SECTION IV
CUMULATIVE IMPACTS ASSESSMENT

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

Yes ___XX___ No ________

The following is a list of past and present timber harvest plans within the **4,628** acre **Doty Creek** watershed **(1113.810003)** resources assessment area:

THP/NTMP#	Silviculture(2)	Yarding System(1)	Acres*	Plan Location
1-08NTMP-009M	GS	T	079	T11N, R15W, S 15, 22, 23
1-98NTMP-025M	SEL	T/C	055	T11N, R15W, S 3
1-11-105M	SEL, CC, STR, NC	T/C	134	T11N, R15W, S 14, 15, 22, 23
1-12-029M	CC	T/C	128	T11N, R15W, S 11, 12, 14
1-12-078M	VR, TR	T	006	T11N, R15W, S 3
1-16-094M	(adjacent but not within WAA per THP is within Robinson and Stewart Creek WAA)			
1-18-095M	SEL	T	199**	T11N, R15W, S 4, 9, 10, 14, 15, 23
1-19-00048M	VR	T	021	T11N, R15W, S 2
1-19-00098M	SEL	T	026	T11N, R15W, S 14
1-19-00191M	TR	T	007	T11N, R15W, S 3

* Approximate acres within assessment area
** Net area with 52 acres of no-cut netted out of gross THP acres

Harvest acreages in the above table indicate that a total of 521 acres or 11.2% of this watershed assessment area have been at least partially harvested in the past 10 years via Timber Harvest Plans. This total includes 225 acres of harvesting associated with THP's 1-18-095M and 1-19-00098M not yet undertaken due to permitting issues. Another 134 acres within this assessment area are managed under NTMPs bringing the total acreage managed for harvesting to 655 acres or 14.1% of the WAA. NTMP's by their nature restrict harvest levels to growth rates over a 10 year period. Considering that volume growth may be approximately 3% in these areas, a timber owner operating under a NTMP would be expected to cut no more than 30% of their stand in any 10 year period. With this in mind it may be more appropriate to consider site disturbance for a NTMP in a 10 year period to be closer to 30% of the stand rather than the entire acreage as reported in this summary. The current project proposes an additional 227+/- acres of harvesting as described in Section 2 of the THP. Harvested acreage noted above will increase by approximately 4.9 percent within the WAA as a result of the proposed harvest. This account of harvesting activities and the harvest rates over the past ten years was used in our evaluation of potential ongoing impacts to watershed resources as summarized herein.

(1) Equipment:	(2) Silviculture:	
T = Tractor	CC = Clearcut	SWR = Shelterwood Removal Cut
C = Cable	SEL = Selection	ST = Seed Tree Seed Cut
H = Helicopter	CT = Commercial Thin	STR = Seed Tree Removal Cut
	TR = Transition	GS = Group Selection
	SPC = Shelterwood Prep Cut	SS = Sanitation- Salvage
	RUA= Rehabilitation	R/W = Road right of way clearing
	AP = Alternative Prescription	SSC = Shelterwood Seed Cut
	NC = No Cut	STA = Special Treatment Area
	VR = Variable Retention	CONV = Conversion

The landowner (GRT) has completed the following commercial timber operations within the past ten years in this WAA.

1-11-105M	SEL, CC, STR, NC	T/C	134	T11N, R15W, S 14, 15, 22, 23
1-12-029M	CC	T/C	128	T11N, R15W, S 11, 12, 14

GRT has additionally filed the following THP's which are at least partially located within the Doty Creek WAA

1-18-095M	SEL	T	199**	T11N, R15W, S 4, 9, 10, 14, 15, 23
1-19-00098M	SEL	T	026	T11N, R15W, S 14

** Net area with 52 acres of no-cut netted out of gross THP acres

These plans although filed some time ago are yet to be approved. Their acreage is accounted for in the above "present and past" projects summary.

Within this WAA the GRT has one additional THP in the planning stages. The new Doty THP being developed in 2020 is currently envisioned to include approximately 50 acres selection silviculture, 67 acres clear cut and plant silviculture and 17 acres of transition silviculture. The harvest methods to be utilized will include both ground based skidding and cable yarding.

Within this WAA, the landowner has no currently foreseen plans for other commercial timber operations beyond that stated above and those planned in this THP within the next five years.

The following is a list of past and present timber harvest plans, within the 3,784 acre terrestrial biological assessment area as shown on the Terrestrial Biological Assessment Area map.

THP/NTMP#	Silviculture(2)	Yarding System(1)	Acres*	Plan Location
1-98NTMP-025M	SEL	T/C	050	T11N, R15W, S 3
1-02NTMP-037M	SEL	T/C	028	T11N, R15W, S 16
1-08NTMP-009M	GS	T/C	016	T11N, R15W, S 15
1-11-105M	CC	C	001	T11N, R15W, S 15
1-11-131M	TR, AP	T	017	T11N, R15W, S 11, 12, 13, 14
1-18-095M	SEL	T	103	T11N, R15W, S 3, 4, 9, 10, 15
1-19-00191M	TR, SEL, VR	T/C	228	T11N, R15W, S 3, 4, 5

* Approximate acres within assessment area
Please see previous paragraphs for abbreviation keys.

Harvest acreages in the above table indicate that a total of 349 acres or 9.2% of this watershed assessment area have been at least partially harvested in the past 10 years via Timber Harvest Plans. This total includes 103 acres of harvesting associated with THP 1-18-095M not yet undertaken due to permitting issues. Another 94 acres within this assessment area are managed under NTMPs bringing the total acreage managed for harvesting to 443 acres or 11.7% of the WAA. NTMP's by their nature restrict harvest levels to growth rates over a 10 year period. Considering that volume growth may be approximately 3% in these areas, a timber owner operating under a NTMP would be expected to cut no more than 30% of their stand in any 10 year period. With this in mind it may be more appropriate to consider site disturbance for a NTMP in a 10 year period to be closer to 30% of the stand rather than the entire acreage as reported in this summary. The current project proposes an additional 227+/- acres of harvesting as described in Section 2 of the THP. Harvested acreage noted above will increase by approximately 6.1 percent within the BAA as a result of the proposed harvest. This list of past harvesting activities and the harvest rates over the past ten years has been used in our evaluation of potential impacts on terrestrial biological resources as summarized within the discussions written for the various resource areas below in this section.

(1) Equipment:	(2) Silviculture:	
T = Tractor	CC = Clearcut	SWR = Shelterwood Removal Cut
C = Cable	SEL = Selection	ST = Seed Tree Seed Cut
H = Helicopter	CT = Commercial Thin	STR = Seed Tree Removal Cut
	TR = Transition	GS = Group Selection
	SPC = Shelterwood Prep Cut	SS = Sanitation- Salvage
	RUA= Rehabilitation	R/W = Road right of way clearing
	AP = Alternative Prescription	SSC = Shelterwood Seed Cut
	NC = No Cut	STA = Special Treatment Area
	VR = Variable Retention	CONV = Conversion

Past Projects: Early Land Use in the Assessment Area

Industrial scale logging began on the Mendocino coast in the 1850s or 1860s and progressed throughout the assessment areas by the early 1900s. Drainages were utilized for log transport, including ground lead skidding operations and the use of tramways and/or railroads along watercourses. Beginning in the late 1930s, many railroad grades were converted to truck roads, and tractor logging in the mid 1900s focused mainly on the logging of residuals, pockets of old-growth which were bypassed in earlier logging endeavors and the beginnings of second-growth logging in some areas. Portions of the assessment area were utilized for ranching activities, most probably involving periodic burning in an effort to maintain grazing land, throughout most of the early 1900s.

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

Yes __XX__ No ______

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

The Gualala River is included on the 303(d) list as impaired based on temperature and sediment conditions according to information located at http://www.waterboards.ca.gov/northcoast/water_issues/programs/tmdls/303d/.

The activities that are believed to have caused or contributed the continuing significant impacts are discussed above as earlier past projects. All resource subjects have been affected by these past projects to some extent. Where the affects from these past projects are considered significant, a discussion can be found under the affected resource assessment area, below.

Watershed and biological resources continue to be impacted by historical logging activities that occurred prior to the implementation of the modern Forest Practice Act. The effects of historical logging activities are noted for a much higher level of environmental impacts than exists under the current Forest Practice Rules. These logging activities which occurred many decades ago significantly affected watershed and terrestrial biological habitat in an adverse manner. Continuing effects of pre-Forest Practice Act land use activities include elevated background levels of sediment in streams, reduced shade canopy and protective cover along some streams or portions of streams and a reduction of terrestrial habitat for species which prefer larger older trees.

Modern timber harvesting operations have been conducted pursuant to the Z'berg Nejedly Forest Practices Act of 1973 and the associated regulations of the Board of Forestry. These projects have been conducted in a sensitive manner resulting in continuing improvement of watershed wide aquatic habitat and other environmental resource parameters. Continuing use of current best management practices and implementation of proactive mitigations conducted in conjunction with this and other proposed projects will insure that continued progress towards recovery is not impeded.

Potential impacts that this project may have on sediment discharge and stream temperatures can be minimized by careful project design and implementation. Sediment production is addressed by utilizing modern harvest practices, which minimize soil disturbing activities in areas, which have characteristically high sediment delivery ratios such as, steep slopes, unstable areas and WLPZ's. Water temperature issues are addressed by application of WLPZ shade canopy retention standards. Sites where the potential for elevated sediment production exists have been identified and sites that can be rehabilitated through remedial action are itemized in the THP and corrective action is called for. The potential for the proposed harvest to contribute to a significant adverse impact by increasing sediment or temperature levels in the downstream fluvial system is considered to be low for the following reasons:

a) WLPZ buffers to be utilized on Class I and Class II watercourses will result in maintenance of dense vegetative cover along these watercourses.
b) Equipment limitation zones on Class III watercourses and WLPZ prohibitions associated with Class I and II watercourses will limit site disturbance in these sensitive areas.
c) Soil disturbance on steep slopes is minimized by the use of cable yarding and tractor long line harvest methodologies.
d) Tractor road watercourse crossings are minimized.
e) Existing and potential sediment production sites have been identified and corrective action proposed.
f) New road construction is minimized to the extent possible while providing for cable yarding access.

Considering these practices the potential for significant sediment to be discharged into watercourses has been mitigated. Therefore, though the watershed is impaired from past land-use activities, this project will not have a significant additive effect.

3. Will the proposed project, as presented, in combination with past, present, and reasonably foreseeable, probable, future projects identified in item 1. and 2. above, have a reasonable potential to cause or add to significant cumulative impacts in any of the following resource subjects?

	Yes, after mitigation(a)	No, after mitigation(b)	No reasonably potential significant effects(c)
A. Watershed		**XX**	
B. Soil Productivity		**XX**	
C. Biological		**XX**	
D. Recreation			**XX**
E. Visual		**XX**	
F. Traffic			**XX**
G. Green House Gas (GHG)			**XX**
H. Wildfire Risk and Hazard			**XX**

(a) Yes, after mitigation, means that potential significant adverse cumulative impacts are left after application of the forest practice rules and mitigation or alternatives proposed in the THP.

(b) No, after mitigation, means that any potential for the proposed timber operations to cause or add to significant adverse cumulative impacts by itself or in combination with other projects has been substantially reduced to insignificance or avoided by mitigation measures or alternatives proposed in the THP and application of the forest practice rules.

(c) No reasonably potential significant cumulative effects means that the operations proposed under the THP 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.

4. If column (a) is checked in (3) above describe why the expected impacts cannot be feasibly mitigated or avoided and what mitigation measures or alternatives were considered to reach these determination impacts. If column (b) is checked in (3) above, describe what mitigation measures have been selected which will substantially reduce or avoid reasonably potential significant cumulative impacts except for those mitigation measures or alternatives mandated by application of the rules of the Board of Forestry.

A) Watershed Resources – (b) No, after mitigation:

a) Sediment effects – Sediment-induced cumulative watershed effects occur when earthen materials transported by surface or mass wasting erosion enter a stream or stream system at separate locations and are then combined at a downstream location to produce a significant adverse change in water quality and channel conditions. Please refer to THP section 2 for detailed erosion control information and project design parameters used to minimize the potential for inadvertent sediment production.

b) Water Temperature Effects – Increased solar radiation resulting from harvesting of streamside shade canopy can contribute to elevated water temperatures. Forestry related cumulative water temperature effects are changes in water temperature caused by the combination of increased solar radiation from two or more locations where stream canopy has been removed. Harvest restrictions in the WLPZs adjacent to perennial watercourses will insure that a robust stand of timber is retained adjacent to watercourses. Based on the retention of shade canopy and my 40+ years past experience with water temperature monitoring on similar Mendocino County streams, I believe, I have sufficient reason to conclude that the proposed timber operation will not have a significant adverse cumulative impact on stream temperatures.

c) Organic Debris Effects – Changes in the level of organic debris associated with streams can create adverse environmental effects. Forestry related cumulative watershed effects associated with organic debris can occur when logs, limbs and other organic material are introduced into a stream or lake at two or more locations. Decomposition of small debris left in watercourses removes dissolved oxygen from the water and may lower the streams ph level both of which in turn adversely affect many aquatic species. Large organic debris perform important in-stream functions such as pool formation and sediment metering effects. The sudden introduction or removal of large amounts of LWD can result in a loss of structural complexity, obstruct or divert stream flow against erodible banks, block fish migration, and cause debris torrents during periods of high flow in the steeper stream reaches.

Harvest restrictions in the WLPZ near major watercourses will insure that a robust stand of timber is retained adjacent to watercourses. Large woody debris that exists prior to harvest will not be salvaged from the WLPZ. LWD accidentally introduced into Class II watercourses, as a result of timber operations, will be removed immediately from the watercourse as per 14 CCR 916.3(b). Residual timber stands will provide a broad based resource pool for future LWD recruitment. Based on the retention of streamside timber stands and the extent to which uneven aged silviculture is used, I believe, I have sufficient reason to conclude that the proposed timber operation will not have a significant adverse cumulative impact on organic debris levels found in association with watercourses.

Chemical Contamination Effects:

Potential sources of chemical contaminants include run off from roads treated with oil or other dust retarding materials, direct application or run off from pesticide and herbicide treatments, contamination by equipment fuels and oils, and the introduction of nutrients released during slash burning or wildfire(s).

The proposed operation will not likely produce run off from oil or other dust-retarding materials. Landings associated with the proposed harvest operation are located well away from watercourses, minimizing the possibility of accidental discharges. Pesticide and herbicide application and treatment is regulated by the State of California in order to minimize the potential for adverse impacts associated with the use of these chemicals.

Fertilizer and pesticide use for legal and illegal horticultural activities may be in use in the headwaters and lower reaches of the watershed. However, if such contaminants are being introduced, the quantity is apparently low enough that significant effects are not noted on this ownership.

The possibility of wildfire in the assessment area is low to moderate due to aggressive fire suppression efforts, good access and typically mild weather due to the coastal weather influence. Wildfires can and do occur periodically in this area. Nutrient inputs from broadcast burning in future operations are a slight possibility. Historically, broadcast burning is limited to the winter months when fuels have higher water content. This means that typically these burns are less intense and that larger elements are retained. Burning has not historically been linked to nutrient problems on this ownership.

Hardwood Treatment:

The Plan Submitter may choose to induce mortality of hardwoods, primarily tanoak, with herbicides. This activity occurred in the past as noted in many of the THPs included in this assessment. As hardwood treatment is prescribed in this THP, it is reasonable to assume that such use will occur in the reasonable future (within 5 years). Chemical agents utilized have included and will likely continue to be glyphosate, imazapyr, and triclopyr. While the primary target species is tanoak, other species have also been targeted such as, manzanita, Scotch/French broom, and pampas grass. General methods of application vary depending upon the size of the target crop, with lower level crops (brush) receiving a foliar application while larger stems are typically treated utilizing "hack and squirt", which is a stem injection method.
The State Department of Pesticide Regulation requires that only State licensed Pest Control Advisers are allowed to recommend application techniques, chemical types, and chemical application rates for a particular situation.

A potential risk is that chemicals may enter waterways affecting aquatic life. To reduce this risk, labeling requirements prohibit mixing of chemicals in locations where spillage may enter waterways. For chemicals applied to forest species, labeling requirements prohibit the application of such chemicals to waterways. Treatment within a WLPZ is prohibited as specified in the THP.

There is concern that chemicals may build up in soils/landfills from discarded containers. To reduce the risk of unintended contamination labeling requirements require that containers be triple rinsed and that rinse water not be disposed of in locations where it may enter a watercourse. Best Management Practices also recommend that rinse water not be disposed of at all, but instead re-utilized as a mixing agent in the next application.

State law requires that Licensed Applicators inform and educate their employees about the hazards of applying chemicals. Licensed Applicators are required by law to provide their workers with appropriate Personal Protective Equipment (PPE) to protect them from exposure to chemicals, and labeling requirements mandate that workers wear this equipment.

The potential risk that chemical build up in soil, both short and long term, is much lower in forest applications where chemicals are usually applied only once in the life of a stand (once every 50 to 100 years). Further, the chemicals commonly used in forested landscapes have short half-lives and are readily broken down in the environment.

Additional mitigations over and above those outlined below to reduce impacts to 'less than significant' are not deemed necessary, as no significant impact has been identified which warrants mitigation. A qualified person with a Pesticide Control Applicator license will be contracted by the plan submitter to conduct such activities. Herbicide treatment is preferable to cutting hardwoods for several reasons:

- Low percentage of coppice growth following herbicide treatment.
- Canopy retention is retained for several months and up to as long as 18 months following application.
- Stems of treated hardwoods may persist in the landscape for several years, providing additional stand structure in the form of hard snags initially, gradually decaying into soft snags, then downed woody debris, and eventually decomposing back into the forest floor.
- Wildlife dependent on hardwood canopy is able to adjust over time to slow canopy reduction providing ample time to relocate to more desirable locations.
- Sufficient canopy is retained following treatment and dieback to protect conifer regeneration from sunscald.
- Treatment and retention on-site promotes nutrient recycling and surface soil retention.
- Canopy dieback is filled with remaining overstory/understory canopy of the preferred conifers species.
- Herbicide use is conducted mainly once in the life of a stand, 50 to 100 year intervals, which will reduce risk of long term effects.
- The quantity used in direct application varies but is usually less than 12 ounces per acre and is applied directly to the targeted vegetation.
- Foliar application rates may range from 16 to 64 ounces per acre depending upon the chemical used; however, foliar applications constitute less than 15% of the total areas treated for this ownership.
- Herbicide treatment is preferable to other site preparation treatments due to the lack of ground disturbance associated with ground based equipment use or potential peak flow and air quality impacts associated with burning.

<u>e) Peak Flow Effects</u> – Cumulative watershed effects that are caused by management induced peak flow increases in streams, during storm events, are difficult to anticipate. Peak flow increases may result from management activities that reduce vegetative cover, compact soils, or change hydrological connectivity of the fluvial system in ways that alter time of concentration during high intensity winter storm events. Typically man induced changes in peak flows are small relative to the magnitude of natural peak flows resulting from medium and large storms.

Past research done on the South Fork of Casper Creek, in Mendocino County, has shown that no significant increases in large winter peak storm flows occurred following removal of 65% of the forest canopy, and compaction of 15% of the watershed with tractor roads, landings, and logging roads (Wright and others 1990). The Casper Creek watershed and the current project area exist in the same rain dominated hydro-geologic environment. Also, these watersheds are subject to the same regional flood events, although flood frequencies may differ slightly according to basin characteristics and varying micro-site effects. The proposed logging operations are far less in magnitude for this project as compared to what has occurred in Caspar Creek.

I considered the potential for this specific project to alter hydrologic processes and impact peak stream flows. Since this operation is located in the redwood region at lower elevations, impacts associated with rain on snow events were considered to be unlikely. Watercourse crossings are planned and constructed so that the potential for watercourse diversion is minimized and flows from watercourses will not be diverted from one drainage to another thereby altering peak flows. Soil compaction and associated increased run-off is minimized by utilizing existing roads and skid trails where possible. Based on the above factors and my 30+ years of field experience with similar timber harvesting operations I believe that my reasoned analysis concluding that increased peak flows are not likely to occur is substantially justified.

f) Fog Drip
While there may be a slight reduction in fog drip as a result of this operation, it is not expected to be significant. The proposed harvest area is within the influence of coastal weather patterns where fog is frequently heavy during the summer months. Studies on the Little North Fork Noyo River done by Burns (1969) and Valentine/Jameson (1993) both indicate a similar stream volume and velocity during the late summer months which would indicate that ground water and the influence of fog drip have not been significantly affected by timber harvesting within the Little North Fork Noyo River drainage over the intervening 24 year period. Logging history and timber management activities have been similar in the North Fork Noyo watershed and the current project area. Pre and post harvest hydrologic conditions, including conditions related to fog drip, would also be expected to be similar . No significant decrease in water yield is expected from any potential decrease in fog drip that may occur. Decreases in evapotranspiration (water output) through the removal of trees should offset any potential decrease in fog drip (water input).

B) Soil Productivity – (b) No, with Mitigation

- Organic Matter Loss –
  Displacement or loss of organic matter can result in a long-term loss of soil productivity. Soil surface litter and downed woody debris are the storehouse of long-term soil fertility, provide for soil moisture conservation, and support soil microorganisms that are critical in the nutrient cycling and uptake process. Since broadcast burning is not proposed the organic layer will not be heavily impacted by this operation. Adverse effects attributable to road construction and tractor road use on organic matter loss/displacement will be minimized by the extensive use of an existing network of roads and tractor roads. The potential for concentrated runoff will be minimized by application of erosion control measures specified in THP Section 2 and the project areas upper slope location.

- Soil Loss – Topsoil displacement or loss can have an immediate effect on site productivity, although effects may not be obvious because of reduced brush competition and lack of side-by-side comparisons or until the new stand begins to fully occupy the available growing space. Surface soil is primarily lost by mass wasting, erosion or by displacement in windrows, piles or fills. Soil loss will be minimal in the THP area due to erosion control requirements and the ridge top location of the property.

- Soil Compaction - Compaction affects site productivity through loss of large soil pores that transmit air and water in the soil and by restricting root penetration. Limiting tractor operations to periods of dry conditions will minimize soil compaction due to the absence of OMC "optimum moisture content" for soil compaction.

- Growing Space Loss - Forest growing space is lost to roads, landings, permanent skid trails and other permanent or non-restored areas subjected to severe disturbance and compaction. Adverse effects attributable to road construction and tractor road use on growing space loss will be minimized by the use of the existing forest transportation network and conversion of ground based skidding on steep slopes to cable yarding.

C) Biological Resources – (b) No, with mitigation

a) Rare Plants & Wildlife – Northern Spotted Owls, coho salmon and steelhead are known to occur in the vicinity of the plan area. Consultation with the NDDB and other sources indicated no other known occurrences of State or Federally listed Threatened and Endangered Species within the THP area. Review of database information identifies a number of other animal and plant species outside of the plan area, which will be given consideration. It is not expected that the proposed operations will affect any of these species adversely.

