The board shall classify all lands within the state, without regard to any classification of lands made by or for any federal agency or purpose, for the purpose of determining areas in which the financial responsibility of preventing and suppressing fires is primarily the responsibility of the state. The prevention and suppression of fires in all areas that are not so classified is primarily the responsibility of local or federal agencies, as the case may be.
>
> **4201.** The purpose of this article is to provide for the classification of lands within state responsibility areas in accordance with the severity of fire hazard present for the purpose of identifying measures to be taken to retard the rate of spreading and to reduce the potential intensity of uncontrolled fires that threaten to destroy resources, life, or property.
>
> **4202.** The director shall classify lands within state responsibility areas into fire hazard severity zones. Each zone shall embrace relatively homogeneous lands and shall be based on fuel loading, slope, fire weather, and other relevant factors present, including areas where winds have been identified by the department as a major cause of wildfire spread.
>
> **4203.** (a) The director shall, by regulation, designate fire hazard severity zones and assign to each zone a rating reflecting the degree of severity of fire hazard that is expected to prevail in the zone.

Wildland fire hazard responsibility areas of the State are generally classified as state, local or federal. The plan area lies within a state responsibility area (SRA). Referencing the FRAP map titled Mendocino County FIRE HAZARD SEVERITY ZONES IN SRA the plan area is located in a High zone.

The Mendocino County General Plan 2009 was also reviewed. County mapping of fire hazard severity defers to CAL FIREs maps particularly in the wildland and wildland urban interface areas. The County identifies the plan area located within the High zone of the SRA. The Gualala and Anchor Bay areas are served by the South Coast Fire Protection District and CALFIRE which has a station at the south end of Sea Ranch

2. Existing and probable future fuel conditions including vertical and horizontal continuity of live and dead fuels - Hazardous fuels are live and dead vegetation that has accumulated and increases the likelihood of unusually large wildland fires. When fire encounters areas of heavy fuel loads (continuous brush, downed vegetation or small trees) it can burn these surface and ladder fuels and may quickly move from a ground fire into a crown fire.

The plan area is a redwood and Douglas fir forest type approximately 2 miles from the coast. The timbered portion on the plan area is a closed canopy, open understory, well stocked redwood dominated stand with an estimated 10% herbaceous layer. The existing fuel condition within the plan area includes both vertical and horizontal continuity of live fuels. The vegetative community and the stand type, composition and density are presented in section III of the plan. Also contained within the section III Project Description is regional information (i.e., topography, aspect, climate regime) which provide background and insight for the assessment of wildfire risk.

Through management of the stand, postharvest fuel conditions will be modified. The Selection harvest method will significantly reduce the amount of ladder fuels. In many cases the overly dense, poor health and poor form trees are harvested to release the dominant and codominant conifers and promote natural regeneration. The selective removal of trees will result in crown separation reducing vertical and horizontal continuity within the stand. The retention of healthy conifers will improve the overall stand health and provide for a more fire resistant stand.

The portion of the THP that is clearcut silviculture (approximately 15% of the plan) will decrease available ladder and crown fuels while temporarily increasing surface fuels. The clearcut unit is at least ½ mile from the nearest adjacent landowner property line.

A significant increase in ground fuel generated by logging slash can be created as a result of logging operations. Where Fire Protection Zones exist slash treatment is addressed in section II of the plan. Across the balance of the plan area accumulations of slash is not anticipated. Landing sites are prone to slash accumulation and piles can be significant. The plan provides for piling and burning as hazard reduction at landings. Current practice observed is equipment bringing landing generated slash back out to the woods. This material is drifted out and packed into skid trails. This practice reduces the vertical continuity of ground fuel and provides for erosion control beyond those areas within the plan where treatment is required by the rules. Although the plan is not a fuel hazard reduction project, operations associated with the majority of this THP will have on the ground results similar to a shaded fuel break.

3. Location of known existing public and private fuel breaks and fuel hazard reduction activities – Fuel breaks are wide strips of land where trees and vegetation have been reduced or removed. These areas can slow, and even stop, the spread of a wildland fire because they provide fewer fuels to carry the fire. They also provide firefighters with safe zones to take a stand against a wildfire, or retreat from fire if the need arises. Typically, fuel breaks are located in strategic locations based upon terrain, existing roads, community areas, and other key access points. Fuel hazard reduction is generally the reduction of surface and ladder fuels and the overstory and understory vegetation is spatially separated so that a ground fire will not, under normal fire conditions, climb into the canopy and turn into a crown fire. This can be achieved by thinning out dense tree stands and preserving mature sized trees.