The RPF, and supervised designee are in the process of identifying and marking trees for retention within the THP area with unique and /or valuable wildlife habitat characteristics. Where possible these trees with special wildlife qualities such as large limbs, broken tops or cavities will be retained.

b) Aquatic and near-water habitat

Pools and Riffles: Pools and riffles affect overall habitat quality and fish community structure. Streams with little structural complexity offer poor habitat for fish communities as a whole, even though the channel may be stable. Structural complexity is often lower in streams with low gradients, and filling of pools can reduce stream productivity. The mitigations provided above to reduce the potential for erosion and sedimentation are considered effective for this resource subject as well by avoiding the filling of pools with sediment.

Large Woody Material: Large woody debris in streams play an important role in creating and maintaining habitat through the formation of pools and increased structural complexity of channels. Pools comprise important feeding locations that provide maximum exposure to drifting food organisms in relatively quiet water. Removal of woody debris can reduce frequency and quality of pools. Large woody material that exists prior to harvest will not be salvaged from the WLPZ, or from below the watercourse transition line of Class III watercourses, thereby maintaining the structure present. Harvest restrictions in the WLPZ and the preponderance of selection silviculture methodology near major watercourses will insure that a robust stand of timber is retained adjacent to watercourses. Residual timber stands will provide a broad based resource pool for future LWD recruitment.

Near Water Vegetation: Many habitat benefits are provided by near-water vegetation, including: shade, nutrients, vertical density, migration corridor, nesting, roosting and escape. Recruitment of large woody material is also an important element in maintaining habitat quality. Harvest restrictions in the WLPZ and the preponderance of selection silviculture methodology near major watercourses will insure that a robust stand of timber is retained adjacent to watercourses.

c) Biological Habitat Components

Snags/Den/Nest trees: Snags, den trees, nest trees and their recruitment are required elements in the overall habitat needs of some wildlife species. Snags of greatest value are >16" DBH and 20+ ft. in height. Den trees are partially live trees with elements of decay, which provide wildlife habitat. Nest trees have importance to birds classified as a sensitive species. Item #33 states that snags will be retained throughout the THP except for those, which pose a safety hazard. Use of both even age and uneven age silvicultural methods will ensure a snag recruitment pool is maintained across the landscape over time.

Downed large, woody debris: Large downed logs (particularly conifers) in the upland and near water environment in all stages of decomposition provide an important habitat for many wildlife species. Large woody debris of greatest value consist of downed logs >16" diameter at the large end and >20 feet in length. Some of the downed logs present before harvest, may be removed if they are merchantable. This will not be all downed logs however, and additional logs are expected to remain following the harvest due to breakage and non-merchantability.

Multistory canopy: Upland multistoried canopies have a marked influence on the diversity and density of wildlife species utilizing the area. More productive timberland is generally of greater value and timber site capability should be considered as a factor in an assessment. The amount of upland multistoried canopy may be evaluated by estimating the percent of the stand composed of two or more tree layers. Near-water multistoried canopies in riparian zones that include conifer and hardwood tree species provide an important element of structural diversity and provide a variety of wildlife habitat requirements. Near-water multistoried canopy may be evaluated by estimating the percentage of ground covered by one or more vegetative strata, with more emphasis placed on shrub species along streams. Increased use of uneven age silvicultural practices will enhance multi-story canopy wildlife habitats on this ownership over time.

Road Density: Frequently traveled permanent and secondary roads have a significant influence on wildlife use of otherwise suitable habitat. Private roads on industrial timberlands within the BAA receive infrequent use on a day-to-day basis. Long term wildlife use of this area is not likely to be significantly impacted by the use of these roads for this small short duration project.

Hardwood Cover: Hardwoods provide an important element of habitat diversity in the coniferous forest and are utilized as a source of food and/or cover by many avian and mammalian species. Hardwood cover can be estimated using the basal area per acre provided by hardwoods of all species. The Forest Practice Rules require that the relative site occupancy of Group B species (hardwoods included) not be increased relative to the occupancy of Group A species. Therefore THP item #14f indicates that some hardwood reduction will occur to maintain long term conifer site occupancy. Hardwoods within WLPZs and trees with high quality wildlife characteristics such as cavities will be retained throughout the plan. Experience has shown that this type of management maintains a sufficient level of hardwood cover in these stands to provide continuity of habitat.

Late Seral Forest Characteristics: This entire watershed has been previously harvested. Stands which meet the criteria for Late Seral stage forest habitat , as defined in 14 CCR 895.1 and in the CDF Technical Rule Addendum #2, do not exist within the assessment area to my knowledge. Though the stands of the THP are not being managed with the goal of creating late seral habitat some late seral characteristics will be maintained and re-created consistent with the Landowners long term management strategies. The retention of larger trees for future LWD recruitment will provide larger standing and downed trees.

Late seral habitat continuity: This entire watershed has been previously harvested. Stands which meet the criteria for Late Seral stage forest habitat, as defined in 14 CCR 895.1 and in the CDF Technical Rule Addendum #2, do not exist within the assessment area to my knowledge and therefore continuity of remnant stands is not relevant to the proposed project.

5. Provide a brief description of the assessment area used for each resource subject.

The assessment area for watershed resources
The watershed assessment area to be are utilized is the Doty Creek WAA #1113.810003 located as shown on the WAA / BAA map. The CWE assessment area to be utilized was selected based on its size, proximity to the plan area and in consideration of the dominant drainage patterns in this area.

The assessment area for visual resources includes all of the area within a 0.7 mile radius of the plan area. The rationale for this particular size and shape is as follows:

1. This area was chosen for consistency and as an area where potential adverse effects to visual resources might occur.
2. This area includes nearly all of the possible vantage points from which this THP area could be seen.

The assessment area for biological resources is comprised of the land area within 0.7 miles of the plan area. The rationale for this particular size and shape is as follows:

1. Terrestrial plants and animals further away from the harvest area will be less affected by the disturbance than those within the plan area and watershed assessment area.
2. Land management history within the assessment area is similar in intensity and nature to the larger surrounding area.
3. Land management history within the assessment area is representative of large timber holdings in the area where more intensive forest management is common and therefore the potential for diluting adverse cumulative effects by using a large assessment area is minimized.

The assessment area for soil productivity resources is the same as the THP area since this is the area where potential significant effects to soil productivity may reasonably be expected to occur.

The assessment area for recreation resources is 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.

The assessment area for traffic resources is the traveled surface of the first public road on which logging traffic must travel to access the plan area and deliver logs to their intended destinations. Log trucks hauling timber from the harvest area will use existing haul roads and public roads within the assessment area which is defined as Fish Rock Road west of the plan area to its junction with Iverson Road, Iverson Road to its junction with 10 Mile Cut-off Road, County Road 501, to its junction with Old State Highway then westerly to Highway 1, Highways 1, 20, 101 and 116 in Mendocino, Humboldt and Sonoma Counties between Eureka and Santa Rosa. Logging traffic commonly uses these rural routes without incident or congestion.

The assessment area for fire hazard considerations is the area within ½ mile of the project area. The assessment area as described seems appropriate for an assessment of potential significant effects associated with fire hazards which may occur in the vicinity of the plan area.

Greenhouse gas emissions is a global phenomenon. Forest products which are produced in local proximity to their end use destination would be expected to have a lesser carbon "foot print" than forest products that are sourced from a far distant supply. If California wants to reduce its carbon foot print it should source as much of its forest product consumption locally as possible. This project lays the groundwork for an ongoing supply of locally produced (California) forest products.

6. List and briefly describe the individuals, organizations, and records consulted in the assessment of cumulative impacts for each resource subject. Records of the information used in the assessment shall be provided to the Director upon request.

List of references consulted during this
Cumulative Impacts Assessment

1. Water Quality Control Plan for the North Coast; North Coast Regional Water Quality Control Board; 2011.

2. California Department of Forestry and Fire Protection Guidelines for Assessment of Cumulative Impacts; CDF; August 13, 1991.

3. Mean Annual Precipitation in the California Region; USDI Geological Survey, Water Resources Division; 1972.

4. Aerial Photographs; NAIP 2005, 2010, 2012, 2016.

5. The Casper Cutting Trials: A Case Study Report 25 Years After Harvest; James L Lindquist & Jackson State Forest, June, 1988.

6. A Guide to Wildlife Habitats of California; California Department of Forestry and Fire Protection; 1988.

7. Northern Spotted Owl Information; California Department of Forestry and Fire Protection; 8/2/90.

8. Methods and Materials for locating and Studying Spotted Owls; Eric Forsman; 1983; USFS (PNW-162).

9. Natural Diversity Database; Natural Heritage Division, California Department of Fish and Game. (2020)

10. Guide to the California Wildlife Habitat Relationships System; Daniel A. Airola; Prepared for the California Department of Fish and Game; 1988.

11. Peterson Field Guides: Western Birds; Third Edition; Roger Tory Peterson; 1990.

12. Empirical Yield Tables for Young-Growth Redwood; James L. Lindquist & Marshal N. Palley; August, 1963.

13. Peterson Field Guides; Mammals; William H. Burt and Richard P. Grossenheider; 1980.

14. Small Mammal Populations In Clearcut Areas of the Jackson Demonstration State Forest, Mendocino County, California; A Technical report for the California Dept. of Fish and Game; Submitted by K. M. Fitts,

15. CDF Mass Mailing regarding Coho Salmon Considerations for Timber Harvesting Under the California Forest Practice Rules; Craig Anthony, Deputy Director, CDF; 4/29/97.

16. Handbook for Forest and Ranch Roads; W. Weaver & D. Hagans, Pacific Watershed Associates, 1994.

17. The Jepson Manual: Higher Plants of California; J.C. Hickman, ed. University of California Press, 1996.

18. Pocket Flora of the Redwood Forest; Dr. Rudolf W. Becking, Island Press, Covelo, California, 1982.

19. Common Riparian Plants of California; Phyllis M. Faber and Robert F. Holland, Pickleweed Press, Mill Valley, California, 1996.

20. Plants of the Pacific Northwest coast; Jim Pojar and Andy MacKinnon, Lone Pine Publishing, Vancouver, British Columbia, 1994.

21. Preliminary Descriptions of the Terrestrial Natural Communities of California; Robert H. Holland, Unpublished report. State of California, The Resources Agency, Department of Fish and Game, Natural Heritage Division. Sacramento, CA, 1986.

22. Cal Flora: www.calflora.org

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

24. Soil Survey of Western Mendocino: http://www.ca.nrcs.usda.gov/mlra02/wmendo

25. http://www.waterboards.ca.gov/northcoast/water_issues/programs/tmdls/303d/

26. https://caltreesplans.resources.ca.gov/caltrees/Default.aspx

27. California Department of Fish and Wildlife February 2020 CALIFORNIA'S KNOWN WOLVES - PAST AND PRESENT https://wildlife.ca.gov/conservation/mammals/gray-wolf

I. CUMULATIVE WATERSHED EFFECTS ASSESSMENT

A. Beneficial Uses

List the on-site and downstream beneficial uses of water that you are aware of and that could be affected by project activities. Beneficial uses of water include, spawning and rearing habitat for coho salmon, steelhead trout and other aquatic wildlife, as well as, habitat for non-aquatic wildlife. Other potential beneficial uses include water supply, recreation, ground water recharge and scientific study.

The NCRWQCB Basin Plan for the North Coast itemizes the following beneficial uses of water resources associated with the Gualala River Hydrologic Area.

USE	Gualala River Hydrologic Area
MUN	E
AGR	E
IND	E
PRO	P
GWR	E
FRSH	E
NAV	E
POW	P
REC1	E
REC2	E
COMM	E
AQUA	P
WARM	E
COLD	E
SAL	-
EST	-
MAR	-
WILD	E
ASBS	-
RARE	E
MIGR	E
SPWN	E
SHELL	-
WQE	-
FLD	-
WET	-
CUL	-

P=Potential
E=Existing

Note: The list of beneficial uses in this table reflects demands on the water resources of the region; water quality objectives based on those uses will adequately protect the quality of the region's waters for future generations.

MUN: Municipal and domestic supply. Includes usual uses in community or military water systems and domestic uses from individual water supply system.

AGR: Agricultural supply. Includes crop, orchard and pasture irrigation, stock watering, support of vegetation for range grazing, and all uses in support of farming and ranching operations.

IND: Industrial service supply. Includes uses that do not depend primarily on water quality, such as mining, cooling water supply, hydraulic conveyance, gravel washing, fire protection, and oil well repressurization.

PRO: Industrial process supply. Includes process water supply and all uses related to the manufacturing of products.

GWR: Groundwater recharge. Natural or artificial recharge for future extraction for beneficial uses and to maintain salt balance or halt saltwater intrusion into freshwater aquifers.

FRSH: Freshwater replenishment. Provides a source of freshwater for replenishment of inland lakes and streams of varying salinities.

NAV: Navigation. Includes commercial and naval shipping.

POW: Hydropower generation.

REC1: Water recreation, body contact. Includes all recreational uses involving actual body contact with water, such as swimming, wading, water-skiing, skin-diving, surfing, sport fishing; used in therapeutic spas and other uses where ingestion of water is reasonably possible.

REC2: Non-contact water recreation. Recreational uses that involve the presence of water, but do not require contact with water, such as picnicking, sunbathing, hiking, beach combing, camping, pleasure boating, tidepool and marine life study, hunting, and aesthetic enjoyment in conjunction with the above activities as well as sightseeing.

COMM:	Ocean commercial and sport fishing. The commercial collection of various types of fish and shellfish, including those taken for bait purposes and sport fishing in oceans, bays, estuaries, and similar non-freshwater areas.
AQUA:	Uses of water for aquaculture or mariculture operations including, but not limited to, propagation, cultivation, maintenance, or harvesting of aquatic plants and animals for human consumption or bait purposes.
WARM:	Warm freshwater habitat. Provides a warm water habitat to sustain aquatic resources associated with a warm water environment.
COLD:	Cold freshwater habitat. Provides a cold water habitat to sustain aquatic resources associated with a cold water environment.
SAL:	Saline water habitat. Provides inland saline water habitat for aquatic and wildlife resources.
WILD:	Wildlife habitat. Provides a water supply and vegetative habitat for the maintenance of wildlife.
RARE:	Preservation of rare and endangered species. Provides an aquatic habitat necessary, at least in part, for the survival of certain species established as being rare and endangered.
MAR:	Marine habitat. Provides for the preservation of the marine ecosystem, including the propagation and sustenance of fish, shellfish, marine mammals, waterfowl, and vegetation such as kelp.
MIGR:	Fish migration. Provides a migration route and temporary aquatic environment for anadromous or other fish species.
SPWN:	Fish spawning. Provides a high-quality aquatic habitat, especially suitable for fish spawning.
SHELL:	Shellfish harvesting. The collection of shellfish such as clams, oysters abalone, shrimp, crab, and lobster for either commercial or sport purposes.
WQE:	Uses of waters, including wetlands and other waterbodies, that support natural enhancement or improvement of water quality in or downstream of a waterbody including, but not limited to, erosion control, filtration and purification of naturally occurring water pollutants, streambank stabilization, maintenance of channel integrity, and siltation control.
FLD:	Uses of riparian wetlands in flood plain areas and other wetlands that receive natural surface drainage and buffer its passage to receiving waters.
WET:	Uses of water that support natural and man-made wetland ecosystems, including, but not limited to, preservation or enhancement of unique wetland functions, vegetation, fish, shellfish, invertebrates, insects, and wildlife habitat.
CUL:	Uses of water that support the cultural and/or traditional rights of indigenous people such as subsistence fishing and shellfish gathering, basket weaving and jewelry material collection, navigation to traditional ceremonial locations, and ceremonial uses.

B. Watershed Assessment Area

Describe the watershed assessment area, including the reasons for selected boundaries.
The Doty Creek WAA (#1113.810003) is the watershed assessment area to be utilized. The assessment area is as shown on the attached map. The CWE assessment area to be utilized was selected based on its size, proximity to the plan area and in consideration of the dominant drainage patterns in this area. The assessment area selected is consistent with the March 16th, 1994 CDF recommended guidelines to RPFs which states: "The watershed assessment area for assessing cumulative watershed effects should be selected to include an area of manageable size (usually an order 3 or 4 watershed) relative to the THP that maximizes the opportunity to detect an impact". The assessment area is of a size where the combined impacts of this THP, existing conditions attributed to past projects and possible impacts from anticipated future projects could be detected if they were significant.

C. Current Stream Channel Conditions

1. Is there one or more order 2 or larger streams that (1) flows through or adjacent to the project area, (2) will receive runoff from areas disturbed by project activities, and (3) has a contributing watershed area of more than 300 acres upstream from the point where the stream flows out of the project area?

Yes ___XX___ No ________

2. Using a copy of attached Table 1, describe the condition of the order 2 or larger stream channels, or apparently different segments of these channels, that lie within the project boundary and are downstream of the point where the contributing watershed area of the stream is less than 300 acres.

(Enter stream channel or segment identification letters or numbers at the top of the form, identify the CDF water class and the stream order number in the next row, then assign ratings on none, slight, moderate, or high to each of the listed channel conditions. The location of identified channels and channel segments should be shown on an attached watershed map. Attach additional rating pages and explanatory notes as needed.)

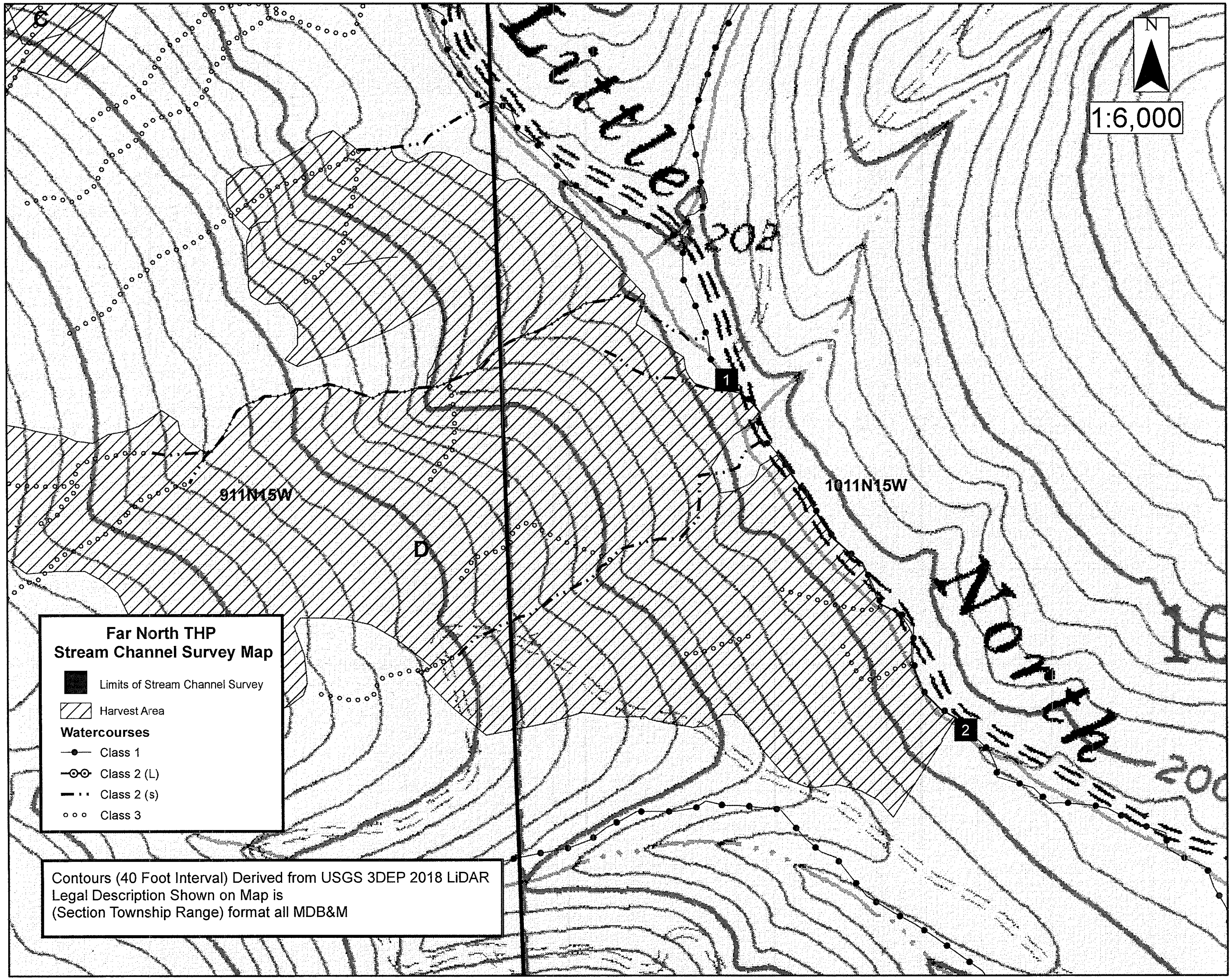
TABLE 1. CHANNEL INVENTORY FORM

Channel or Segment No.	1	.
- Class/Order	1	.
- Gravel embeddedness	SL	.
- Pool Filling	SL	.
- Aggrading	SL	.
- Bank Cutting	SL	.
- Bank Mass Wasting	N	.
- Down cutting	SL	.
- Scouring .	SL	.
- Debris Clearing	SL	.
- Debris Jamming	SL	.
- Canopy Reduction	SL	.
- Recent Flooding	N	.

N = None SL = Slight M = Moderate S = Severe

Comments:

Channel Segment #1: This channel segment is the upper end of Little North Fork Gualala River. The watershed upstream from the base of this stream segment is approximately 1700 acres in size. Shade canopy over the water is high due to narrow channel width and the heavily timbered slopes which flank this channel reach. The width of the channel varies from 10 feet to 20+ feet. Pools are frequent but typically shallow 1 to 3 feet deep at the head tapering down to a few inches at the tail of the pool occur in this reach. LWD occurs in significant quantities though out this reach with many logs having been placed via "LWD projects". Terrain in this area is moderate and only minimal LWD recruitment by mass wasting events is evident. Several localized occurrences of bank cutting were observed in this stream reach. Evidence of significant aggradation readily apparent but due to lower channel gradients sediment deposition appears to be occurring. Overall this stream segment appears to be quite healthy with salmonid young of the year present in quantity.



Far North THP
Stream Channel Survey Map
Limits of Stream Channel Survey
Harvest Area
Watercourses
Class 1
Class 2 (L)
Class 2 (s)
Class 3
Contours (40 Foot Interval) Derived from USGS 3DEP 2018 LiDAR
Legal Description Shown on Map is
(Section Township Range) format all MDB&M
1:6,000
N
911N15W
1011N15W
Little North
D
C
1
2

156

3. Are you aware of any current stream channel conditions, including those listed in previous section C.2, that occur outside of the project boundary, but within the assessment area, that are contributing to a reduction in the beneficial uses of water listed in section A?

Yes __XX__ No ______

Most of the timbered portion of this CWE assessment area was harvested during the historic logging period and prior to the advent of a modern Forest Practice Act. Legacy truck roads tend to be significant sources of continuing sediment delivery due to their proximity to watercourses and the tendency for truck roads to use fill for crossing tributaries. Impacts associated with this early harvest triggered a positive response to questions concerning past projects under item "B". While stream channels are continuing to recover the area as a whole now appears to be generally well vegetated and stabilized.

During plan preparation, conditions which are or could contribute to a reduction in the beneficial uses of water were searched for. Sites which were identified and remedial measures are proposed are as described in the Map Point table located near the end of THP section 2.

4. Are you aware of any current stream channel conditions, including those listed in previous section C.2, that occur outside of the assessment area and that are contributing to a reduction in the beneficial uses of water listed in section A?

Yes ______ No __XX__

D. PAST PROJECTS

Based on your review for this assessment and knowledge of watershed conditions on and off the proposed project area, have past projects in the watersheds on channels within the assessment area resulted in any of the following impacts? (Yes or No)

1.	Increased sediment inputs that embedded gravels, filled pools, or caused channel aggradation within some portion of the stream system?	[Y] N
2.	Increased channel downcutting or bank erosion as a result of increased flows, sediment transport, or other channel modifications?	[Y] N
3.	Increased water temperatures resulting from canopy removals along stream channel?	[Y] N
4.	Inputs of unstable organic debris to streams or lakes?	[Y] N
5.	Removal of large organic debris leading to loss of pool habitat?	[Y] N
6.	Chemical inputs to streams or lakes?	Y [N]
7.	Other (describe)	Y [N]

Comments:

Most of the timbered portion of the CWE assessment area was harvested during the historic logging period and prior to the advent of a modern Forest Practice Act. The railroad logging of the mid to late 1800's and early 1900's required extensive excavation for railroad grades which were primarily located in close proximity to major watercourses. Some of these railroad grades were modified into truck roads and typically were left un-maintained at the completion of use. These legacy truck roads often provide sources of continuing sediment delivery due to their proximity to watercourses. Most of these excavations have contributed significant sediment to the fluvial system in the past but have generally stabilized over time. Impacts associated with this early harvest triggered a positive response to questions concerning past projects under item "B". While stream channels are continuing to recover the area as a whole now appears to be generally well vegetated and stabilized.

E. Potential On-Site Effects

Based on current conditions and your knowledge of the impacts of similar past projects, what is the potential of the proposed project, as described and mitigated, to produce the following individual effects? (High, Moderate, Low)

1. Increased stream or lake sediment from:

   a. Channel or bank erosion — H M $\boxed{L}$

   b. Streamside or inner gorge mass wasting that could directly enter a stream channel. — H M $\boxed{L}$

   c. Debris flows or torrents that could move directly into the stream system from sideslopes, swales, small channels, roads, landings, or skid trails. — H M $\boxed{L}$

   d. Debris flows or torrents caused by debris jams. — H M $\boxed{L}$

   e. Sideslopes mass wasting that directs surface runoff into gullies, swales, or small channels connected to the stream system. — H M $\boxed{L}$

   f. Sheet, rill, or gully erosion that could be discharged into the stream system from roads, landings, or skid trails (include all disturbed areas from the top of the cut to the bottom of the fill). — H M $\boxed{L}$

   g. Sheet, rill, or gully erosion from harvested or site preparation areas that could enter the stream system. — H M $\boxed{L}$

2. Openings created by project activities along stream channels that could result in substantially increased stream temperature. — H M $\boxed{L}$

3. Increased amounts of small organic debris in streams or lakes as a result of project activities. — H M $\boxed{L}$

4. Movement of roadway chemicals, machinery fuels, pesticides, nutrients released by burning, or other chemicals into streams or lakes as a result of project activities. — H M $\boxed{L}$

5. Increased peak flows as a result of vegetation removal, snow accumulation in new openings, or more efficient runoff routing created by project activities. — H M $\boxed{L}$

6. Inputs of large organic debris in streams or lakes as a result of project activities. — H M $\boxed{L}$

7. Extraction of large organic debris from streams or lakes as a result of project activities. — H M $\boxed{L}$

8. Loss of future large organic debris as a result of streamside timber harvesting. — H M $\boxed{L}$

9. Other factors (list) — H M L

The current Forest Practice Rules are designed to effectively maintain, restore or enhance the beneficial uses of water within the proposed project area. Harvesting within the WLPZs of watercourse segments within or adjacent to the proposed THP will be limited as described in Items #26 and #27 of the THP. Variable width ELZs apply to Class III watercourses as also described in Item #26.

The proposed THP has been designed to minimize the potential for further impacts to the beneficial uses of water within this watershed.

F. Future Projects

Based on your review of current watershed conditions, the effects of past projects, and accounting for currently proposed mitigation measures - Are the identified future projects likely to result in (Yes or No)?

1.	Increased sediment inputs that will fill pools, embed stream gravels, or cause channel aggradation in some portion of the system?	Y $\boxed{N}$
2.	Increased channel down cutting or bank erosion from increased flows, sediment transport, or other stream modifications?	Y $\boxed{N}$
3.	Additional openings along stream channels that could result in unacceptable increases in water temperatures.	Y $\boxed{N}$
4.	New inputs of organic debris to streams or lakes.	Y $\boxed{N}$
5.	Extraction of large organic debris from streams or lakes?	Y $\boxed{N}$
6.	Chemical inputs to streams or lakes?	Y $\boxed{N}$
7.	Other factors (list)	Y $\boxed{N}$

Future Timber Harvest Plans will be prepared and regulated by the Forest Practice Act and the Forest Practice Rules and are not likely to cause significant adverse environmental impacts. Implementation of the measures proposed within individual THPs along with responsible logging practices within the framework of the rules of the FPA will eliminate significant adverse effects. Mitigation measures proposed within future THPs, when properly implemented, are more likely to enhance the productivity of an area while maintaining non-timber related values.

G. Interactions

Considering the combined impacts of:

- Beneficial uses of water described in Part A,
- Current stream channel conditions from Part C,
- Effects of past projects listed in Part D, and
- Expected on-site effects of the proposed project from Part E;

What is the potential for developing adverse cumulative watershed effects in the assessment area, as described in Part B, as a result of:

1.	The proposed project combined with the ongoing effects of past projects, but without the expected impacts of future projects?	H	M	$\boxed{L}$
2.	The proposed project combined with the effects of past projects and the expected impact of future projects listed in Part F?	H	M	$\boxed{L}$

H. Impact Evaluation

Will the proposed project, as presented, in combination with the impacts of past and future projects, as identified in Parts C through F and with the interactions rated in Part G above, have a reasonable potential to cause or add to significant cumulative impacts to watershed resources.

Yes (after mitigation) -	____
No (after mitigation) -	XX
No (no reasonable potential significant effects) -	____

II. CUMULATIVE SOIL PRODUCTIVITY IMPACTS ASSESSMENTS

A. Soil Productivity Impacts Inventory

Cumulative soil productivity impacts occur when the combined impacts of a sequence of management activities produce a significant reduction in soil productivity. These impacts may occur as part of separate activities on the same project, as residual effects of past projects, and as the likely impacts of future projects.

Forest management activities are required to be conducted in a manner that assures "where feasible, the productivity of timberlands is restored, enhanced, or maintained." Therefore, productivity losses resulting from site disturbance in excess of that required by suitable silvicultural and harvesting practices, where conducted individually or in sequence, must be considered as significant.

Impact significance must also be considered relative to the soil productivity potential of the area in question. Losses that can be considered acceptable on highly productive lands may be unacceptable, or even exceed the productivity potential, of lower site lands. For example, productivity reductions from loss of growing space associated with development of roads and skid trails necessary for timber management on high site lands may be greater than the total unit-area productivity of a poor site.

B. Soil Productivity Resources Assessment

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

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

The relationship between these site factors and soil productivity is described in Section B of the Appendix to Technical Rule Addendum No. 2 of the Forest Practice Rules.

The potential impact of successive management activities must be assessed for each of these factors individually and in combination, and the overall impact should be classed as significant when:

- The area disturbed by proposed timber operations will exceed that required by the silvicultural and harvest systems approved for use under proposed THP, including unnecessary duplication of existing skid trails, roads, landings, yarding disturbance and mechanical site preparation.
- The amount of organic matter loss and soil displacement with use of the proposed silvicultural and harvesting systems will substantially exceed that of other, feasible systems.
- The amount of compaction and puddling with use of the proposed silvicultural and harvesting systems will substantially exceed that of other, feasible systems, under the soil moisture conditions expected at the time of proposed operations.
- The combined loss of soil productivity from loss of growing space, organic matter loss, soil displacement, and soil compaction from the proposed operations will substantially exceed that of other feasible combinations of silvicultural and harvesting systems.

C. Impacts evaluation

Will the proposed project, as presented, alone or in combination with the impacts of past and future projects have a reasonable potential or cause or add to significant, cumulative soil productivity impacts as a result of:

	Yes, after mitigation	No, after Mitigation	No reasonably potential significant impacts
1. Organic matter loss		XX	
2. Surface soil loss		XX	
3. Soil compaction		XX	
4. Growing space loss		XX	
5. Any combination of items 1 through 4		XX	

The proposed timber harvesting activities, in conjunction with the Forest Practice Rules and Regulations will not have a significant adverse impact on the soil productivity within the assessment area. Existing roads and landings will be used to access most of the harvest area. Existing skid trails will be used where feasible. New roads construction is minimized to the extent possible. Use of heavy equipment in WLPZ's is strictly limited and variable width ELZs apply to all Class III watercourses as described in THP Item #26.

III. CUMULATIVE BIOLOGICAL RESOURCE IMPACTS ASSESSMENT

A. Biological Resource Inventory

1. Identify any of the following categories of listed species known or potentially may occur in the Biological Assessment Area(s) for the proposed timber operations:

- Federally and/or State Threatened or Endangered.
- Sensitive Species (as defined in the Forest Practice Rules)
- Species of Special Concern (as defined by the California Department of Fish and Game).

2. Identify any other wildlife or fisheries resource concerns known or suspected to occur within the Biological Assessment Area(s), including the reasons for boundary selection.

The Department of Fish and Game "Natural Diversity Database" was searched for any listed animals, plants, and communities that have been detected in the vicinity of the project area. Quadrangles searched were Eureka Hill, Zeni Ridge, Stewarts Point, McGuire Ridge, Point Arena and Gualala. This scoping process covers a much wider area than the biological assessment area. This is considered to be a conservative approach in order to ensure that positive sightings of listed species potentially occurring within the THP area would be addressed. Results of this query are summarized on the following pages. General information pertaining to individual species presented herein comes from a wide variety of sources including the California Wildlife Habitat Relationship System and common field guides.

Scientific Name	Common Name	Federal Status	State Status	CDFW Status	CA Rare Plant Rank
Abronia umbellata var. breviflora	pink sand-verbena	None	None	-	1B.1
Agrostis blasdalei	Blasdale's bent grass	None	None	-	1B.2
Ammodramus savannarum	grasshopper sparrow	None	None	SSC	-
Aplodontia rufa nigra	Point Arena mountain beaver	Endangered	None	SSC	-
Aquila chrysaetos	golden eagle	None	None	FP ; WL	-
Arborimus pomo	Sonoma tree vole	None	None	SSC	-
Arctostaphylos nummularia ssp. mendocinoensis	pygmy manzanita	None	None	-	1B.2
Ardea herodias	great blue heron	None	None	-	-
Ascaphus truei	Pacific tailed frog	None	None	SSC	-
Asio flammeus	short-eared owl	None	None	SSC	-
Astragalus agnicidus	Humboldt County milk-vetch	None	Endangered	-	1B.1
Astragalus rattanii var. rattanii	Rattan's milk-vetch	None	None	-	4.3
Athene cunicularia	burrowing owl	None	None	SSC	-
Bombus caliginosus	obscure bumble bee	None	None	-	-
Bombus occidentalis	western bumble bee	None	Candidate Endangered	-	-
Bryoria pseudocapillaris	false gray horsehair lichen	None	None	-	3.2
Calamagrostis bolanderi	Bolander's reed grass	None	None	-	4.2
Calystegia purpurata ssp. saxicola	coastal bluff morning-glory	None	None	-	1B.2
Campanula californica	swamp harebell	None	None	-	1B.2
Carex lyngbyei	Lyngbye's sedge	None	None	-	2B.2
Carex saliniformis	deceiving sedge	None	None	-	1B.2
Castilleja ambigua var. ambigua	johnny-nip	None	None	-	4.2
Castilleja ambigua var. humboldtiensis	Humboldt Bay owl's-clover	None	None	-	1B.2
Castilleja mendocinensis	Mendocino Coast paintbrush	None	None	-	1B.2
Ceanothus gloriosus var. exaltatus	glory brush	None	None	-	4.3
Ceanothus gloriosus var. gloriosus	Point Reyes ceanothus	None	None	-	4.3
Cerorhinca monocerata	rhinoceros auklet	None	None	WL	-
Circus hudsonius	northern harrier	None	None	SSC	-
Coastal and Valley Freshwater Marsh	Coastal and Valley Freshwater Marsh	None	None	-	-
Coastal Brackish Marsh	Coastal Brackish Marsh	None	None	-	-
Coastal Terrace Prairie	Coastal Terrace Prairie	None	None	-	-
Coptis laciniata	Oregon goldthread	None	None	-	4.2

Scientific Name	Common Name	Federal Status	State Status	CDFW Status	CA Rare Plant Rank
Corynorhinus townsendii	Townsend's big-eared bat	None	None	SSC	-
Cuscuta pacifica var. papillata	Mendocino dodder	None	None	-	1B.2
Danaus plexippus pop. 1	monarch - California overwintering population	None	None	-	-
Dicamptodon ensatus	California giant salamander	None	None	SSC	-
Emys marmorata	western pond turtle	None	None	SSC	-
Entosphenus tridentatus	Pacific lamprey	None	None	SSC	-
Erethizon dorsatum	North American porcupine	None	None	-	-
Erigeron biolettii	streamside daisy	None	None	-	3
Erigeron supplex	supple daisy	None	None	-	1B.2
Erysimum concinnum	bluff wallflower	None	None	-	1B.2
Eucyclogobius newberryi	tidewater goby	Endangered	None	SSC	-
Eumetopias jubatus	Steller (=northern) sea-lion	Delisted	None	-	-
Fratercula cirrhata	tufted puffin	None	None	SSC	-
Fritillaria roderickii	Roderick's fritillary	None	Endangered	-	1B.1
Gilia capitata ssp. pacifica	Pacific gilia	None	None	-	1B.2
Gilia capitata ssp. tomentosa	woolly-headed gilia	None	None	-	1B.1
Glehnia littoralis ssp. leiocarpa	American glehnia	None	None	-	4.2
Glyceria grandis	American manna grass	None	None	-	2B.3
Haliotis kamtschatkana	pinto abalone	None	None	-	-
Helminthoglypta arrosa pomoensis	Pomo bronze shoulderband	None	None	-	-
Hesperevax sparsiflora var. brevifolia	short-leaved evax	None	None	-	1B.2
Hesperocyparis pygmaea	pygmy cypress	None	None	-	1B.2
Horkelia marinensis	Point Reyes horkelia	None	None	-	1B.2
Horkelia tenuiloba	thin-lobed horkelia	None	None	-	1B.2
Hosackia gracilis	harlequin lotus	None	None	-	4.2
Hypogymnia schizidiata	island tube lichen	None	None	-	1B.3
Hysterocarpus traskii pomo	Russian River tule perch	None	None	SSC	-
Juga chacei	Chace juga	None	None	-	-
Kopsiopsis hookeri	small groundcone	None	None	-	2B.3
Lasiurus blossevillii	western red bat	None	None	SSC	-
Lasthenia californica ssp. bakeri	Baker's goldfields	None	None	-	1B.2
Lasthenia californica ssp. macrantha	perennial goldfields	None	None	-	1B.2

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Scientific Name	Common Name	Federal Status	State Status	CDFW Status	CA Rare Plant Rank
Lasthenia conjugens	Contra Costa goldfields	Endangered	None	-	1B.1
Lathyrus palustris	marsh pea	None	None	-	2B.2
Lavinia symmetricus parvipinnis	Gualala roach	None	None	SSC	-
Lilium maritimum	coast lily	None	None	-	1B.1
Lycopodium clavatum	running-pine	None	None	-	4.1
Microseris paludosa	marsh microseris	None	None	-	1B.2
Myotis thysanodes	fringed myotis	None	None	-	-
Northern Coastal Bluff Scrub	Northern Coastal Bluff Scrub	None	None	-	-
Northern Coastal Salt Marsh	Northern Coastal Salt Marsh	None	None	-	-
Numenius americanus	long-billed curlew	None	None	WL	-
Oenothera wolfii	Wolf's evening-primrose	None	None	-	1B.1
Oncorhynchus clarkii clarkii	coast cutthroat trout	None	None	SSC	-
Oncorhynchus gorbuscha	pink salmon	None	None	-	-
Oncorhynchus kisutch pop. 4	coho salmon - central California coast ESU	Endangered	Endangered	-	-
Oncorhynchus mykiss irideus pop. 16	steelhead - northern California DPS	Threatened	None	-	-
Pandion haliaetus	osprey	None	None	WL	-
Passerculus sandwichensis alaudinus	Bryant's savannah sparrow	None	None	SSC	-
Pelecanus occidentalis californicus	California brown pelican	Delisted	Delisted	FP	-
Perideridia gairdneri ssp. gairdneri	California Gairdner's yampah	None	None	-	4.2
Piperia candida	white-flowered rein orchid	None	None	-	1B.2
Potamogeton epihydrus	Nuttall's ribbon-leaved pondweed	None	None	-	2B.2
Progne subis	purple martin	None	None	SSC	-
Rana boylii	foothill yellow-legged frog	None	NONE	SSC	-
Rana draytonii	California red-legged frog	Threatened	None	SSC	-
Rhyacotriton variegatus	southern torrent salamander	None	None	SSC	-
Riparia riparia	bank swallow	None	Threatened	-	-
Sidalcea calycosa ssp. rhizomata	Point Reyes checkerbloom	None	None	-	1B.2
Sidalcea malachroides	maple-leaved checkerbloom	None	None	-	4.2
Sidalcea malviflora ssp. purpurea	purple-stemmed checkerbloom	None	None	-	1B.2
Speyeria zerene behrensii	Behren's silverspot butterfly	Endangered	None	-	-
Spirinchus thaleichthys	longfin smelt	Candidate	Threatened	-	-
Strix occidentalis caurina	Northern Spotted Owl	Threatened	Threatened	-	-

Scientific Name	Common Name	Federal Status	State Status	CDFW Status	CA Rare Plant Rank
Taricha rivularis	red-bellied newt	None	None	SSC	-
Taxidea taxus	American badger	None	None	SSC	-
Trifolium buckwestiorum	Santa Cruz clover	None	None	-	1B.1
Trifolium trichocalyx	Monterey clover	Endangered	Endangered	-	1B.1
Usnea longissima	Methuselah's beard lichen	None	None	-	4.2
Veratrum fimbriatum	fringed false-hellebore	None	None	-	4.3

BIRDS:

Accipiter cooperii **Cooper's Hawk**
The Cooper's hawk is a forest hawk widely distributed throughout the United States year round. This species is present throughout most of California and is a fairly common accipiter in the coastal redwood eco-region. Cooper's hawks feed on a variety of small animals including small mammals, rodents, birds, reptiles and amphibians. Cooper's hawks frequently hunt in broken forested areas and in semi-open meadows and fields. This species may nest in either coniferous or deciduous forests where suitable platform structures to support a nest exist and near water sources. When in predominately coniferous forests, nests are typically located below the lowest live limbs. Cooper's hawks also occur in urban parks and residential areas. Cooper's hawks are highly adaptable and quickly acclimatize and thrive in human altered environments. Like many raptors, Cooper's hawk populations were highly impacted by organochorine pesticides. Since the ban on the use of DDT, their populations appear stable.

No nesting structures were observed by biologists or foresters in the THP area that are attributable to this species. With the relative abundance and wide-spread distribution of this species, as well as standard WLPZ protection measures in the most likely habitat, no significant adverse impacts are expected.

Literature:

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Accipiter gentilis **Northern Goshawk**
The northern goshawk is a forest hawk with a Holarctic distribution, occupying a wide variety of temperate and boreal forests in North America (Squires and Reynolds 1997). In California, northern goshawks occur in the Klamath, Cascade, Sierra Nevada, and North Coast Ranges. This species is listed as a Species of Special Concern by CDFG and is a Board of Forestry Sensitive Species.

At large spatial scales, the goshawk is a forest habitat "generalist"(e.g. occurring in a variety of coniferous, deciduous, and mixed forest types). Habitat requirements at the stand level are fairly narrow. Regardless of forest type, goshawks nest in large trees in forest stands containing a high density of large trees and high canopy closure. Nest sites tend to be located near water on north or west facing, gentle to moderate slopes and near small forest openings or habitat edges. Canopy overstory depth and percent shrub cover were the best variables in predicting goshawk occupancy in nesting stands in Washington. At the landscape scale, these researches found the best variables predicting occupancy was proportion of late seral forest (60-75% of forests with >70% canopy closure of conifers and >10% of the canopy in trees >21 in.) and reduced landscape heterogeneity. No information on nesting habitat in coastal redwood forests is currently available, partly because of the low densities at which goshawks are found in this forest type.

Northern goshawks are generally associated with mature, unmanaged forests, although they will occupy residual mature stands in managed forests if the required habitat components are present. The typical suitable nesting habitat condition at ten nests in northwest California included a mature Douglas-fir stand within a young growth Douglas-fir tract with a scattered hardwood component.

Telemetry studies suggest that goshawks prefer to forage in areas with large trees, high basal area, and high canopy cover. However, goshawks have also been observed foraging in forest openings and clear-cuts. Goshawks in Nevada will forage in open sagebrush away from trees.

The lack of historical records in the coastal redwood region suggests that goshawks occurred there in low densities, perhaps due to the dense understory conditions typically found in this eco-region. Goshawks are also infrequently found on the Oregon Coast Range, which may be due to the dense understory vegetation occurring in that eco-region. The plan area is not believed to be habitat for the goshawk, due primarily to the density of the understory vegetation, relatively high densities of smaller conifer and hardwoods, and high landscape heterogeneity.

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***Accipiter striatus* Sharp Shinned Hawk**

The sharp shinned hawk is a forest hawk widely distributed year round throughout much of North America. This species is present throughout the majority of California and is a fairly common accipiter in the coastal redwood eco-region. Nesting requirements usually include small or moderate-sized trees in coniferous or coniferous-hardwood mixed stands with dense branches, sparse ground cover and near water, though this is not exclusive (Wheeler 2003). The species may forage in open areas near the forests edge, in the upper canopy of tall trees, or beneath the canopy in small trees (Wheeler 2003).