Within and adjacent to the plan area there are no known designated public or private fuelbreaks. There are no known CAL FIRE fuel treatment program projects adjacent to the plan area. The Sea Ranch Community Wildfire Protection Plan (CWPP) has been developed. General fuel reduction treatment goals and areas identified by The Sea Ranch CWPP address among other things, roadside fuel breaks and defensible space for structures.

Timber harvesting maintains, reuses and creates skid trails, cable corridors and truck roads whose presence by definition is a fuel break. The Gualala river and its tributaries act as natural fuel breaks. Fuel hazard reduction and slash treatment, where the condition or location exists, is addressed in section II of the plan. In this plan, slash will not be generated near roads used by the public or near structures used for human occupation which would require slash treatment. During logging operations there is generally equipment on site that would be suitable for the construction of fuelbreaks or to support CAL FIRE in fire suppression activities.

4. Road access for fire suppression resources- In the unfortunate event of wildfire the CALFIRE fire station at The Sea Ranch is approximately 7 air miles from the plan area and 11-12 miles by road. Access to the plan area is gained from the paved county road 501. The majority of appurtenant roads within the plan area are existing permanent rocked roads. Gates are generally left open during the day while active logging operations are occurring which would allow access for fire suppression resources. Gate openings can accommodate over-sized loads.

Finding: The potential for significant forest fuel loading will not be created within the plan area. The proposed project will not add to a cumulative increase in wildfire risk and hazard.

Cumulative Impacts Sources Of Information:

The following sources of information or persons were consulted for preparation of the Cumulative Impact Assessment.

A. **Watershed Resources:**

Thalweg profile analysis, Gualala river watershed assessment & cooperative monitoring program (2018)

GRWC Monitoring Plan Report 2000-2005, Kathleen Morgan 2006

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Dawson, T. E. 1996. The use of fog precipitation by plants in coastal redwood forests. Pages 90-93 in J. LeBlanc, editor. Proceedings of the conference on coast redwood forest ecology and management. University of California, Cooperative Extension, Forestry.

Lewis, J., S. Mori, E. Keppeler, and R. Ziemer. 2001. Impacts of logging on storm peak flows, flow volumes and suspended sediment loads in Caspar Creek, California. Pages 85-125 in: M. S. Wigmosta and Steven J. Burges editors. Land Use and Watersheds: Human Influence on Hydrology and Geomorphology in Urban and Forest Areas. Water Science and Application Volume 2, American Geophysical Union, Washington, D.C.

Regional Assessment of Stream Temperatures Across Northern California and their Relationship to Various Landscape-Level and Site Specific Attributes, Lewis et al. 2000, Forest Science Project, HSUF Arcata, CA

Gualala River Watershed Literature Search And Assimilation By Patrick Higgins 791 Eighth Street, Suite N, Arcata, CA 95521

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Gualala Redwood Timber LLC Stream Reports For The Years 1995 To 2018

Geo Hazard Maps Created By Tim Best, C.E.G.

USGS 7.5 min map Gualala and McGuire Ridge

Aerial Photographs- 1960 black and white photos and 2004 color photos and NAIP imagery

Lidar imagery of the Gualala River

Google Earth

B. **Soil Productivity:**
GRT's geographic information system maps

Soil Veg Maps- Dave Devries at Mesa Technical 2630 Hilgard Berkeley, CA 94709

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C. **Biological Resources:**
Sources Of Information:
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California Red Legged Frog Movement and Habitat Use , Dr. Gary Fellers, Western Ecology Research Center, July 2007

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Raptors of California, Hans and Pam Peeters, 2005 University of California Press

The Audubon Society Field Guide to North American Bird, John Whitaker, Alfred Knopf Inc 1992

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California Mammals, E.W. Jameson and Hans Peeters, University of California Press, Berkeley, 1988.

California's Wildlife, Vol. I - Amphibians and Reptiles, California Statewide Wildlife Habitat Relationships System, May 2, 1988.
California's Wildlife, Vol. II - Birds, California Statewide Wildlife Habitat Relationships System, November, 1990.
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Pam Town, Biologist, Billings Montana

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GRT property wide Rare Plant Assessment by Clare Golec, updated 2001

Nest Site Selection And Breeding Status Of Ospreys In The Gualala Redwoods, HJW

Wildlife Species With Special Status That May Be Present On Gualala Redwoods Or Other HJW Managed Properties By Lawrence Kobernus 1995 Updated By Troy Leopardo 1999

CDF Guidelines For Species Surveys. RPF Mass Mailing July 1999

Northwest Weeds, Ronald Taylor, Mountain Press Publishing 1990

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H: Fire Hazard Assessment Sources
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Mendocino County General Plan 2009

http://www.fire.ca.gov/fire_prevention/fire_prevention_wildland_codes

Additional Persons contacted for information on cumulative impacts analysis-
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