No nesting structures were observed during extensive fieldwork conducted during plan preparation in the THP area that may be attributable to this species. With the relative abundance and widespread distribution of this species, the maintenance forest edges suitable for foraging, as well as standard WLPZ protection measures in the most likely habitat, no significant adverse impacts are expected.

Literature:

California Wildlife Habitat Relationships System. 2001. California Department of Fish and Game, California Interagency Wildlife Task Group. http://www.dfg.ca.gov/whdab/M132.html

Wheeler, B.K. 2003. Raptors of western North America. Princeton University Press, Princeton, N.J.

Agelaius tricolor **Tricolored Blackbird**
The tricolored blackbird is a year round resident and its distribution in the United States is mostly restricted to California. It is considered locally common throughout the central valley and in coastal areas south of Sonoma County. This species is listed as a Species of Special Concern by the CDF&G. Tricolored blackbirds are associated with emergent wetlands for nesting and foraging. Nests are usually located in dense grasses, cattails, or dense shrubs near fresh water sources. Tricolored blackbirds are ground foragers, feeding on insects, grains, and weed seeds. Major threats to this species include urban development and wetland destruction. As the project provides protection measures for riparian areas and will maintain upslope stands of conifers, no adverse impacts are expected for this species.

Aquila chrysaetos **Golden Eagle**
Golden eagles are widely distributed across North America during summer months and are year round residents throughout much of the western United States. The golden eagle is sparsely distributed throughout most of California, occupying primarily mountain and desert habitats. The largest populations in California are found in the interior Coast Ranges, particularly south of San Francisco Bay, and in the Great Basin habitats of northeastern California. Although they nest on the perimeters of the Central Valley in oak woodland habitats, none are known from the valley itself, with the exception of a historically active site on the Sutter Buttes. The lowest densities appear to occur in the Coastal Redwood eco-region. This species is listed as a Species of Special Concern by the CDFG and a Board of Forestry Sensitive Species.

Golden eagle territories typically consist of a group of 1-13 nests and a surrounding hunting range. Golden eagles construct their nests on cliff ledges, on high rocky outcrops, or in large trees. In the interior Coast Ranges, tree nests are more commonly used. In the Great Basin and southern California desert regions, cliff-nesting habitat is more available and is more commonly used by nesting eagles. Grassland, oak savanna, and open woodland and chaparral habitats provide suitable foraging habitat for golden eagles. Golden eagles are perch and aerial foraging opportunists with their diet consisting mainly of small mammals including jackrabbits, hares, and squirrels, such as the California ground squirrel and Belding's ground squirrel (in northeastern California). In some regions, game birds and waterfowl are an important food source during the winter. Because cattle grazing promotes large populations of ground squirrels, open, grazed rangelands are also highly compatible golden eagle foraging habitat.

In western North America, the golden eagle population is estimated at 100,000 birds. Although populations in Alaska and Canada appear stable, some small but steady regional declines have been reported in southern California due to urbanization and in the intermountain West due to widespread fires altering foraging habitat for jackrabbits. However, declines in productivity have not been observed.

No golden eagle nests are known to occur in the planning area. Golden eagles are known to nest in Mendocino County, east of the planning area and along some of the major drainages such as the Navarro River. The Biological Assessment Area is generally considered too densely forested to support nesting golden eagles. However, because the species is wide-ranging, individuals may seek out foraging opportunities in grazing areas in the Biological Assessment Area, although this is unlikely. Because the plan will maintain suitable perch trees in timbered stands within WLPZ's and adjacent areas, no significant adverse impacts are expected.

Literature:
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Ardea herodias **Great Blue Heron**
Great blue heron range throughout North America except for extremely high latitudes and elevations. This species is found in a variety of aquatic habitat including salt and freshwater marshes, estuaries, mudflats, lagoons, lakes, rivers, and flooded fields. This species is listed as a Board of Forestry Sensitive Species.

Great blue herons nest from late February to July. Nesting usually occurs colonially or solitary in secluded groves of live or dead trees near shallow-water feeding areas. Throughout much of the species' range, rookeries are found in riparian conifer and hardwood forests, usually in the tallest trees or shrubs available.

In the coastal redwood eco-region, great blue herons are thinly scattered over many aquatic habitats, including coastal rivers, forest ponds, lowland marshes, bottomland pastures, coastal bays, and lagoons (Harris 1991). One known rookery occurs near the mouth of the Ten Mile River. Other incidental sightings of great blue herons along Noyo River are common and blue herons can be observed at McGuire's Pond. No rookeries have been observed or recorded in the Biological Assessment Area. No significant adverse impacts are expected.

Literature:

Davis, W.E. 2001. Herons, egrets, and bitterns. *In* Elphick, C., J.B. Dunning, Jr., D.A. Sibley (eds.), National Audubon Society: The Sibley guide to bird life & behavior. Alfred A. Knopf Press, New York, New York.

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Stokes, D. and L. Stokes. 1996. Stokes field guide to birds: western region. Little, Brown, and Company Press, New York, New York.

Brachyramphus maramoratus **Marbled Murrelet**
Marbled murrelets (hereafter murrelets) are a small near-shore seabird distributed from Alaska to northern California. In California, murrelets occur from the Oregon border to the Santa Cruz Mountains. Although marbled murrelets live primarily in near-shore marine environments, during the nesting season they fly inland to nest in low-elevation old-growth and mature coniferous forests. Murrelets are listed as Federally Threatened, State Endangered, and are a Board of Forestry Sensitive Species.

The murrelet nesting period begins in late March, and most young fledge by mid-September. Murrelets incubate only one egg in each nesting attempt, however, there is some evidence that murrelets in California and Oregon may try to re-nest after a failed nesting attempt or may even try two clutches. Murrelets do not construct their nests, but use wide horizontal limbs located in the canopies of old growth or second growth coniferous forests as a nesting platform. Although most nests have been located in conifers, one nest was recently located in a hardwood in British Colombia.

The majority of existing data indicate that murrelets are found primarily in old-growth or mature forest conditions. Throughout its range, excluding Alaska, murrelet habitat can be generally characterized on several spatial scales. At the site (stand) scale the best variables predicting site occupancy are platform density, number of platform trees, greater tree heights and canopy complexity (including number of canopy layers), larger tree diameters, densities of large trees, proximity to other occupied sites, elevation, and slope. In California, the best predictors of stand occupancy were large trees (>39 in. DBH), low elevation slopes, and proximity to streams. In Douglas-fir stands in southern Oregon, murrelets mostly occupied stands in low-elevation slopes with west facing aspects. In both states, cool temperatures and high rainfalls were found to be important climatic variables.

The only known study conducted at the microsite scale in California occurred in the Santa Cruz Mountains in Central California. Murrelets in this study area selected forested areas with greater basal area of trees >47 in. DBH and were located lower on slopes. Nest areas were also closer to streams; however, this variable and position on slope are likely highly correlated. In a study combining data from Washington and Oregon, including data from the Klamath Mountains in southwest Oregon, murrelets select areas within sites exemplified by many platform trees, high platform density, larger platforms, more moss, more horizontal cover, and increased flight access, including distance to edges.

At the nest tree scale, average nest tree characteristics in California appear to be similar to those found in Oregon and Washington with the exception that the majority of nest trees in California have been found in coast redwood. Nest tree characteristics may be summarized as follows:

- Located near openings (natural or man-made) in the canopy for access.
- Large potential nest platforms
- Substrate for nest cup
- Horizontal and/or vertical cover over nest limb
- Sufficient tree heights for murrelet take offs and stall landings

Nest limb descriptions in California show murrelets using large limbs with significant substrate depths and overhead cover. Habitat selection studies in Washington and Oregon confirmed that murrelets overwhelmingly select nest limbs with greater platform widths, extensive moss cover, greater substrate depths, and a high percentage of vertical cover. As these variables appear biologically meaningful, it is logical to infer that they may be equally important for nesting murrelets in California.

Although there are several recorded instances of murrelets using a residual tree in otherwise younger stands for nesting, these residual trees are located in watersheds where other occupied sites are present, such as the residual tree in Big Creek Basin, Santa Cruz Mountains and the nest tree located in Alder Creek on Mendocino Redwood Company property. The Alder Creek tree is also located approximately 650 ft from suitable habitat, although occupancy status of this habitat is not yet known. Several researchers have suggested that use of residual trees is more likely if the stand is located near suitable old growth habitat (within 200 m.) and when the residuals are clustered within the stand. Use of residuals may also be more likely if they are located in watersheds where other occupied sites exist. Although reproductive success in these residuals is not well known, the murrelet nest located in the Big Creek Basin residual tree apparently failed. Landscape level studies have found that occupied sites across the species range are located in closer proximity to other occupied sites.

Because so few murrelet occupied sites have been found on managed forests in California, our understanding of the microhabitat requirements of the bird changes, as new occupied sites are located. The discovery of more nest and occupied sites will assist in the determination of the range and variability of microhabitat requirements of nesting marbled murrelets. The nests that have been measured across the species range (excluding Alaska) suggest that the number of potential nest sites on trees may one of the best predictors of stand occupancy. Murrelets require a broad flat surface (referred to as a platform) on a large lateral limb or other lateral structure; large lateral limbs are usually found on trees with larger diameters and/or on older-aged trees. Potential nest platforms include mistletoe blooms, deformed limbs, and areas where a tree may have been damaged.

Surveys for murrelets are currently required in all stands that support potential habitat. Here, potential habitat is defined as mature, old growth, or younger coniferous forests with multiple residual conifers in smaller clumps, which have deformations or other structures suitable for nesting. Although this definition is general, it encompasses some of the new information on murrelet nesting, including documented activity in younger forests (40-80 years) in the Oregon coast range and sites found in 1995 along Alder Creek. Nonetheless, nearly all marbled murrelet nest trees have been located in old growth and mature stands or stands with old-growth characteristics.

One small patch of unoccupied potential habitat known as the Green Bridge habitat patch is located near the western terminus of the appurtenant road. Please refer to THP Section II, Item 32 for additional information about the Green Bridge Habitat patch.

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Nelson, S.K., T.E. Hamer, A.K. Wilson, and D.J. Meekins. 2003. Marbled murrelet nest tree and nest site selection in the Pacific Northwest. Pacific Seabirds 30(1):51-52.

Casmerodius albus **Great Egret**

Great egrets range throughout the United States during summer months except for extremely high latitudes and elevations. In California, great egrets occur as year round residents in the Sacramento Valley and along the coast in the north. This species is listed as a Board of Forestry Sensitive Species.

Great egrets are large, colonially nesting water birds that feed on fish, snakes, amphibians, snails, crustaceans, insects, and small mammals. This species is found in a variety of aquatic habitat including salt and freshwater marshes, estuaries, mudflats, lagoons, lakes, rivers, and flooded fields.

Great egrets nest in groves of large trees, usually near water, and often-in mixed colonies with great blue herons. Because great egrets are sensitive to disturbance during nesting, rookeries usually occur in isolated locations. Great egrets can be found foraging throughout the year in coastal lagoons, saltwater marshes, tidal mudflats, bays, estuaries, freshwater marshes, irrigation canals, flooded fields, and slow-moving water around lakes and streams.

Breeding occurs from March to July. Breeding occurs primarily in the Central Valley, the Sacramento-San Joaquin Valley Delta, around San Francisco Bay, and along the central coast. Additional nesting colonies occur around Humboldt Bay, on the Modoc Plateau, near the Salton Sea, and along the Colorado River. Great egrets disperse along the entire California coast during the winter.

Great egrets were hunted almost to extinction for their plumage in the late 19th and early 20th centuries. With passage of the Migratory Bird Act, populations increased dramatically throughout their range. The use of organochloride pesticides (DDT) caused population declines through eggshell thinning leading to lower reproductive success. As with most species in this Family, the greatest threat to great egrets today is localized agricultural expansion and wetland drainage for urbanization. Human intrusion often results in the abandonment of nests.

This species is common along the north coast in winter. Incidental sightings of this species have been reported along the Ten Mile and Big Rivers. No known rookeries occur within the Biological Assessment Area. No significant adverse impacts are expected.

Literature:

Davis, W.E. 2001. Herons, egrets, and bitterns. *In* Elphick, C., J.B. Dunning, Jr., D.A. Sibley (eds.), National Audubon Society: The Sibley guide to bird life & behavior. Alfred A. Knopf Press, New York, New York.

Stokes, D. and L. Stokes. 1996. Stokes field guide to birds: western region. Little, Brown, and Company Press, New York, New York.

Chaetura vauxi **Vaux's Swift**

Vaux's swifts occur as a summer resident from southeast Alaska south to central California. The majority of nesting habitat for this species is natural and artificial cavities, although nesting does occur in other structures such as chimneys and smoke stacks. In coast redwood forests, the Vaux's swifts roost and nest in large hollow trees. This species is listed as a Species of Special Concern by CDF&G. The main limiting factor for this species nesting on forested landscapes is the abundance of large, hollow trees or snags. The proposed project parameters include retention of existing snags and residual wildlife trees to the maximum extent feasible. As snags, residual wildlife trees (culls) will be retained and silviculture is limited to unevenaged management , no significant adverse impacts are expected.

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Charadrius alexandrinus nivosus **Western Snowy Plover**

This species is associated with sandy beaches at marine or estuarine shores. It is also found near salt pond levees and the shores of large alkali flats. It requires sandy, gravely or friable soils for nesting. This species is listed as Federally Threatened and Species of Special Concern by CDF&G. The major threats to the snowy plover are nest destruction/disturbance on beaches and coastal development. This species has been observed at MacKerricher State Park and the Ten Mile Dunes Recreation Area, a few miles north of Fort Bragg. As no suitable habitat exists within the vicinity of the plan area, no significant adverse impacts are expected.

California Wildlife Habitat Relationships System. 2001. California Department of Fish and Game, California Interagency Wildlife Task Group. http://www.dfg.ca.gov/whdab/M132.html

Stokes, D. and L. Stokes. 1996. Stokes field guide to birds: western region. Little, Brown, and Company Press, New York, New York.

Circus cyaneus **Northern Harrier**

Northern harriers are distributed throughout North America during the breeding season, and throughout much of the United States year around, including the coastal redwood region. This species is listed as a Species of Special Concern by CDF&G. Northern harriers typically nest near ground level in moist open areas such as wet meadows, freshwater and saltwater marshes, abandoned fields etc. As the project provides protection measures for riparian areas and will maintain upslope stands of conifers, no adverse impacts are expected for this species.

Dendroica petechia brewsteri **Yellow Warbler**
Yellow warblers are neo-tropical migrants widely distributed throughout North America during summer months. In California, yellow warblers occur in desert, montane, and coastal wooded or mixed conifer habitats with substantial shrubs. This species is listed as a Species of Special Concern by CDF&G. Yellow warblers commonly nest in riparian areas associated with willows and alders though both nesting and foraging can occur in upland forest habitats. As the project provides protection measures for riparian areas and will maintain upslope stands of conifers, no adverse impacts are expected for this species.

Falco peregrinus **Peregrine Falcon**
Peregrine falcons are distributed worldwide, with the exception of Antarctica. The breeding range in California includes most of the Coast Range, inland north coastal mountains, Klamath Mountains, Cascade Ranges, and the Sierra Nevada. Although uncommon, wintering birds can be seen throughout California. This species is listed as federally and State Endangered and is a Board of Forestry Species of Special Concern.

Peregrines typically feed on highly mobile, flocking, and colonial nesting birds, such as shorebirds, waterfowl, and doves and pigeons. It has been suggested that the distribution of peregrines is limited by the distribution of prey species of this type.

Peregrine falcons nest on cliff ledges, small outcrops and in trees. Along coastal areas from California northward to British Columbia, nesting also occurs on "sea stacks". A number of re-introduced pairs also nest on tall buildings and nests have been located on bridges and towers. Cliffs that provide lodges, potholes, or small caves, usually with an overhang, and that are relatively inaccessible to mammalian predators are required components of nesting habitat. Nest sites usually provide a panoramic view of open country, are near water, and are typically associated with local abundance of passerine, waterfowl, or shorebird prey.

Peregrine populations underwent massive declines throughout North America beginning in the early 1950s and reached a low point in the 1970s. The subsequent recovery has been very rapid, primarily as a result of reintroducing birds reared in captivity, protection from persecution under federal and state laws, and the ban on the use of pesticides.

One of the densest Peregrine falcon populations in the state is located along the coast from Sonoma County north. A Peregrine falcon nests are known to occur in the North Fork Usal Creek area, North Fork Noyo headwaters, Reeves Canyon and Rancheria Creek drainages. .

Due to a lack of potential nesting locations and no historical or recent sightings within the Biological Assessment Area, it is expected that Peregrine falcon use of the plan area is transient at best. No significant adverse impacts are expected.

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Fratercula cirrhata **Tufted Puffin**
This species is a coastal shorebird distributed from Alaska to California and does not generally enter into forested regions. This species is listed as a Species of Special Concern by CDF&G. Because this species does not utilize the habitat present within or near the THP, no significant adverse impacts are expected.

Haliaeetus leucocephalus **Bald Eagle**
Bald eagles are widely distributed across North America during summer months and are year round residents throughout much of the United States. During summer months, bald eagles may be found across most of California with the exception of the southeast portion and may be found year around in the north-central portion of the state. This species is listed as State Endangered and is a Board of Forestry Sensitive Species.

Bald eagle nest sites are always associated with a lake, river, or other large water body that supports abundant fish and waterfowl prey items. In California, 70% of the breeding eagle population is associated with water bodies over 200 ha (494 ac). Nest trees are usually within 1 mile (1.6 km) of water and are typically in mature and old-growth conifer stands. Nests are constructed in trees that provide an unobstructed view of the water body and that are typically the dominant or co-dominant tree in the surrounding stand. Snags and dead-topped trees are important for perch and roost sites. Nest sites are usually located in areas lacking human disturbance, however, numbers of bald eagle territories are increasing in areas in close proximity to humans including urban parks, neighborhoods, and golf courses.

Historically, bald eagles bred in a variety of habitats in California, including offshore islands, on coastal cliffs and pinnacles, and along coastal rivers, interior valley streams and wetlands, and mountain lakes and rivers. Nest trees included a wide variety of hardwoods as well as conifers. However, most eagle nesting territories are now found in mountainous habitats in ponderosa pine and mixed conifer forests. Ponderosa pine is the tree most often used for nesting, although nest sites have been observed in a variety of tree species. The only known occurrence of a bald eagle nesting in a redwood is on the Mad River in Humboldt County on Green Diamond Resource Company (formerly Simpson) ownership.

Bald eagles are territorial during the breeding season, but densities and home range sizes are highly variable because of large variations in the dispersion and availability of potential nest sites and prey. For example, in western Washington, the mean density of occupied nests <2 km from 6416 km of forested marine shorelines was 1 nest/10.4 km while the density of occupied nests along 1728 km of inland waters in eastern Washington was 1 nest/34.6 km. These densities suggest that the Washington nesting population of bald eagles is near, or at, saturation. Other reported densities range from 0.08 nests per km of shoreline in British Columbia to 0.56 in Alaska. In Oregon, the average inter-nest distance among eight pairs was 3.2 km. Bald eagles winter communally along specific rivers, lakes, or reservoirs that support prey species and have large trees or snags for perch sites and night roosts.

Bald eagles were highly persecuted up until 1940, when they were afforded protection under the Bald Eagle Protection Act. Further dramatic declines in bald eagle populations occurred during the next 3 decades from the use of pesticides, especially organochlorine pesticide (DDT), which bio-accumulates through the food chain and causes eggshell thinning and breakage. DDT was banned in the U.S. in 1972, and since that time bald eagle populations have rebounded dramatically. For example, in 1963, a total of 417 active occupied sites were known in the lower 48 states, while in 1998, an estimated 5,748 breeding sites were reported. The bald eagle population in the lower 48 states has approximately doubled every 7 to 8 years during the past 30 years.

In 1999, 199 known nest sites were recorded in California, with most nest sites found in northern California. No bald eagle nests are known to occur in the planning area, and there are no records of bald eagles in the nine USGS 7.5 minute quad block encompassing the planning area in the NDDB. Two nests were reported along Big River and additional nests along the Ten Mile River in Mendocino County prior to 1940. The nearest record of nesting bald eagles is Booneville, from former CDF&G biologist Ted Wooster in 1999. Since nesting Bald Eagles are not known to occur within the assessment area and because the plan will maintain suitable perching trees in timber stands within WLPZs and adjacent areas, no significant adverse impacts are expected.

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***Icteria virens* Yellow Breasted Chat**
Yellow breasted chats are neo-tropical migrants widely distributed throughout North America during summer months. In California, yellow breasted chats occur in both coastal and Sierra foothill riparian habitats, although they are uncommon along the coast in

northern California. This species is listed as a Species of Special Concern by CDF&G. Yellow breasted chats are closely associated with dense thickets of willow and shrubs near watercourses for nesting and foraging. As the project is designed to protect such riparian areas, no significant adverse impacts are expected.

***Pandion haliaetus* Osprey**
The osprey is a migratory, fish-eating hawk with one of the broadest geographic distributions of any bird. The species is widely distributed throughout Eurasia, the Americas, Africa, and Australia. In California, ospreys breed throughout northern California from the Cascade Range south to Marin County and throughout the Sierra Nevada. This species is listed as a Species of Special Concern by the CDF&G and is a Board of Forestry Sensitive Species.

Large river systems in northwestern California support numerous breeding pairs. The essential habitat requirements of osprey include a water body with abundant and accessible fish and a nearby nest site. Foraging almost exclusively on fish, ospreys are only found in association with lakes, reservoirs, coastal bays, ocean coastlines, or large rivers and deltas. Nests are usually within 1,000 ft of a food source, but are occasionally found as far away as 1 mile. Nests are typically constructed on top of tall, broken-top trees or snags, which are often taller than the surrounding vegetation. Nest sites are usually in open forest habitat or along the edge of a water body for easy accessibility. Artificial nest platforms are readily used and often result in higher productivity than natural nest sites.

Osprey were highly impacted by organochloride pesticide (DDT) use from the late 1940's to the mid-1970s, and pesticide poisoning extirpated smaller populations in several states. The ban on DDT lead to an explosion of osprey populations with numbers increasing in the U.S. alone from an estimated 8,000 pairs in 1981 to over 14,000 nesting pairs in 1994. The number of breeding pairs in California was estimated from 500-700 in 1994 and populations continue to grow.

Ospreys are readily observed along the Mendocino County Coastline. There are no known existing osprey nest sites within the proposed plan area. No significant adverse impacts are expected based on the above.

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***Progne subis* Purple Martin**
The purple martin is a neo-tropical migrant occurring throughout much of the United States. Purple martin are summer residents in California, utilizing a variety of open forest habitats (including redwood), woodlands, and riparian areas, and nesting mostly in woodpecker cavities. It feeds primarily on insects caught on the wing, but will also forage on the ground. It is listed as a Species of Concern by the CDF&G. The primary threats to this species are loss of riparian habitat, removal of snags, and competition for nest cavities with other species, including introduced European starlings and house sparrows. As described in Item #26 of the THP, harvesting within the Class II WLPZs will be limited. As such, there will be very little disturbance of riparian habitat as a result of operations on the plan. All snags will be retained except any posing a safety hazard during operations, as described in Section II, THP Item #33. Given these protection measures, no significant adverse impacts are expected.

***Strix occidentalis caurina* Northern Spotted Owl**
The northern spotted owl (hereafter spotted owl) is one of three spotted owl subspecies inhabiting western North America. The range of the spotted owl extends from southwestern British Columbia to Northwestern California south to Marin County, California. The eastern edge of its range corresponds roughly with the eastern periphery of the Cascade Range and the Central Valley in California. This sub-species is listed as Federally Threatened, a Species of Special Concern by CDF&G, and is a Board of Forestry Sensitive Species. Throughout its range, the spotted owl is associated primarily with mature/old conifer forests. Studies of habitat use indicate

that owls generally select mature/old forests for nesting, roosting, and foraging in an amount equal to or greater than expected, and younger forests in an amount less than expected. However, spotted owl populations in some physiographic provinces deviate from this general pattern.

Spotted owl home range sizes vary widely between forest type, physiographic province, and individual spotted owls. Spotted owl home range size in the California coast redwood zone averaged 1,476 ac [Irwin & Rock 2005], while home range sizes in the Eastern Cascade physiographic province in Washington averaged 8,072 ac. Several studies found a negative correlation between home range size and the proportion of mature/old forests in the home range and breeding densities negatively correlated with the amount of forest fragmentation. However, as spotted owls persist in relatively small home ranges in regions with little mature/old forests remaining, other factors likely influence home range size. For example, spotted owl home range sizes were smaller when wood rats were the primary prey, while spotted owl home range sizes were larger when flying squirrels dominated the spotted owl's diet. In addition, spotted owl home range size tends to be negatively correlated with the abundance of wood rats.

Habitat use studies in many of the forest types and physiographic provinces across the spotted owl's range have led to an emphasis on the importance of forest structure. Optimal spotted owl habitat has been characterized as uneven-aged forest with a multi-layered canopy, high canopy closure, large overstory trees, and a considerable degree of decadence, such as trees with broken tops and cavities for nesting, dead snags, decaying logs, and woody debris on the forest floor.

Deviations from the general patterns of mature/old forest habitat associations occur at both the individual and population levels. This is particularly true in the coastal redwood forest zone, where substantial spotted owl populations persist in forests much younger than those typically inhabited in other forest types and eco-regions. In the coastal redwood forest zone, spotted owls nesting and roosting occur in areas dominated by younger age classes, and relatively high breeding densities have been reported in managed forests from this region. Although spotted owls in the coastal redwood region use younger stands for nesting and roosting, several studies indicate that spotted owl use of nesting and roosting habitat may still be dependent on forest structural attributes associated with mature/old forest. At the landscape level, habitat mosaics surrounding spotted owl nests in the coastal redwood zone contain a greater amount of younger 31-45 yr and 45-60 yr age class forest than unused sites.

The location and habitats of the spotted owls within the Biological Assessment Area are well known due to extensive monitoring conducted since 1989. Habitat and disturbance mitigation is incorporated into the THP. As the plan proposes uneven aged silvicultural management, habitat components will remain within the THP and surrounding area. Quantity of habitat associated with any individual NSO activity center will be evaluated out to the 0.7 mile radius even if the area in question extends outside of the stated biological assessment area. Given the habitat remaining after harvest, in conjunction with the intensive monitoring these owls receive, no significant adverse impacts are expected.

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MAMMALS:

Corynorhinus townsendii **Townsend's Big-eared bat**

Townsend's big-eared bats are a CDFW Species of Special Concern. The Townsend's big-eared bat is a medium-sized bat that occurs throughout California and western North America, except at extreme high-elevations. Townsend's big-eared bats use caves, mines, buildings (none of which are known to be present on this ownership) and old growth conifers with large basal hollows (which are present as rare isolates on this ownership) for roosting and maternity colonies. This species uses open areas including forest edges and riparian corridors along larger watercourses for foraging and is also known for picking prey off of vegetation.

Although Townsend's big-eared bats occur throughout California, except at high elevations (e.g. alpine habitats), their occurrence is generally spotty, apparently limited by occurrence of roost opportunities. Roosting, maternity and hibernacula sites in California include limestone caves, lava tubes, abandoned mines, buildings, barns, and other abandoned anthropogenic structures (Williams 1986).

In the coastal forests of northern California, this species is known to roost in large basal hollows of old growth redwood trees (Fellers and Pierson 2002, Mazurek 2004). Mazurek (2004) confirmed the use of two old-growth trees with large basal hollows as Townsend's big-eared bat maternity roosts in Grizzly Creek State Park, Humboldt County. These trees exhibited diameters at breast height (dbh) of approximately 10 feet and 15 feet with basal hollow openings of approximately 30 square feet (12 feet high x 2.5 feet wide) and 75 square feet, (15.4 feet high x 4.9 feet wide) respectively. Mazurek (2004) further surveyed an additional 180 trees with basal hollows, of which 13 (7%) were likely used as maternity roosts based on guano DNA analysis. Average dbh of the 13 trees was approximately 9 feet; however, no range of dbh was provided. This study was located within old-growth forest where basal hollows occur in much higher densities than typically occurs on industrial timberland forests. In Mendocino County, another study on industrial managed landscapes examining wildlife use of 15 isolated legacy trees with basal hollows compared to those without did not find any evidence of roosting by Townsend big-eared bats (Zielinski and Mazurek 2004). Lastly, in a study of roosting and foraging behavior of Townsend's big-eared bats in Sonoma County of coastal California, basal hollows in six redwood trees used by daytime roosting males had a minimum dbh of approximately 4 feet with basal hollow openings ranging between approximately 3 and 83 square feet, however these basal hollows were not used as maternity roosts (Fellers and Pierson 2002). Density of trees with basal hollows in the area was not indicated, however, the area was described generally as second growth redwood, and therefore the density of trees with basal hollows was likely low to moderate in occurrence. Frequency and intensity of use of isolated basal hollows by roosting Townsend's big-eared bats, especially for maternity roosts or hibernacula is unknown, but based on the studies conducted to date, use of these basal hollow isolates may be low in Mendocino County and consist mainly of daytime roosting sources.
Colony size ranges from a few dozen to several hundred. Some colonies are known to change roosts during the maternity season based on changing thermal regimes within the roosts; using cooler roosts earlier in the year (Peirson et al. 1991) and warmer roosts after pups are born. These roost changes may depend on the type and structure of the roost itself (Sherwin et al. 2003). Maternal colonies form between March and June and one pup / female is born between May and July (Pearson et al. 1952; Harvey et al. 2011). Young begin to disperse in September and October (Pearson et al. 1952, Tipton 1983). Maternity roosts and hibernacula sites may be sensitive to anthropogenic disturbance, resulting in abandonment. However, types and frequency of disturbance leading to abandonment has not been documented in Townsend's big-eared bat use of basal hollows. Mazurek (2004) describes one of the basal hollows used as a maternity colony in Grizzly Creek occurring directly adjacent to a "high traffic foot trail".

There are no known Townsend's big-eared bat colonies and no known mine shafts or caves present on the timberland owner's property. Abandoned anthropogenic structures are not known to be present on the timberland owner's property within the Plan boundary or within 300 feet of the Plan boundary on the timberland owner's property. Large old-growth legacy trees with basal hollows could be considered as cave analogues (Mazurek 2004) and function as maternity roosts or hibernacula roosts. On the timberland owner's property within the BAA, potential roost structures conservatively include large trees (≥42 inches dbh; adapted from maternity roosts in large redwood trees with average dbh of 9 feet as described by Mazurek 2004) with large basal hollows and an internal roost area large enough for flying forays (larger than the entrance). The roost entrance in general must be at least 10 square feet in size with a minimum opening dimension of 2 feet. The roost ceiling must be dome-like (allowing for multiple bats to roost in clusters) and occur at least 1 foot above the top of the entrance (allows for better protection from predators and changing microclimates). The only light penetrating the roost area must originate from the roost entrances so that the internal roost area remains semi-dark to dark (Fellers and Pierson, 2002).

Because no habitat (maternity roosts or hibernacula) for this species is known to occur in the THP area or within 400 feet of the THP area and due to protection measures established should this species later be found occupying the project area no significant adverse impacts are expected to this species.

Antrozous pallidus **Pallid Bat**

The pallid bat is a common, widely distributed species throughout California. Day roost habitat includes caves, crevices, mines, and occasionally buildings and tree hollows. Habitat preferences appear to be rocky outcrops, cliffs, and crevices with open habitats for foraging. This species is listed as a Species of Special Concern by the CDF&G. The NDDB has no listing for the pallid bat in Mendocino County, although the species is known to exist in Sonoma & Marin Counties. The California Wildlife Habitat Relationship System suggests a low likelihood of occurrence in coastal redwood forests. Management measures implemented on this THP which will benefit the pallid bat include retention of snags, retention of residual wildlife trees, retention of trees near Class I and Class II watercourses, and extensive use of unevenaged management silviculture prescriptions. No adverse impacts are expected.

Arborimus pomo **Sonoma Tree Vole aka red tree vole**

The Sonoma tree vole (*Arborimus pomo*) is an arboreal, small rodent restricted to coastal forests in the humid fog belt in northwestern California where their range extends from Sonoma County northward into Del Norte County. The red tree vole (*A. longicaudus*) and the Sonoma red tree vole were split in 1991 based on genetic studies. This species is listed as a Species of Concern by the CDF&G.

The Sonoma tree vole (hereafter tree vole) has a specialized diet consisting of the soft tissue of Douglas-fir needles. It will also feed on needles, buds, and bark of Douglas-Fir and other conifers. The tree vole is a nocturnal rodent that is active year round.

It has been suggested that old-growth forest appears to be optimum habitat due to tall, multi-layered canopies retaining humidity and intercepting fog, thereby functioning as both a source of free water and a climatic buffer and that red tree vole nests were most abundant in old-growth forests. However, recent findings suggest that red tree voles may not be old-growth dependent and occur in a variety of stand ages such as closed sapling-pole-saw timber, large saw timber, and old-growth coniferous forest stands. In a study on industrial timberlands, investigators found tree vole nest abundance increased with stand age, however none of the stands sampled were old growth. Another investigator found significantly more Sonoma tree voles nests in mature (>61 cm DBH) stands than in young or pole stands, although nests were found in younger stands. Basal area of Douglas-fir (75-90 m^2/ha) and percent slope (25-37%) were the best variables explaining tree vole nest abundance. Hardwoods are not recognized as an important habitat component; however, nests have been located in tanoaks.

Tree vole nests occur in the Biological Assessment Area. When nest trees are located they are marked for retention with additional screen trees also being retained. Generally, it has been found that the tree vole is fairly common in young stands of Douglas-fir, which is a vegetative component that is wide-spread throughout the proposed harvest area and BAA. Since Douglas-fir will continue to be present in a variety of age classes following operations and into the long-term future, no significant adverse impacts are expected.

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Martes pennanti **Pacific Fisher**
On 5/9/2016 the Fish and Game Commission found that the Northern California Evolutionarily Significant Unit of fisher does not warrant listing.

The Pacific fisher is a large member of the weasel family occurring in Canada and the U.S., including portions of the Pacific Northwest into northern California. According to CAL FIRE and DFG range maps (CAL FIRE, August, 2009; DFG CWHR, Version 8.2) fishers are considered rare or absent in the coastal redwood forests of Mendocino County, and are based on limited anecdotal sightings occurring in this region. These un-substantiated sightings should be viewed with caution as they are inherently unreliable. According to range maps produced by Bill Zelinski and Keith Slauson, foremost experts on fisher in California, the fisher's range based on verifiable records includes eastern Mendocino County but excludes the coastal region. Substantial survey effort in coastal Mendocino County supports this observation as track plate surveys and camera surveys have failed to provide physical evidence of fisher in coastal redwood forests. Meso-carnivore track plate surveys conducted by the prior landowner Georgia-Pacific in the 1990s failed to detect fisher, as well as camera surveys conducted in 2003 on the adjacent ownership of Jackson State Demonstration Forest. The most comprehensive and systematic meso-carnivore surveys conducted to date were on the adjacent Mendocino Redwood Company ownership wherein surveys conducted from 2004-2010 failed to detect fisher. In terms of anecdotal evidence, the hundreds of field hours spent by biologists during 20 years of northern spotted owl surveys on this tract have failed to sight fisher. The lack of fisher detections during meso-carnivore surveys in the region and the lack of sightings by biologists in the assessment area suggest that fisher are either absent, or are so rare as to escape detection.

There have been limited fisher habitat studies on coastal redwood managed forests in northern California. These studies, conducted in Del Norte and Humboldt County, only examined habitat where fisher were detected and were not directed at characterizing den or rest sites, therefore, they are of limited utility when characterizing a range of fisher habitat requirements in the coastal redwood region. These detection surveys suggest fishers occur less commonly (e.g. significantly lower detection rates) in coast redwood forests closer to the coast than in Douglas-fir/hardwood forests dominating more xeric inland sites. Fisher detection rates were positively correlated with stands of large diameter mixed Douglas-fir and hardwood, elevation, log volume, and moderate slopes. Fisher may generally be associated with either late-successional forests or second growth forests containing late-successional structural elements such as high densities of large conifer (esp. Douglas-fir) and hardwood, snags, deformed trees, large woody debris, high canopy closure, etc. Fisher use cavities in large diameter trees and snags for natal and maternal dens and more rarely, downed logs and brush piles. For resting sites fisher will also use large limbs (platforms), tree cavities, rock piles, and sub-nivean cavities. The fisher is an opportunistic hunter and feeds on a variety of vertebrates, including birds, rabbits, and rodents, including woodrats.

Although the range of habitat requirements for fisher in coastal redwood forests is unknown, the typically described habitat for fishers is not generally present the assessment area. Green Diamond Resources, which manages redwood/Douglas-fir in northern California has conducted several studies regarding fishers on their ownership, and states "Green Diamond's work on this species demonstrated that most of the same conservation measures developed for the owls were also beneficial for fishers."[1] Ongoing habitat relationship studies being conducted on the Hoopa Valley Tribal ownership in the Klamath Region has suggested merit in this generalized approach on industrial managed landscapes. With the likely absence of fisher in the biological assessment area and the maintenance of late successional elements, where they exist, including large woody debris, snags, large hardwoods and conifers, and structurally complex wildlife trees and screen trees, WLPZ protection measures, as well as single and grouped leave trees in even aged management units for future snag recruitment, no significant further adverse impacts are expected to this species

Myotis lucifugus **Little Brown Myotis**
This species of bat has a moderate range, but is locally common within its range. This species is listed as a Species of Special Concern by the CDF&G. Populations appear to be limited by the availability of roosting sites, which are primarily buildings, trees, rocks, wood, and occasionally caves. The little brown myotis may roost in cavities and fire scars present on some residual wildlife trees. Because the assessment area does not contain the highest use habitats, and potential roosting sites will not be significantly affected (retaining of culls and residual trees), no significant adverse impacts are expected.

Myotis yumanensis **Yuma Myotis**
The Yuma Myotis appears to prefer open forests and woodlands adjacent to water sources to forage over. This species will roost in buildings mines, caves, or crevices. A lack of suitable roosting locations within the assessment area indicates that the area may not be heavily used by this species. This species is listed as a Species of Special Concern by the CDF&G. Considering that potential water sources over which they feed will be protected, there are no significant adverse impacts expected.

Humboldt Martin (*Martes americana humboldtensis*) – This species is not known to be present in the Westport area. According to the Ecology of American Martens in Coastal Northwestern California, Progress Report II, by K. Slauson, W. Zielinski, and J. Hayes, this species inhabits two major vegetation types associated with serpentine and non-serpentine soils. On serpentine soil types, this species occupies areas of rock outcrops with a moderate to heavy understory component. On non-serpentine soils, this species occupies mainly late seral and old growth structure (dense shrub layers, large diameter trees, snags, and logs). According to the above cited study, the decline of this species is mainly due to historic trapping for its fur and loss of old growth forests. The serpentine habitat described in the study does not occur in or adjacent to the harvest area. This stand will be transitioned to an uneven aged structure which will likely improve the habitat in this stand over time by creating multiple canopy layers.

Point Arena Mountain Beaver (*Aplodontia rufa nigra*) – The PAMB is a locally restricted subspecies with a small range occurring in the coastal vicinity of Point Arena in Mendocino County. Mountain beavers are active year round. They breed from December through March in burrows in deep soils and thickets adjacent to streams and springs. Nest chambers are 1-4.5 feet under the ground. Young are born from February to June. This species feeds and vegetative parts of plants: mostly berries, salal, ferns, lupine, willows, and grasses. Mountains beavers forage on the ground and up to 15 feet in trees and shrubs, and store food in or around the burrow. This species typically utilizes dense riparian understory vegetation for cover, but can be found in areas with open or intermediate canopy coverage as well. Mountain beavers need fresh, abundant drinking water throughout the year. The planned harvest is located beyond the range of this species.

Canis lupus **(Gray Wolf) Federal Endangered. State Endangered,**
One June 4th, 2014 the gray wolf became listed as endangered under the California Endangered Species Act (CESA). The plan and assessment areas include habitat for gray wolfs. According to CDFW information titled CALIFORNIA 'SKNOW WOLVES PASTAND PRESENT (February 2020) the gray wolf is moving back into northeastern California in small but increasing numbers. Two wolf packs identified as the Lassen and Shasta packs are known. The Shasta pack is thought to be no longer operating as a pack. Other wolves fitted with tracking collars that are known to be or known to have been in California include (OR7), (OR25), (OR54, now deceased), (OR44) and (OR59, now deceased). Other contemporary wolf sightings have been reported in Siskiyou, Modoc, Lassen, and Plumas counties.
Although unlikely to occur, protection measures are included in section I1 of the plan should a gray wolf be observed in the plan area. No significant adverse impacts are expected to this species.

[1] http://www.greendiamond.com/environment/wildlife.asp#owl

FISH:

***Oncorhynchus kisutch* Coho Salmon**

Taxonomy: Coho salmon are one of the six species of "salmon," two species of "salmon-trout," and several species of "trout" within the genus *Oncorhynchus*. Within this group, they are more closely related to Chinook salmon (*O. tshawytscha*) than to other salmon. In California, Coho populations are considered to be at the southernmost extent of their range and have adapted to what is considered extreme conditions for the species.

Distribution: Coho salmon historically spawned and reared in most coastal streams from central California to near Point Hope, Alaska in North America, and in Asia from North Korea to the Anadyr River in Russia. In California, spawning populations once ranged in most coastal streams from the Smith River in Del Norte County south to the San Lorenzo River in Santa Cruz County. By 1991, about half of the historic Coho streams in California had lost their populations, and it appears they are still declining. Small populations are presently scattered in coastal streams and rivers from Del Norte to Santa Cruz Counties. In the ocean, Coho spawned in California generally remain in waters off California and southern Oregon.

Along coastal Mendocino County, juvenile Coho are found in higher densities on all major rivers and their tributaries within five miles of the coast, especially larger watercourses with north-south aspects or geomorphic and climatic features that maintain cool temperature regimes. As distance from the coast increases along these watercourses, Coho densities attenuate.

Life History: Most juvenile Coho rear in riverine habitat with highest densities found in deep (>1m), cool pools with abundant cover, particularly in summer. They will utilize a variety of habitats where cover, depth, temperature, and velocities are appropriate. They are typically associated with abundant instream shelter such as logs, root wads, and undercut banks. In California streams, which undergo pronounced seasonal differences, juveniles show major shifts in habitat preferences throughout the year. In springtime, when flows are moderate and fish are small, they are widely distributed throughout all riverine habitat types. As stream flows diminish in summer, fish concentrate in pools or deep runs. During winter they seek refuge from high flows in off-channel pools and smaller tributary streams. Shelter complexity is particularly important during this over wintering stage. It should be noted that some juvenile rearing occurs in freshwater estuaries and lagoons.

In California streams, temperature is a major factor limiting juvenile Coho. Stream temperatures of 12 –14 C are optimal, and these fish generally do not persist in streams where temperatures reach 22 -25°C for extended periods. Researchers in the Mattole River watershed found Coho to be absent from sites where the maximum temperature exceeded 18°C for extended periods. Temperatures above 25 -26°C are considered lethal.

Coho typically prefer clear water, as even moderate silt loads will damage the gills of young Coho and reduce growth rates. High turbidity and silt loads can be detrimental to all juvenile stages, from incubation and emergence to growth and feeding.

Emigration to the ocean in California usually takes place in March, April and May, when groups of 10-50 fish abandon shelter habitat and enter the main stem of the river system. Most downstream movements occur at night but are not continuous, interspersed with periods of feeding and holding in areas of low velocity. As fish enter the estuary they transform into smolts and linger for a period to adjust their osmoregulatory system to seawater. After entering the ocean, young salmon at first remain close to the parent stream, but eventually move northward along the continental shelf of California and Southern Oregon.

Status: Two Coho salmon ESUs in California were listed in 1996 and 997 as Threatened by NMFS due to a 90 – 95 % population decline over a fifty year period. Both ESUs, the Southern Oregon Northern California (SONC) and the Central California Coast (CCC).

On Aug 5, 2004, the California State Fish and Game Commission listed Coho as Endangered South of Punta Gorda. Due to required watercourse buffer protections and other measures minimizing thermal effects and sediment movement to watercourses, no significant adverse impacts are expected to this species and its habitat.

Oncorhynchus mykiss **Steelhead / Rainbow Trout**

Taxonomy: Steelhead and rainbow trout are considered one of the two species of "salmon-trout" within the genus *Oncorhynchus.* Within this group, they are more closely related to "salmon" than to other "trout" (cutthroat). They are the most abundant and widespread native salmonid in western North America. They are successful because of their ability to adapt to a wide variety of habitats and their flexible life history patterns. As a result many populations have evolved distinctive characteristics and have been given taxonomic (subspecies) recognition. In California, as in all the western states, the mixing of hatchery-reared fish into native populations has further blurred the sometimes vague distinctions between sub groups.

It is generally believed that, prior to the disruption of the rainbow trout gene pool by introductions of hatchery fish, there were three distinct groups: redband trout of the upper Columbia and Fraser River basins, redband trout of the Sacramento-San Joaquin River drainage, and coastal rainbow trout. Red band trout is the general name given to the mostly resident forms in the interior basins, whereas coastal rainbow trout is the name used to refer to the anadromous and resident coastal forms. Steelhead trout is the name awarded to the anadromous (migratory) component of the coastal group; however, within this group non-migratory populations (resident) are also present.

Within the California coastal rainbow trout stock (O. m. irideus), NOAA Fisheries (formerly NMFS) has recognized six distinct Evolutionarily Significant Units (ESUs) based on analysis of genetic and life history data:

- Klamath Mountain Province steelhead
- Northern California steelhead
- Central Valley steelhead
- Central Coast steelhead
- South/Central Coast steelhead
- Southern steelhead

Populations of "steelhead" within the Northern California steelhead ESU are found in almost all permanent fish-bearing rivers in coastal Mendocino County.

Distribution: The Pacific coast rainbow trout were originally native to streams from Alaska down to Baja California. In California they were originally distributed in all permanent streams from San Diego north to the Klamath River drainage. The Northern California steelhead ESU includes all trout from Redwood Creek (Humboldt County) to the Gualala River (Sonoma County), including the Noyo River drainage. It should be noted that rainbow trout have been introduced into most cold-water streams and lakes not only throughout North America, but also throughout the world.

Life History: California rainbow trout have life history patterns that are both flexible and variable. However, two basic life history patterns seem to exist: migratory and resident. Both types can exist in the same population, but the dominance of one type or another is the defining trait for the population. Migratory populations are either sea-run (anadromous), lake-run (limnodromous), or within river-run (potodromous). Anadromous steelhead and limnodromous trout migrate from the ocean and lakes to tributary streams to spawn, whereas potodromous trout migrate within rivers to spawning areas.

Anadromous steelhead are additionally defined by two life history patterns: winter and summer. Sexually mature winter steelhead enter the stream from the ocean during winter high flows to migrate, spawn, and potentially return to the ocean. In contrast, summer steelhead enter rivers as immature fish during spring flows and migrate to headwater reaches where they over-summer and mature in deep pools. They then spawn during the following winter or spring flows. Summer steelhead are not found south of the Mattole River drainage in Humboldt County. The steelhead population on the ownership is primarily winter run with a resident subpopulation.

In contrast to this complex migratory life history pattern for anadromous steelhead, resident trout often spend their entire lives within a small stream reach, although some migration is also known to occur within this group. Juvenile steelhead and trout have the same habitat requirements for instream rearing, regardless of the life history strategy of their progenitors. They are found in cool, clear, fast flowing streams where riffles predominate, where cover from terrestrial vegetation, undercut banks, and boulders is abundant, and where invertebrate food sources are plentiful. Cool temperature is a primary habitat characteristic needed for optimal growth of rainbow trout. Temperatures above 23°C are usually lethal, with optimal temperatures ranging around 15-18°C.

As a further reflection of their life history plasticity, the age at which juvenile steelhead migrate downstream to the ocean is highly variable, presumably dependent on various factors such as, genetics, river characteristics, and stochastic climatic events. Generally, steelhead will spend 1-3 years in the stream; locally they appear to spend about two years in fresh water. After entering the ocean, where they may forage from 1-4 years, steelhead grow rapidly on a diet of fish, squid, and crustaceans taken in ocean surface waters. The distribution of California stocks within the ocean is poorly understood, but research suggests that most California fish do not wander far from the California coast.

Having reached maturity in the marine pasture, California winter steelhead enter coastal streams when winter stream flows permit passage back to their natal spawning areas. They may move upstream any time during the period from December – March, peaking typically in January and February. The life history patterns for steelhead and rainbows are defined by variability that presumably allows them to maintain abundance and diversity in the face of highly variable ocean and stream conditions.

Status: Steelhead were listed as Threatened by NMFS in 2000 in the Northern California steelhead ESU for the following reasons:

- Increased water temperature from loss of shading
- Siltation of holding pools and spawning riffles
- Predation from introduced pikeminnows in the Eel River
- Interactions with hatchery steelhead
- Fisheries (high seas gill netting)

Steelhead in this ESU are still widely distributed, but their numbers continue to decline, possibly at less than 10 % of their former abundance. Due to required watercourse buffer protections and other measures minimizing thermal effects and sediment movement to watercourses, no significant adverse impacts are expected to this species and its habitat.

Oncorhynchus tshawytscha **Chinook Salmon**

Taxonomy: Within the genus *Oncorhynchus,* Chinook salmon are most closely related to Coho salmon. Within the species there are many distinct populations, usually recognized as "runs" or "stocks," that show genetically based adaptations to local and regional environments. In California there are at least seventeen distinct runs, recognized by river system and the timing of the run. Stocks within major tributaries are often recognized independently as well, based on differences in genetics and life histories. Nevertheless, of the seventeen major recognized runs, thirteen occur within the larger river systems of California's north coast, from the Smith River to the Russian River, and four stocks are endemic to California's Central Valley. NOAA Fisheries recognizes six Evolutionarily Significant Units (ESU) of geographically proximate Chinook populations in California, of which the California Coastal Chinook ESU encompasses coastal Mendocino County. The present and historic status of these fish in streams in this region is largely unknown.

Distribution: In North America Chinook salmon spawn in streams from Alaska to the San Joaquin and Kings Rivers in the Central Valley, although they are found in the ocean as far south as southern California. The California Coastal ESU includes Chinook spawned in rivers and streams south of the Klamath River to the Russian River, California. Anecdotal accounts and some research indicate the presence of Chinook within the relatively smaller streams of coastal Mendocino County, specifically the Big, Ten Mile, and Noyo Rivers and even Wages Creek. Although their numbers in this region are unknown, it is generally believed they were a lesser component of the instream salmonid community being largely overshadowed by Coho and steelhead. Hatchery Chinook were planted in the Ten Mile River in the 1970s, but spawning surveys indicate that returning spawners diminished over time. It is unknown as to whether local Chinook are progeny from a coastal "run" or "strays" from larger rivers, such as the Klamath, Eel or Sacramento.

Life History: Although Chinook have a great array of life history patterns that allow them to take advantage of many riverine environments, two basic life history patterns predominate: stream-type and ocean-type. Stream-type Chinook have adults that run up streams in spring or summer, before they have reached maturity, and juveniles that spend a long time (usually >1 year) in fresh water. Ocean-type Chinook have adults that spawn soon after entering fresh water, from summer to late fall and winter, and juveniles that spend a relatively short time (3-12 months) rearing in fresh water. In this area it is unlikely that stream-type Chinook occur, due to the relatively small river systems, especially in summer. The ocean-type life history strategy allows fish to take advantage of high quality spawning and rearing areas, which are often too warm in summer to support salmonids. This strategy may be advantageous for Chinook in this region. Ocean-type Chinook (and hatchery fish) often display a high rate of "straying" which may account for local populations. California Chinook generally remain off the California coast, presumably due to high rates of feed production linked to ocean upwelling and the California Current.\

Status: All Chinook salmon runs in California have declined, many to extinction. In this region Chinook were listed as Threatened by NMFS in 1999 in the California Coastal Chinook ESU. Chinook are generally regarded as large river fish; therefore the single biggest factor for their decline has been the construction of massive dams and diversions on all major rivers. In the Central Valley dams have blocked Chinook access from over half the streams they once used. Although each run has special problems associated with it, the general factors for decline are:

- Dams and diversions causing loss of access to historic habitat and limiting water resources
- Over harvesting in the ocean and rivers which depletes wild runs
- Loss of floodplains and estuarine habitat caused by diking and draining
- Enhanced predation of juveniles by non-native predatory species, such as striped bass.
- The false assumption of wild-run abundance due to wild runs mixing with hatchery fish
- Competition from hatchery-reared juveniles and adults
- Diseases introduced from hatchery-reared fish
- Pollution and urbanization
- Increases in stream temperature from loss of shading in riparian areas
- Siltation of spawning areas from logging and road building
- Global warming, as it affects the marine environment

The present status of Chinook populations in coastal Mendocino County streams is mostly unknown due to a nearly total lack of biological information for coastal Chinook salmon south of the Eel River. Due to required watercourse buffer protections and other measures minimizing thermal effects and sediment movement to watercourses, no significant adverse impacts are expected to this species should it occur or its habitat.

(For additional discussion of mitigation and protection measures specific to this THP, see the **"Coho, Steelhead and Chinook Salmon Assessment: Pre and Post Harvest"**, below.)

REPTILES and AMPHIBIANS:

Ascaphus truei **Coastal Tailed Frog**
The coastal tailed frog is a stream-breeding frog generally associated with high gradient, cold, permanent headwater streams. This species is occurs in British Columbia, Washington, Oregon, and Northern California primarily west of the Cascade crest. Species distribution in California includes Humboldt and Mendocino counties. This species is listed as a Species of Special Concern by CDFG. The coastal tailed frog lays its eggs in cold, fast-flowing streams and tadpoles attach themselves to the underside of rocks. Tailed frogs are dependent on permanent stream flow because the tadpoles require several years to metamorphose into adults. Research in Oregon suggests that streams with substrates with low amounts of fine sediments are preferred for breeding habitat. Due to required watercourse shade canopy retention practices and watercourse buffer protections and other measures minimizing sediment movement to watercourses, no significant adverse impacts are expected to this species and its habitat.

Plethodon elongatus **Del Norte salamander**
The Del Norte salamander is a woodland salamander found in coastal forests under woody substrate and in rock rubble and talus. The range of this species includes Northern California and Southern Oregon. Records for this species in California include locations in Del Norte, Siskiyou, Trinity, and Humboldt counties, but not Mendocino County. This species is listed as Species of Special Concern by CDFG. The Del Norte salamander is considered to have a life history similar to other Plethodontid salamanders: egg clutches laid under moist substrate and protected by females until hatching, and relatively small home ranges. No adverse impacts are expected for this species or its habitat because it does not occur in this area.

Rana aurora aurora **Northern Red-legged Frog**
The northern red-legged frog is a pond-breeding frog usually associated with ponds, wetlands, and other lentic aquatic habitat, and adjacent terrestrial areas. The northern red-legged frog is a subspecies of the red-legged frog and occurs in British Columbia, Washington, Oregon, and the northwest coast of California. This subspecies is listed as a Species of Special Concern by CDFG. The red-legged frog lays egg masses in still water in the spring. Larvae hatch and metamorphose in a single season. Adults have been known to travel long distances in upland forest but return to breeding sites to reproduce. Required buffer protections to streams, wetlands, and other aquatic habitats are expected minimize significant adverse impacts to this species and its habitat.

Rana boylii **Foothill Yellow-legged Frog**
The foothill yellow-legged frog is a stream-breeding frog associated with permanent streams. This frog is distributed from western Oregon to southern California in the coast range and the west side of the Cascade and Sierran crests. This species is a CDFW species of special concern in this area. The yellow-legged frog lays egg masses in pools in streams in the spring. Larvae hatch and metamorphose in a single season. Adults appear to remain close to aquatic habitat, probably because of the dry upland conditions in their range. Required buffer protections to streams, wetlands, and other aquatic habitats are expected minimize significant adverse impacts to this species and its habitat.

Rana draytonii **California Red-legged Frog**
The California red-legged frog is remarkably similar to the northern red-legged frog. This pond-breeding frog usually associated with ponds, wetlands, and other lentic aquatic habitat, and adjacent terrestrial areas. The northern red-legged frog is a subspecies of the red-legged frog and occurs in British Columbia, Washington, Oregon, and the northwest coast of California. This subspecies is listed as Federally Threatened and Species of Special Concern by CDFG. The red-legged frog lays egg masses in still water in the spring. Larvae hatch and metamorphose in a single season. Adults have been known to travel long distances in upland forest but return to breeding sites to reproduce. Required buffer protections to streams, wetlands, and other aquatic habitats are expected minimize significant adverse impacts to this species and its habitat.

Rhyacotriton variegatus **Southern Torrent Salamander**
The southern torrent salamander is a stream-breeding salamander that occurs in cold, permanent headwater streams and seeps. This salamander occurs in western Oregon and northwestern California south to Mendocino County. This species is listed as a Species of Special Concern by CDFG. The southern torrent salamander lays eggs in the interstitial spaces between gravel in the water and may be sensitive to excessive fine sediments in the stream. This salamander is dependent on permanent water because larvae take several years to metamorphose into adults. Adults of this species remain close to cold permanent water throughout its life probably because of dry conditions in adjacent upland areas. Required buffer protections to watercourses and other measures to minimize sediment inputs into streams are expected to minimize significant adverse impacts to this species and its habitat.

MOLLUSKS:

Helminthoglypa Pomoensis **Pomo Bronze Shoulderband**
The Pomo Bronze Shoulderband is a large snail, which is found in heavily timbered Redwood Canyons. Since riparian areas and watercourses are to be protected, no significant adverse impacts to this species or its habitat are expected.

PLANTS and PLANT COMMUNITIES:

Agrostis blasdalei **Blasdale's Bent Grass**
CNPS List 1B. This species is associated with coastal bluffs, scrub and coastal prairies. A botanical survey will be conducted prior to operations. If this species is found to be present mitigation measures outlined in THP Section II will be implemented to minimize the potential for impacting this species.

Alisma gramineum **Narrow-Leaved Water Plantain**
CNPS List 2. This perennial herb inhabits assorted shallow freshwater marshes and swamps in elevation ranges of 3500 to 5600 feet. The plan area is below the elevational range of this species.

Arctostaphylos mendocinensis **Pygmy Manzanita**
CNPS List 1B. This species is associated with the Pygmy Forest habitat community. As this habitat community does not exist within or near the THP area, no adverse impacts are expected.

Astragalus agnicidus **Humboldt Milk-vetch**
CNPS List 1B, California Endangered. This species is found in broadleaved upland forest and north coast coniferous forest habitat types. This species has never been found in the vicinity of the plan area and therefore it is anticipated that the species will not be affected by the proposed operation. A botanical survey will be conducted prior to operations. If this species is found to be present mitigation measures outlined in THP Section II will be implemented to minimize the potential for impacting this species.

Blennosperma nanum **var.** ***robustum*** **Point Reyes Blennosperma**
CNPS List 1B. This species is found in coastal scrubs and prairies. Microsites are usually open coastal hills in sandy soil. It is associated with coastal lupines and Mendocino County Indian Paintbrush. A botanical survey will be conducted prior to operations. If this species is found to be present mitigation measures outlined in THP Section II will be implemented to minimize the potential for impacting this species.

Boschniakia hookeri **Small Groundcone**
CNPS List 2. This parasitic perennial herb is limited to North America and more specifically a redwood forest type. The botanical assessment will include habitat required by this species. A botanical survey will be conducted prior to operations. If this species is found to be present mitigation measures outlined in THP Section II will be implemented to minimize the potential for impacting this species.

Calamagrostis crassiglumis **Thurber's Reed Grass**
CNPS List 2. This species is commonly generally found in coastal scrub and freshwater marshes. Microsites may include marshy swales within grassland or coastal scrub. A botanical survey will be conducted prior to operations. If this species is found to be present mitigation measures outlined in THP Section II will be implemented to minimize the potential for impacting this species.

Calamagrostis foliosa **Leafy Reed Grass**
CNPS List 4, California Rare. This species is found in coastal bluff scrub and north coast coniferous forest habitat types. The botanical assessment will include habitat required by this species. A botanical survey will be conducted prior to operations. If this species is found to be present mitigation measures outlined in THP Section II will be implemented to minimize the potential for impacting this species.

Campanula californica **Swamp Harebell**
CNPS List 1B. The preferred habitat is bogs, fens, and other wet meadow areas in and around coastal prairie, freshwater marsh, closed cone coniferous forest and north coast coniferous forest habitat, including along the western edge of the redwood forest type. A botanical survey will be conducted prior to operations. If this species is found to be present mitigation measures outlined in THP Section II will be implemented to minimize the potential for impacting this species.

Carex arcta **Northern Cluster Sedge**
CNPS List 2. This species is found in bogs, fens and North coast coniferous forest habitat types. A botanical survey was conducted and this species was not found to occur in the project area. A botanical survey will be conducted prior to operations. If this species is found to be present mitigation measures outlined in THP Section II will be implemented to minimize the potential for impacting this species.

Carex californica **California Sedge**
CNPS List 2. This species is associated with closed cone coniferous forests, coastal prairies, meadows, marshes, and swamps. A botanical survey will be conducted prior to operations. If this species is found to be present mitigation measures outlined in THP Section II will be implemented to minimize the potential for impacting this species.

Carex livida **Livid Sedge**
CNPS List 1A. This species is associated with bogs and fens. It has not been observed in Mendocino County since 1866. The NDDB cites "Smith & Wheeler' as being doubtful that this species will ever be found in California again. A botanical survey will be conducted prior to operations. If this species is found to be present mitigation measures outlined in THP Section II will be implemented to minimize the potential for impacting this species.

Carex lyngbyei **Lyngbye's Sedge**
CNPS List 2. This perennial herb is associated with both freshwater and brackish marshes and swamps located at or near sea level. Since riparian areas are to be protected, no significant adverse impacts to this species or its habitat are expected. A botanical survey will be conducted prior to operations. If this species is found to be present mitigation measures outlined in THP Section II will be implemented to minimize the potential for impacting this species.

Carex saliniformis **Deceiving Sedge**
CNPS List 1B. This species is found in moist to wet open areas, such as meadows in close proximity to the coast. The botanical assessment will include habitat required by this species. A botanical survey will be conducted prior to operations. If this species is found to be present mitigation measures outlined in THP Section II will be implemented to minimize the potential for impacting this species.

Carex viridula* var. *viridula **Green Sedge**
CNPS List 2. This species is usually found in freshwater bogs, fens and marshes within the North Coastal Coniferous forests. A botanical survey will be conducted prior to operations. If this species is found to be present mitigation measures outlined in THP Section II will be implemented to minimize the potential for impacting this species.

Castilleja affinis* ssp. *litoralis **Oregon coast Indian paintbrush**
CNPS List 2. This herb inhabits coastal dunes, scrub and bluff scrub. The proposed THP is not located within or near these types of coastal habitat, therefore no significant impacts are expected.

Castilleja ambigua* ssp. *humboldtiensis **Humboldt Bay Owl's Clover**
CNPS List 1B. This species is found in salt marshes, primarily in the Humboldt Bay region. Because there are no salt marshes within or near the THP area, no significant impacts are expected.

Castilleja mendocinensis **Mendocino Coast Indian Paintbrush**
CNPS List 1B. This species is associated with coastal bluffs, scrub, closed cone forests and prairies. A botanical survey will be conducted prior to operations. If this species is found to be present mitigation measures outlined in THP Section II will be implemented to minimize the potential for impacting this species.

Clarkia amoena ssp. whitneyi **Whitney's Farewell-to-Spring**
CNPS List 1B. This species is found in coastal bluff scrub and coastal scrub habitats less than 100m. Because these habitats are not found within or adjacent to the THP area, there are no significant impacts expected.

Coastal and Valley Freshwater Marsh
Impacts to this habitat type are not anticipated from the proposed harvest based on non-occurrence of the habitat type in or around the plan area and on the use of modern harvesting procedures, which minimize impacts to the fluvial system.

Coastal Brackish Marsh
Because there are no brackish marshes within or associated with this THP area, no significant adverse impacts are expected for this habitat type. Impacts to this habitat type are not anticipated from the proposed harvest based on non-occurrence of the habitat type in or around the plan area and on the use of modern harvesting procedures, which minimize impacts to the fluvial system.

Coastal Terrace Prairie
Because there are no coastal terrace prairies within or associated with this THP area, no significant adverse impacts are expected for this habitat type.

Collinsia corymbosa **Round-Headed Chinese Houses**
CNPS List 1B. This species is found in coastal sand habitat. Because there is no coastal sand habitat within or adjacent to the THP area, there are no significant impacts expected.

Cupressus goveniana **ssp.** ***pigmea*** **Pygmy Cypress**
CNPS List 1B. This species is associated with Mendocino Pygmy Cypress Forest. This species is associated with the Mendocino Pygmy Forest habitat type and since this habitat type is not associated with the project area, impacts to this species are not anticipated.

Erigeron biolettii **Streamside Daisy**
CNPS List 3. This species is found in broadleaved upland forest, cis-montane woodland, and North coast coniferous forest habitat types. A botanical survey was conducted and this species was not found to occur in the project area. If subsequent fieldwork identifies populations of this species they will be afforded appropriate protection measures, and as such no significant adverse impacts are expected.

Erigeron supplex **Supple Daisy**
CNPS List 1B. This species is found on coastal areas and coastal bluffs. Because there are none of these habitat types on or near the THP area, no significant adverse impacts are expected.

Erysimum menziesii **ssp.** ***menziesii*** **Menzies Wallflower**
CNPS List 1B, California Endangered, Federal Endangered. This species is found in coastal strands and dunes. Microsites are dunes and coastal strand from 0-35 meters. It is associated with coastal lupines and Mendocino Coast Indian Paintbrush. As the habitat that this species is associated with is not located within or near the THP, no significant adverse impacts are expected.

Erythronium revolutum **Coast Fawn Lily**
CNPS List 2. This species is found on stream banks and in wet places in woodlands. A botanical survey will be conducted prior to operations. If this species is found to be present mitigation measures outlined in THP Section II will be implemented to minimize the potential for impacting this species.

Fen
A fen is typically defined as a lowland area that is wet or marsh-like. The Inglenook Fen is located inside MacKerricher State Park which is described as the best example of a fen in the region. Some components of the Inglenook Fen include saturated soils and heavy riparian vegetation. Since there are no habitat types in or directly adjacent to the plan area that meet the definition of this type of habitat, no adverse impacts are expected.

Frittilaria roderickii **Roderick's Frittilary**
CNPS List 1B, California Endangered. This species is found in coastal bluff scrub, coastal prairie, and valley foothill grassland habitat types. A botanical survey will be conducted prior to operations. If this species is found to be present mitigation measures outlined in THP Section II will be implemented to minimize the potential for impacting this species.

Gilia capitata ssp. capitata **Pacific Gilia**
CNPS List 1B. This species is found in coastal dune areas. Because there are no coastal dunes within or adjacent to the project area, no significant adverse impacts are expected.

Gilia millefoliata **Dark-eyed Gilia**
CNPS List 1B. This species is found in coastal dune areas. Because there are no coastal dunes within or adjacent to the project area, no significant adverse impacts are expected.

Glyceria grandis **American Manna Grass**
CNPS List 2. This species is found in bog, fen, meadow, marsh, swamp, stream bank and lake margin habitat types. A botanical survey will be conducted prior to operations. If this species is found to be present mitigation measures outlined in THP Section II will be implemented to minimize the potential for impacting this species.

Hemizonia congesta ssp. leucocephala **Hayfield Tarplant**
CNPS List 3. This species is found in coastal scrub and valley foothill grassland habitat types. Because there are no such habitat types within or adjacent to the project area, no significant adverse impacts are expected.

Hesperolinon adenophyllum, **Glandular Western Flax**
CNPS List 1B. This annual herb occupies chaparral sites, foothill woodland forest types, valley grassland plant communities, and usually on serpentine soils. None of these habitats exist within, or adjacent to, the project area. Because there is no appropriate habitat for this species associated with this project area, no significant adverse impacts to this species or its habitat are expected.

Horkelia marinensis **Point Reyes Horkelia**
CNPS List 1B. The preferred habitat of this species is sandy coastal flats less than 100 feet in elevation. Because there are no such habitat types within or adjacent to the project area, no significant adverse impacts are expected.

Horkelia tenuiloba **Thin-Lobed Horkelia**
CNPS List 1B. This species is found in broadleaved upland forest and chaparral habitat types. Because there are no such habitat types within or adjacent to the project area, no significant adverse impacts are expected.

Juncus supiniformis **Hair-Leaved Rush**
CNPS List 2. This species is found in bog, fen, marsh, and swamp habitat types near the coast. Because there are no such habitat types within or adjacent to the project area, no significant adverse impacts are expected.

Lasthenia macrantha ssp. bakeri **Baker's Goldfields**
CNPS List 1B. This species is found in closed-cone forest opening and coastal scrub habitat types. A botanical survey will be conducted prior to operations. If this species is found to be present mitigation measures outlined in THP Section II will be implemented to minimize the potential for impacting this species.

Lasthenia macrantha ssp. macrantha **Perennial Goldfields**
CNPS List 1B. This species is found in coastal scrub, coastal bluff scrub, and coastal dune habitat types. Because there are no such habitat types within or adjacent to the project area, no significant adverse impacts are expected.

Lilium maritimum **Coast Lily**
CNPS List 1B. This plant species is a Federal Species of concern. The general habitat type is closed-cone coniferous forest, coastal prairie, coastal scrub, north coast coniferous forest, broadleaved upland forest, and marsh and swamp. Historically the microhabitat for the coast lily has been in sandy soil, often on raised hummocks or bogs. A botanical survey will be conducted prior to operations. If this species is found to be present mitigation measures outlined in THP Section II will be implemented to minimize the potential for impacting this species.

Limnanthes bakeri **Baker's Meadowform**
CNPS List 1B, California Rare. This annual herb inhabits wet, open areas such as meadows, seeps, marshes, swamps, and grasslands. A botanical survey will be conducted prior to operations. If this species is found to be present mitigation measures outlined in THP Section II will be implemented to minimize the potential for impacting this species.

Lupinus milo-bakeri **Milo Baker's Lupine**
CNPS List 1B, California Threatened. This endemic, annual herb is most commonly found in Foothill Woodland and Valley Grassland plant communities. This species is listed as rare and threatened by the State. Because the project is dominated by north coast coniferous forest, habitat for this species does not exist within the project area, and no significant adverse impacts to this species or its habitat are expected.

Lycopodium clavatum **Running-Pine**
CNPS List 2. This species is found in marsh, swamp, and North coast coniferous forest habitat types. A botanical survey will be conducted prior to operations. If this species is found to be present mitigation measures outlined in THP Section II will be implemented to minimize the potential for impacting this species.

Microseris borealis **Northern Microseris**
CNPS List 2. This species is associated with bogs, fens and maybe wet areas. The Inglenook Fen is located inside MacKerricher State Park, many miles northwest of the THP area. A botanical survey will be conducted prior to operations. If this species is found to be present mitigation measures outlined in THP Section II will be implemented to minimize the potential for impacting this species.

Mona Della villas ssp. globes **Robust Mona Della**
CNPS List 1B. This species is found in chaparral, cismontane woodland, and coastal scrub habitat types. Because there are no such habitat types within or adjacent to the project area, no significant adverse impacts are expected.

Navarre leucocephala **ssp. *Bakeri*** **Baker's Navarretia**
CNPS List 1B. This species is associated with vernal pools of meadows and low flats within foothill woodland regions, with alkali or adobe soils. The primary sites in which this species would be found are protected by WLPZs or EEZs. However, nearly all of the THP area is on slopes; flat areas are primarily confined to ridge tops, and there are no vernal

pools and no alkali or adobe soils within the project area. Because appropriate habitat for this species does not exist in the project area, no significant adverse impacts to this species or its habitat are expected.

Northern Coastal Salt Marsh
Impacts to this habitat type are not anticipated from the proposed harvest based on non-occurrence of the habitat type in or around the plan area and on the use of modern harvesting procedures, which minimize impacts to the fluvial system.

***Phacelia insularis* var. *continentis* North Coast Phacelia**
CNPS List 1B. This species is found in coastal scrub and dunes. Microsites are open maritime bluffs with sandy soil less than 200 feet in elevation. It is associated with coastal lupines and Mendocino Coast Indian Paintbrush. Because appropriate habitat for this species does not exist in the project area, no significant adverse impacts to this species or its habitat are expected.

***Pinus contorta* ssp. *bolanderi* Bolander's Beach Pine**
CNPS List 1B. This species is associated with Pygmy Forest habitat. Because appropriate habitat for this species does not exist in the project area, no significant adverse impacts to this species or its habitat are expected.

***Pleuropogon hooverianus* North Coast Semaphore Grass**
CNPS List 1B, California Threatened. This species is associated with moist grassy areas, vernal pools in broadleaf upland forests and north coast coniferous forests. The primary sites in which this species is found are protected by WLPZs or EEZs. A botanical survey will be conducted prior to operations. If this species is found to be present mitigation measures outlined in THP Section II will be implemented to minimize the potential for impacting this species.

***Potamogeton epihydrus* ssp. *nuttallii* Nuttall's Pondweed**
CNPS List 2. This perennial herb prefers freshwater wetlands under natural conditions and in shallow waters. This native to California has been observed in El Dorado, Modoc, Mariposa, Plumas, and Shasta Counties. CNPS has ranked this species as very rare. No Freshwater Marsh exists within the plan area. Impacts to this plants habitat type are not anticipated from the proposed harvest based on non-occurrence of the habitat type in or around the plan area and on the use of modern harvesting procedures, which minimize impacts to the fluvial system.

***Puccinellia pumila* Dwarf Alkali Grass**
CNPS List 2. This species is associated with coastal salt marshes and swamps. Impacts to this plants habitat type are not anticipated from the proposed harvest based on non-occurrence of the habitat type in or around the plan area and on the use of modern harvesting procedures, which minimize impacts to the fluvial system.

***Rhynchospora alba* White Beaked-rush**
CNPS List 2. This species is associated with bog and fen, meadow, marsh, and swamp habitat types. A botanical survey will be conducted prior to operations. If this species is found to be present mitigation measures outlined in THP Section II will be implemented to minimize the potential for impacting this species.

***Sanguisorba officinalis* Great Burnet**
CNPS List 2. This species is associated with bogs, fens and seepage areas along stream borders, often in serpentine soils. The areas where this species may occur are protected by WLPZs or ELZs. A botanical survey will be conducted prior to operations. If this species is found to be present mitigation measures outlined in THP Section II will be implemented to minimize the potential for impacting this species.

***Senecio bolanderi* var. *bolanderi* Seacoast Ragwort**
CNPS List 2. This species is associated with coastal scrub and north coast coniferous forest. This species has a potentially wide range of distribution but is expected to be more likely to occur near the coast. A botanical survey will be conducted prior to operations. If this species is found to be present mitigation measures outlined in THP Section II will be implemented to minimize the potential for impacting this species.

***Sidalcea calycosa spp rhizomata* Point Reyes Checkerbloom**
CNPS List 1B. This species is associated with marshes and swamps near the coast below 30m elevation. These habitat types are not present in the THP area, and this species is not expected to exist in the THP area. No significant adverse impacts are expected.

***Sidalcea malachroides* Maple-Leaved Checkerbloom**
CNPS List 1B. This plant has a wide distribution of habitat preferences, with a preferred microhabitat of woodlands and clearings near the coast, often in disturbed areas. A botanical survey will be conducted prior to operations. If this species is found to be present mitigation measures outlined in THP Section II will be implemented to minimize the potential for impacting this species.

***Sidalcea malviflora* ssp. p*urpurea* Purple-stemmed Checkerbloom**
CNPS List 1B. This perennial endemic herb is typically found in broadleaved upland forests and coastal prairie. Historically this species has been commonly located in San Francisco and San Mateo with few observations in southern Mendocino. A botanical survey will be conducted prior to operations. If this species is found to be present mitigation measures outlined in THP Section II will be implemented to minimize the potential for impacting this species.

Sphagnum Bog
Sphagnum bogs are generally associated with Mendocino Pygmy Forest areas. This habitat type is not present in the THP area, and therefore no significant adverse impacts are expected to this habitat type or species utilizing this habitat type are anticipated.

***Tracyina rostrata* Beaked Tracyina**
CNPS List 1B. This species is found in cismontane woodland and valley/foothill grassland habitat types. Because there are no such habitat types within or adjacent to the project area, no significant adverse impacts are expected.

***Trichodon cylindrus* cylindrical trichodon**
CNPS List 2. This species is found in broadleaved upland forest and upper montane coniferous forest habitat types. Because there are no such habitat types within or adjacent to the project area, no significant adverse impacts are expected.

***Triquetrella californica* Coastal Triquetrella**
CNPS List 1B. This byrophyte is found in coastal scrub and coastal bluff scrub. Because there are no such habitat types within or adjacent to the project area, no significant adverse impacts are expected.

Upland Douglas-fir Forest
The THP area is not located within a pure, upland Douglas-fir forest. The dominant species is coast redwood with co-dominant Douglas-fir and mixed hardwoods in the understory. Upland Douglas-fir forests are defined by old-growth, dominant Douglas-fir with an evergreen hardwood component. This habitat type is not present in the THP area, and therefore no significant adverse impacts are expected to this habitat type or species utilizing this habitat type are anticipated.

Viburnum ellipticum **Oval-Leaved Viburnum**
CNPS List 2. This species is found in chaparral, cismontane woodland, and lower montane coniferous forest habitat types. Because there are no such habitat types within or adjacent to the project area, no significant adverse impacts are expected.

Viola palustris **Marsh Violet**
CNPS List 2. This species is associated with wet, brushy areas in coastal scrub or coastal bogs. There are no coastal scrub or coastal bog habitats within the plan area. Other wet areas are protected by ELZ's. Given these factors, no significant adverse impacts are expected.

LICHENS:

Usnea longissima **Methuselah's Beard Lichen**
This lichen is usually associated with overstory canopies of mature forests. However, occurrences have been detected in a variety of stands. The occurrence of this species was not detected in this area. Any populations identified in the future shall be afforded appropriate protection measures, and no significant adverse impacts are expected.

Coho, Steelhead and Chinook Salmon Assessment

Class I Watercourse Assessment:
The plan area is adjacent to the Little North Fork of the Gualala River which is a Class I watercourse. Two minor tributaries to the LNF Gualala which are associated with the harvest area are also said to be Class 1 watercourses according to a CDFW stream model.

Shade and Temperature
The WLPZ is typically heavily timbered on both sides of the stream. Harvesting in Class I WLPZs is restricted so that required canopy retention will be achieved.

Low-vegetated cover and Stream bank Stability
A moderate to high level of low-vegetated cover is present along the channel bank. Due to limitations on use of heavy equipment within the WLPZ and directional felling practices which will occur within WLPZ's, changes in the "low-vegetated cover" are anticipated to be minimal.

Erosion Control
Roads within the plan area are permanent and seasonal roads. An erosion control plan has been prepared which identifies corrective actions to be taken on existing and potential erosion sites. Remedial action for these sites is specified in the ECP and corrective measures will be taken as a part of the timber operations.

LWD Loads and Recruitment
The amount of LWD within Class I watercourses associated with the plan area is considered to be low to moderate. Additional recruitment will occur over time since a population of potential recruitment trees will be retained because harvesting is limited within WLPZs.

Maintenance Period
Per 14 CCR 1050(d) & (e), "Upon approving a work completion report, the Director may prescribe a maintenance period which extends for as much as three years after filing the work completion report based on physical evidence (such as location of erosion controls in disturbed areas with high or extreme hazard, on steep or unstable slopes, or within or adjacent to the standard width of a watercourse or lake protection zone) that erosion controls need to be maintained for the extended maintenance period in order to minimize soil erosion or slope instability or to prevent degradation of the quality and beneficial uses of water. Also, after approving the work completion report, the director may extend the prescribed maintenance period for as much as three years after filing of the work completion report if subsequent inspection by the department during the prescribed maintenance period show that erosion controls have failed or are likely to fail to minimize soil erosion or slope instability or to prevent degradation of the quality and beneficial uses of water. The erosion control maintenance period on permanent and seasonal roads and associated landings that are not abandoned in accordance with 14 CCR 923.8 is three years.

Class II Watercourse Assessment
Shade and Temperature
Shade canopy levels within Class II zones are from 80% to 100+%. Harvesting in Class II WLPZs is restricted so that required canopy retention will be achieved.

Low-vegetated cover and Stream bank Stability
A moderate level of low-vegetated cover is present within the Class II WLPZ along channel banks. Due to limitations on use of heavy equipment within the WLPZ and directional felling practices which will occur within WLPZ's, changes in the "low-vegetated cover" are anticipated to be minimal.

Erosion Control
Roads within the plan area are permanent and seasonal roads. An erosion control plan has been prepared which identifies corrective actions to be taken on existing and potential erosion sites. Remedial action for these sites is specified in the ECP and corrective measures will be taken as a part of the timber operations.

LWD Loads and Recruitment
The amount of LWD within Class II watercourses associated with the plan area is moderate. Additional recruitment will occur over time since a population of potential recruitment trees will be retained because harvesting is limited within WLPZs.

Maintenance Period
Per 14 CCR 1050(d) & (e), "Upon approving a work completion report, the Director may prescribe a maintenance period which extends for as much as three years after filing the work completion report based on physical evidence (such as location of erosion controls in disturbed areas with high or extreme hazard, on steep or unstable slopes, or within or adjacent to the standard width of a watercourse or lake protection zone) that erosion controls need to be maintained for the extended maintenance period in order to minimize soil erosion or slope instability or to prevent degradation of the quality and beneficial uses of water. Also, after approving the work completion report, the director may extend the prescribed maintenance period for as much as three years after filing of the work completion report if subsequent inspection by the department during the prescribed maintenance period show that erosion controls have failed or are likely to fail to minimize soil erosion or slope instability or to prevent degradation of the quality and beneficial uses of water. The erosion control maintenance period on permanent and seasonal roads and associated landings that are not abandoned in accordance with 14 CCR 923.8 is three years.

Class III Watercourse Assessment
There are several Class III watercourses within the proposed project area. A 30 foot ELZ will be in effect near Class III watercourses where slopes are less than 30%; where slopes are greater than 30%, a 50 foot ELZ will be applied. The centerlines of all Class III watercourses have been flagged. This will minimize any potential for bank destabilization and maximize opportunities for sediment filtration in the future.

B. Habitat Condition

Describe the pre-project condition of the following terrestrial habitat components within the project area and assessment area(s). Lastly, rate the anticipated post-project condition of these habitat components after completion of the proposed project.

Habitat Components	Pre-Project On-Site	Pre-Project Off-site	Post-Project On-Site
1. Presence of snags / dens / nest trees	H M $\boxed{L}$ N	H $\boxed{M}$ L N	H M $\boxed{L}$ N
2. Amount of downed large woody debris . .	$\boxed{H}$ M L N	$\boxed{H}$ M L N	$\boxed{H}$ M L N
3. Presence of multistory canopy . . .	H $\boxed{M}$ L N	H $\boxed{M}$ L N	H $\boxed{M}$ L N
4. Road density	H $\boxed{M}$ L N	H $\boxed{M}$ L N	H $\boxed{M}$ L N
5. Presence of hardwoods	$\boxed{H}$ M L N	$\boxed{H}$ M L N	H M $\boxed{L}$ N
6. Continuity of late seral stage forest	H M L $\boxed{N}$	H M L $\boxed{N}$	H M L $\boxed{N}$

C. Presence of Significant Wildlife Areas

Are any of the following significant wildlife areas located on-site of your proposed operation and off-site within the assessment area(s)?

	On-Site	Off-Site
5. Wetlands	Y $\boxed{N}$	$\boxed{Y}$ N
6. Riparian areas	$\boxed{Y}$ N	$\boxed{Y}$ N
7. Other	Y N	Y N

Will your operation significantly affect the use of these areas by wildlife?

Yes ________ No **XX**

During timber operations, wildlife may be affected for a short period. However, the long term benefits in habitat are likely to increase due to a commitment to uneven age silvicultural methodologies.

D. Other Projects

Identify and discuss the effects of the following projects within the assessment area(s) that might interact with the effects of the proposed timber operation:

1. Past and future projects in the biological assessment area(s) under the ownership or control of the timber/timberland owner that did or could cause a significant impact on biological resources.

The entire timbered portion of the biological assessment area has been harvested within the past 120 years. Short-term impacts on biological resources have occurred during the timber operations of these stands, mostly from heavy equipment activity. Long term effects of these timber harvests have been beneficial to many species through increased forage potential and enhanced early successional site conditions while likely detrimental to other biological resources which favor late successional site conditions. Many forest wildlife species occur in harvested areas and appear to do well. Most of the biological assessment area is not habitat for many of the species of special concern, with the exception of the northern spotted owl and steelhead trout. Nesting, roosting, and foraging habitat does occur within the assessment area for the northern spotted owl, and suitable spawning and rearing habitat for salmonids is present within the watershed. Future timber harvests within the biological assessment area are anticipated to occur within the next 10 years as previously described. These future timber harvests will be subject to the Forest Practice Rules, which regulate scope and intensity of harvesting.

2. Past and future projects planned or expected in the biological assessment area(s) not under the control of the timber / timberland owner that did or could cause a significant impact on biological resources.

Future timber harvests, on non-federal lands, are regulated by the Forest Practice Act and the Forest Practice Rules. Based on the history of harvest in this area and the continued presence of timber resources within the BAA additional timber harvesting is anticipated on other private ownerships. Responsible logging practices within the framework of the rules of the FPA will minimize the potential for significant adverse impacts on biological resources.

E. Interactions

Considering the interactions between:

- the biological resources of the assessment area (Parts A & C)
- current habitat condition on-site and off-site (Part B)
- the ongoing effects of past projects (Part D)
- the effects of future projects (Part D)

What is the potential for developing significant cumulative effects on the biological resources of the assessment area(s) as a result of:

1. The proposed project combined with the effects of past projects without the impacts of future projects?

   H M [L]

2. The proposed project combined with the effects of past projects and the expected impacts of future projects listed in Part D?

   H M [L]

F. Impacts Evaluation

Based on the information gathered by the RPF, the contents of the THP, the forest practice rules, information from the review of other plans, the magnitude of impacts identified in parts A through D, and the interactions rated in Part E, is the proposed project likely to produce significant adverse cumulative effects to the biological resources within the assessment area(s)?

Yes ________ No **XX**

Will the proposed project, as presented, in combination with the impacts of past and future projects as identified in Parts A through D, the interactions rated in Part E, and considering feasible alternatives and mitigation actions, have a reasonable potential to cause or add to significant cumulative impacts to biological resources within the assessment area(s)?

1. Yes, after mitigation . . . . ________
2. No, after mitigation . . . . **XX**
3. No; no reasonably potential significant effects . . . . ________

IV. CUMULATIVE RECREATION RESOURCES IMPACTS ASSESSMENT

A. Recreational Resources Inventory

The recreational assessment area is the area that includes the logging area plus 300 feet.

To assess recreational cumulative impacts: Identify the recreational activities involving significant numbers of people in and within 300 feet of logging area (example: fishing, hunting, hiking, picnicking, camping).

Identify any recreational Special Treatment Areas described in the Board of Forestry rules on the plan area or contiguous to the area.

None.

If a public use of the area is identified, continue to Part B.

B. Change in Recreational Resources.

Discuss whether the timber operation will significantly alter the recreational opportunities on the logging area or within 300 feet of the logging area.

Public recreation opportunities are not available within 300 feet of the project area. Post-harvest recreational resources will not be significantly affected.

C. Other Projects:

Information on other projects in the assessment area that might interact with the effects of the proposed timber operation need to be identified and discussed. Discuss the following:

1. Any past or future projects in the recreational assessment area that are under the ownership or control of the timber / timberland owner that will impact recreational opportunities used by the public identified in Part A, above.

No other projects within the assessment area that are under the control of the timberland owner will impact recreational opportunities in the assessment area.

2. Any known future projects planned or expected in the area for assessment of recreational impacts that are not under the control of the timber / timberland owner that will impact recreational opportunities used by the public identified in Part A, above.

None.

D. Impacts Evaluation

Will the proposed project, as presented, in combination with the impacts of past and future projects, as identified in Parts A through C above, have a reasonable potential to cause or add to significant cumulative impacts to recreation resources?

Yes, after mitigation --	______
No, after mitigation ---	______
No; no reasonable potential significant effects -------------------------------------	XX

V. CUMULATIVE VISUAL RESOURCE IMPACTS ASSESSMENT

A. Visual Resource Inventory

To assess visual cumulative effects:

1. Identify any Special Treatment Areas designated as such by the Board of Forestry because of their visual values on or near the plan area? None.
2. Determine how far the proposed timber operation is from the nearest point that significant numbers of people can view the timber operation. At distances of greater than 3 miles from viewing points activities are not easily discernible and will be less significant.

   The harvest area will be visible to motorists traveling on Fish Rock Road and Old Stage Road.

3. Identify the manner in which the public identified in 1. and 2. will view the proposed timber operation (from a vehicle on a public road, from a stationary public viewing point or from a pedestrian pathway).

   - Harvest unit "A" is adjacent to Old Stage Road for approximately 1200 feet and will be visible to motorists traveling on this road.
   - Harvest unit "E" is adjacent to Fish Rock Road for approximately 2600 feet and will be visible to motorists traveling on this road.

   If the information in item 1. or 2. identifies a significant visual resource, continue with section B below.

B. Change in Visual Resource

Discuss the probability of the timber operation changing the visual setting viewed by the public as a result of vegetation removal, creation of slash and debris, or soil exposure.

Adjoining areas have been similarly harvested in the past and the planned harvest will be less intense than most as viewed from public roadways itemized above. Harvesting in units A and E are limited to a selective cut. Slash reduction measures within 100 feet of public roads is required as specified in Section 2 of the THP. Adjoining areas have been similarly harvested in the past and no significant change in the visual resource was noted.

C. Other Projects

Information on other projects in the assessment area that might interact with the effects of the proposed timber operation need to be identified and discussed. Discuss the following:

1. Any past and future projects in the visual assessment area that are under the ownership or control of the timber / timberland owner and that could interact to cause a significant change in any identified visual resource.
   The RPF is not aware any such projects.

2. Known future projects in the visual assessment area that are not under the control of the timber / timberland owner and could interact with any identified visual resources.
   The RPF is not aware any such projects.

D. Impacts Evaluation

Will the proposed project, as presented, in combination with the impacts of past and future projects, as identified in Parts A through C above, have a reasonable potential to cause or add to significant cumulative impacts to visual resources?

Yes, after mitigation	
No, after mitigation	XX
No: no reasonably potential significant effects	

VI. CUMULATIVE VEHICULAR TRAFFIC IMPACTS ASSESSMENT

A. Traffic Resource Inventory

The traffic assessment area involves the first roads not part of the logging area on which logging traffic must travel. To assess traffic cumulative effects:

1. Identify whether any publicly owned roads will be used for the transport of wood products. (If the answer to item A. indicates that public roads will not be used, then no further assessment is needed).

The assessment area for traffic resources is the traveled surface of the first public road on which logging traffic must travel to access the plan area and deliver logs to their intended destinations. Log trucks hauling timber from the harvest area will use existing haul roads and public roads within the assessment area which is defined as Fish Rock Road west of the plan area to its junction with Iverson Road, Iverson Road to its junction with 10 Mile Cut-off Road, Old Stage Road, County Road 501, to its junction with Old State Highway then westerly to Highway 1, Highways 1, 20, 101 and 116 in Mendocino, Humboldt and Sonoma Counties between Eureka and Santa Rosa. Logging traffic commonly uses these rural routes without incident or congestion.

2. Identify any public roads that have not been used recently for the transport of wood products and will be used to transport wood products from the proposed timber harvest.

None.

3. Identify any public roads proposed for transport of wood products that have existing traffic or maintenance problems.

Traffic and maintenance on these roads are not expected to be significantly impacted by the temporary increase in traffic associated with this intermittent project. Maintenance is often a function of use and fuel taxes paid are designed to offset maintenance costs incurred as a result of usage.

B. Activity Levels

Discuss how the logging vehicles used in the timber operation will change the amount of traffic on public roads, especially during heavy traffic conditions

Log trucks hauling timber from the harvest area will use existing haul roads and public roads within the assessment area as described above. Logging traffic commonly uses these rural routes without incident or congestion.

C. Other Projects

Information on other projects in the assessment area that might interact with the effects of the proposed timber operation need to be identified and discussed. Discuss the following.

1. Other past or future projects on lands under the control of the timber / timberland owner that will add significantly to traffic on public roads during the period these roads are used by logging vehicles from the proposed timber operation.

   Timber harvested under the current Elk THP 1-19-00098MEN and Little THP 1-18-095MEN will likely use the same road systems but combined use from both projects will not elevate commercial use about normal levels.

2. Any known future projects not under the control of the timber / timberland owner that will impact public road traffic during the period that these roads are used by logging vehicles from the proposed timber operation.

   None.

D. Impacts Evaluation

Will the proposed project, as presented, in combination with the impacts of past and future projects, as identified in Parts A through C above, have a reasonable potential to cause or add to significant cumulative impacts to vehicular traffic on public roads?

Yes, after mitigation	
No, after mitigation	
No: no reasonably potential significant effects	XX

G. GREENHOUSE GAS (GHG) IMPACTS

912.9 Technical Rule Addendum #2 states the following concerning analysis of GHG impacts:

> G. GREENHOUSE GAS (GHG) IMPACTS
>
> Forest management activities may affect GHG sequestration and emission rates of forests through changes to forest inventory, growth, yield, and mortality. Timber Operations and subsequent production of wood products, and in some instances energy, can result in the emission, storage, and offset of GHGs. One or more of the following options can be used to assess the potential for significant adverse cumulative GHG Effects:
>
> **1.** Incorporation by reference, or tiering from, a programmatic assessment that was certified by the Board, CAL FIRE, or other State Agency, which analyzes the net Effects of GHG associated with forest management activities.
>
> 2. Application of a model or methodology quantifying an estimate of GHG emissions resulting from the Project. The model or methodology should at a minimum consider the following:
> **a.** Inventory, growth, and harvest over a specified planning horizon
> **b.** Projected forest carbon sequestration over the planning horizon
> **c.** Timber Operation related emissions originating from logging equipment and transportation of logs to manufacturing facility
> **d.** GHG emissions and storage associated with the production and life cycle of manufactured wood products.
>
> **3.** A qualitative assessment describing the extent to which the Project in combination with Past Projects and Reasonably Foreseeable Probable Future Projects may increase or reduce GHG emissions compared to the existing environmental setting. Such assessment should disclose if a known 'threshold of significance' (14 CCR § 15064.7) for the Project type has been identified by the Board, CAL FIRE or other State Agency and if so whether or not the Project's emissions in combination with other forestry Projects are anticipated to exceed this threshold.

Our approach to evaluating this concern is consistent with approach #2 itemized above. Current project parameters were applied to the CalFire model and summarized on the following pages support our conclusion that the project will result in a net reduction in atmospheric carbon dioxide over time (**break even projected at 12.7 years**). This is possible due two primary processes.

1) Wood products used for building store carbon typically for decades deferring their conversion through the natural carbon cycle process.
2) Forests growing at faster rates store more carbon at a correspondingly faster rate. Younger forests grow more quickly and have lower decay rates than older decadent stands of timber.

Other factors not quantified by the model include:

- A reduction in fire hazard as a result of the planned harvest due to the fact that overgrown roads will be opened and rehabilitated providing much improved access for wildfire fighting equipment in the event of a forest fire.
- California consumes far more natural resources including wood than we produce. This is a type of economic/environmental colonialism which amongst its many other negative attributes increases carbon emissions associated with moving bulky resources long distances. Locally produced wood products have a lower per unit "carbon cost" than those imported from abroad. I think time will show that real solutions to this issue will be more consumer based than producer based.

The State of California has continually 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, Executive order B-30-15, and SB 32 2016). Executive Order S-3-05 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. Executive Order 8-30-15 and SB 32 extended the previous goals, setting a new goal to further reduce emissions of greenhouse gases 40% below 1990 levels. In the Final 2017 AB 32 Scoping Plan Update, transportation is identified as the largest contributor to carbon emissions. The plan discusses California's Climate Policy Portfolio, which includes goals of more clean, renewable fuels, cleaner zero or near-zero emission cars, trucks, and buses, etc.

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.

Forested landscapes produce carbon emissions through harvesting, wildfire, pest mortality and other natural and anthropogenic events. However, forestry is a net sink for carbon, the primary greenhouse gas due to the fundamental processes of photosynthesis. Through the process of photosynthesis, plants absorb CO_2 from the air, and use the carbon as a building block of plant tissue and emit O_2 back into the atmosphere. The 2006 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 June 2008 CARB Scoping Plan stated that "the 2020 target for California's forest lands is to achieve a 5MMT CO_2 EQ reduction through sustainable management practices, including the risk of catastrophic wildfire, and the avoidance of or mitigation of land-use changes that reduce carbon storage...". Additionally, the 2017 AB 32 Scoping Plan identifies the importance of "natural and working landscapes, like forests and farms... .". It also states the goal for all the natural and working lands is to "maintain these lands as a

carbon sink and avoid at least 15-20 metric tons of GHG emissions by 2030." While there will be emissions associated with this harvest, they will be kept as low as feasible (via a close proximity to markets and efficient use of modern equipment as mandated by the State of California. Emissions will be offset to an extent by the maintenance and enhancement of forest carbon storage (both growing stock and lumber) and the reduction in fire hazard associated with better emergency access.

This Tree Farms management is consistent with public GHG reduction goals in that relative to maintaining and increasing the growth of high-quality commercial forest trees, improvement of forest health, and reduction fire risk. Additionally this Tree Farms contribution of locally produced used to meet the demands of Californians reduces GHG emissions associated with the transportation of forest products from distant lands to meet California's needs. To this last point the Final 2017 AB 32 Scoping Plan Update identified transportation as the largest carbon contributor.

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 non-forest use, 6) improve forest management, 7) reduce harvest, 8) increase agro-forestry, 9) plant trees in urban areas. 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 due largely to improved emergency access while promoting fast growing timber stands. By maintaining timber management there is a reduced risk of deforestation through conversion of the land to non-forest uses.

In summary based on application of modern forest management principles and practices and the geographic advantage of this Tree Farms close proximity to its market forest products which are sold into management is consistent with public GHG reduction goals. This plan, alone or in combination with other harvest plans in the watershed, ownership, Mendocino County, or State of California is not expected to have an adverse impact on global warming. Carbon from trees harvested will be sequestered for decades or longer in the form of the wood products cut from the logs. Additional carbon will be sequestered in the future as newly planted, sprouting, and growing crop trees occupy and grow on the site.

Far North THP - GHG Estimate Summary

Emissions Source/Sink/Reservoir	**Total Tonnes CO2 Sequestered/Emitted**
Live Trees	34727
Wood Products	26285
Site Prep Emissions	-87
Non-Bio Harvest Emissions	-900
Non-Bio Milling Emissions	-355
Total Sequestration	59670
Years to Recoup	12.7 Years

Spreadsheet analysis for harvest operations to be conducted in association with this THP are located on the following pages.

Impacts Evaluation

Will the proposed project, as presented, in combination with the impacts of past and future projects, as identified in Parts A through C above, have a reasonable potential to cause or add to significant cumulative impacts to Green House Gas Impacts?

Yes, after mitigation ____

No, after mitigation ____

No: no reasonably potential significant effects XXX /

https://ww3.arb.ca.gov/cc/scopingplan/scopingplan.htm

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Far North SWR Tractor Summary		
	Beginning Stocks	Ending Stocks
Emissions Source/Sink/Reservoir	Metric Tonnes CO2 Equivalent Per Acre Basis	
Live Trees (Conifers and Hardwoods)	108.08	314.60
Wood Products		108.21
Site Preparation Emissions		0.00
Non-biological emissions associated with harvesting		-3.07
Non-biological emissions associated with milling		-1.45
Sum of Net Emissions/Sequestration over Identified Harvest Cycles (CO2 metric tonnes)		310.21
Project Summary		
Project Acres	Step 17- Insert the acres that are part of the harvest area.	26
Total Project Sequestration over defined Harvesting Periods (CO2 metric tonnes)		8,065

Years until Carbon Stocks are Recouped from Initial Harvest (Includes Carbon in Live Trees, Harvested Wood Products, and Landfill)
14 Years

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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

Multipliers to Estimate Carbon Tonnes per MBF (Sampson, 2002)

Forest Type	Step 0. Identify the approximate percentage of conifers by volume within the harvest plan. Must sum to 100%	Multiplier from Cubic Feet (merchantable) to Total Biomass	Pounds Carbon per Cubic Foot
Douglas-fir	19%	1.675	14.38
Redwood	67%	1.675	13.42
Pines	3%	2.254	12.14
True firs	11%	2.254	11.18
Hardwoods		2.214	11.76
Conversion of Board Feet to Cubic Feet	0.165	Pounds per Metric Tonne	2,204
Multipliers to Estimate Total Carbon Tonnes per MBF	Conifer	1.74	
	Hardwoods	1.95	
Multipliers to Estimate Merchantable Carbon Tonnes per MBF	Conifer	1.00	
	Hardwoods	0.88	

Harvest Periods / Inventory / Growth Rates / Harvest Volume

Harvest Periods		Inventory		Growth Rates		Harvest Volume	
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)
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 1.	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 available.	Step 7. Enter estimated hardwood basal area harvested/treated per acre
User must enter harvest cycles to 100 years and/or at least three entry cycles.	0	15	23	400	0.47896233	8	8
	20	23	24.5792466	605	0.465527328	10	10
	40	25.09166852	23.88979317	770	0.443512514	10	10
	60	30.481677	22.76004345	866	0.407438676	10	10
	80	37.79829817	20.90881697	1000	0.348327493	10	10
	100	47.78848493	17.87536683	1281	0.251466937	10	10
	0	0	0	0	0	0	0
	0	0	0	0	0	0	0
	0	0	0	0	0	0	0
	0	0	0	0	0	0	0
	0	0	0	0	0	0	0

Inventory Conversion / Site Preparation

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	26	3	96	12	None	0
20	40	4	147	13	None	0
40	44	3	160	13	None	0
60	53	3	195	12	None	0
80	66	3	241	11	none	0
100	83	3	305	10	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		209	-2.75	Sum of emissions (Metric Tonnes CO2e) per acre	0

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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	(0.02)	22	2	-0.03	-0.26	0	0.00	0.00	0	0.00	0.00	-0.01			-0.177632653
20	(0.02)	22	2	-0.03	-0.32	0	0.00	0.00	0	0.00	0.00	-0.02	**Step 13.** Enter Estimated Load Average: MBF/Truck	4.5	-0.222040816
40	(0.02)	22	2	-0.03	-0.32	0	0.00	0.00	0	0.00	0.00	-0.02			-0.222040816
60	(0.02)	22	2	-0.03	-0.32	0	0.00	0.00	0	0.00	0.00	-0.02	**Step 14.** Enter Estimated Round Trip Haul in Hours	6	-0.222040816
80	(0.02)	22	2	-0.03	-0.32	0	0.00	0.00	0	0.00	0.00	-0.02			-0.222040816
100	(0.02)	0	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	-0.02			-0.222040816
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	**-0.14**				**-1.56**			**0.00**			**0.00**	**-0.09**			**-1.29**

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. The efficiency rating from mills in California is 0.67 (DOE 1605b) for conifers	The difference between carbon delivered to mills and carbon remaining after milling is assumed to be emitted immediately. The efficiency rating from mills in California is .5 (DOE 1605b) for hardwoods	**Estimate.** The weighted average carbon remaining in use at year 100 is 46.3% **Estimate.** The carbon in landfills at year 100 is 29.8% of the initial carbon produced in wood products.	**Estimate.** The weighted average carbon remaining in use at year 100 is 23.0% **Estimate.** The carbon in landfills at year 100 is 29.8% of the initial carbon produced in wood products.
0	100%	0%	29.27	0.00	-0.20	19.61	0.00	14.92	0.00
20	100%	0%	36.59	0.00	-0.25	24.52	0.00	18.66	0.00
40	100%	0%	36.59	0.00	-0.25	24.52	0.00	18.66	0.00
60	100%	0%	36.59	0.00	-0.25	24.52	0.00	18.66	0.00
80	100%	0%	36.59	0.00	-0.25	24.52	0.00	18.66	0.00
100	100%	0%	36.59	0.00	-0.25	24.52	0.00	18.66	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
		Sum of emissions associate with processing of lumber			-1.45	Sum of CO2 equivalent in wood products		108.21	0.00

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Far North Cable Clear-cut Summary

	Beginning Stocks	Ending Stocks
Emissions Source/Sink/Reservoir	Metric Tonnes CO2 Equivalent Per Acre Basis	
Live Trees (Conifers and Hardwoods)	134.81	298.91
Wood Products		110.05
Site Preparation Emissions		-2.49
Non-biological emissions associated with harvesting		-3.41
Non-biological emissions associated with milling		-1.50
Sum of Net Emissions/Sequestration over Identified Harvest Cycles (CO2 metric tonnes)		266.75
Project Summary		
Project Acres	Step 17- Insert the acres that are part of the harvest area.	27
Total Project Sequestration over defined Harvesting Periods (CO2 metric tonnes)		7,202

Years until Carbon Stocks are Recouped from Initial Harvest (Includes Carbon in Live Trees, Harvested Wood Products, and Landfill)
24 Years

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 — Multipliers to Estimate Carbon Tonnes per MBF (Sampson, 2002)

Forest Type	Step 0. Identify the approximate percentage of conifers by volume within the harvest plan. Must sum to 100%	Multiplier from Cubic Feet (merchantable) to Total Biomass	Pounds Carbon per Cubic Foot
Douglas-fir	29%	1.675	14.38
Redwood	44%	1.675	13.42
Pines	0%	2.254	12.14
True firs	27%	2.254	11.18
Hardwoods		2.214	11.76
Conversion of Board Feet to Cubic Feet	0.165	Pounds per Metric Tonne	2,204
Multipliers to Estimate Total Carbon Tonnes per MBF	Conifer	1.77	
	Hardwoods	1.95	
Multipliers to Estimate Merchantable Carbon Tonnes per MBF	Conifer	0.98	
	Hardwoods	0.88	

Harvest Periods		Inventory		Growth Rates		Harvest Volume	
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)
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 1.	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 available.	Step 7. Enter estimated hardwood basal area harvested/treated per acre
User must enter harvest cycles to 100 years and/or at least three entry cycles.	0	18	33	500	0.631898939	16	25
	40	22	33.27595758	685	0.647427993	8	10
	60	27.70389099	36.22451743	834	0.581923822	10	10
	80	34.39353012	37.86299387	1024	0.474587612	12	10
	100	42.86354003	37.35474611	1284	0.298704733	14	5
		0	0	0	0	0	0
	0	0	0	0	0	0	0
	0	0	0	0	0	0	0
	0	0	0	0	0	0	0
	0	0	0	0	0	0	0
	0	0	0	0	0	0	0

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	32	5	117	18	Heavy	-2.49
40	39	5	143	18	None	0
60	49	5	180	19	None	0
80	61	6	224	20	None	0
100	76	5	279	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
	Difference between ending stocks and beginning stocks		162	2.34	Sum of emissions (Metric Tonnes CO2e) per acre	-2.49

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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	(0.04)	24	2	-0.03	-0.48	0	0.00	0.00	0	0.00	0.00	-0.03	**Step 13.** Enter Estimated Load Average: MBF/Truck	4.3	-0.371789274
40	(0.02)	24	2	-0.03	-0.24	0	0.00	0.00	0	0.00	0.00	-0.01			-0.185894637
60	(0.02)	24	2	-0.03	-0.30	0	0.00	0.00	0	0.00	0.00	-0.02	**Step 14.** Enter Estimated Round Trip Haul in Hours	6	-0.232368296
80	(0.03)	24	2	-0.03	-0.36	0	0.00	0.00	0	0.00	0.00	-0.02			-0.278841955
100	(0.03)	24	2	-0.03	-0.42	0	0.00	0.00	0	0.00	0.00	-0.02			-0.325315615
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	**-0.14**				**-1.78**			**0.00**			**0.00**	**-0.09**			**-1.39**

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. 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 weighted average carbon remaining in use at year 100 is 46.3%. **Estimate.** The carbon in landfills at year 100 is 29.8% of the initial carbon produced in wood products.	**Estimate.** The weighted average carbon remaining in use at year 100 is 23.0%. **Estimate.** The carbon in landfills at year 100 is 29.8% of the initial carbon produced in wood products.
0	100%	0%	57.56	0.00	-0.40	38.56	0.00	29.35	0.00
40	100%	0%	28.78	0.00	-0.20	19.28	0.00	14.67	0.00
60	100%	0%	35.97	0.00	-0.25	24.10	0.00	18.34	0.00
80	100%	0%	43.17	0.00	-0.30	28.92	0.00	22.01	0.00
100	100%	0%	50.36	0.00	-0.35	33.74	0.00	25.68	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	100%	0%	0.00	0.00	0.00	0.00	0.00	0.00	0.00
		Sum of emissions associate with processing of lumber			-1.50	Sum of CO2 equivalent in wood products		110.05	0.00

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Far North Tractor Clear-cut Summary		
	Beginning Stocks	Ending Stocks
Emissions Source/Sink/Reservoir	Metric Tonnes CO2 Equivalent Per Acre Basis	
Live Trees (Conifers and Hardwoods)	134.81	298.91
Wood Products		110.05
Site Preparation Emissions		-2.49
Non-biological emissions associated with harvesting		-2.39
Non-biological emissions associated with milling		-1.50
Sum of Net Emissions/Sequestration over Identified Harvest Cycles (CO2 metric tonnes)		267.78
Project Summary		
Project Acres	Step 17- Insert the acres that are part of the harvest area.	8
Total Project Sequestration over defined Harvesting Periods (CO2 metric tonnes)		2,142

Years until Carbon Stocks are Recouped from Initial Harvest (Includes Carbon in Live Trees, Harvested Wood Products, and Landfill)
24 Years

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			
Multipliers to Estimate Carbon Tonnes per MBF (Sampson, 2002)			
Forest Type	**Step 0.** Identify the approximate percentage of conifers by volume within the harvest plan. Must sum to 100%	Multiplier from Cubic Feet (merchantable) to Total Biomass	Pounds Carbon per Cubic Foot
Douglas-fir	29%	1.675	14.38
Redwood	44%	1.675	13.42
Pines	0%	2.254	12.14
True firs	27%	2.254	11.18
Hardwoods		2.214	11.76
Conversion of Board Foot to Cubic Feet	0.165	Pounds per Metric Tonne	2,204
Multipliers to Estimate Total Carbon Tonnes per MBF	Conifer	**1.77**	
	Hardwoods	**1.95**	
Multipliers to Estimate Merchantable Carbon Tonnes per MBF	Conifer	**0.98**	
	Hardwoods	**0.88**	

Harvest Periods		Inventory		Growth Rates		Harvest Volume	
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)
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 1.	**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 available.	**Step 7.** Enter estimated hardwood basal area harvested/treated per acre
User must enter harvest cycles to 100 years and/or at least three entry cycles.	0	18	33	500	0.631898939	16	25
	40	22	33.27595758	685	0.647427993	8	10
	60	27.70389099	36.22451743	834	0.581923822	10	10
	80	34.39353012	37.86299387	1024	0.474587812	12	10
	100	42.86354003	37.35474611	1284	0.298704733	14	5
		0	0	0	0	0	0
	0	0	0	0	0	0	0
	0	0	0	0	0	0	0
	0	0	0	0	0	0	0
	0	0	0	0	0	0	0
	0	0	0	0	0	0	0

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	32	5	117	18	Heavy	-2.49
40	39	5	143	18	None	0
60	49	5	180	19	None	0
80	61	6	224	20	None	0
100	76	5	279	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
	Difference between ending stocks and beginning stocks		162	2.34	Sum of emissions (Metric Tonnes CO2e) per acre	-2.49

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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 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	(0.04)	25	1	-0.01	-0.23	2	-0.04	-0.72	0	0.00	0.00	-0.03	**Step 13.** Enter Estimated Load Average: MBF/Truck	4.3	-0.371789274
40	(0.02)	25	1	-0.01	-0.11	2	-0.04	-0.36	0	0.00	0.00	-0.01			-0.185894637
60	(0.02)	25	1	-0.01	-0.14	2	-0.04	-0.45	0	0.00	0.00	-0.02	**Step 14.** Enter Estimated Round Trip Haul in Hours	6	-0.232368296
80	(0.03)	25	1	-0.01	-0.17	2	-0.04	-0.54	0	0.00	0.00	-0.02			-0.278841955
100	(0.03)	25	1	-0.01	-0.20	2	-0.04	-0.63	0	0.00	0.00	-0.02			-0.325315615
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	**-0.14**				**-0.86**			**-2.69**			**0.00**	**-0.09**			**1.39**

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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%	57.56	0.00	-0.40	38.56	0.00	29.35	0.00
40	100%	0%	28.78	0.00	-0.20	19.28	0.00	14.67	0.00
60	100%	0%	35.97	0.00	-0.25	24.10	0.00	18.34	0.00
80	100%	0%	43.17	0.00	-0.30	28.92	0.00	22.01	0.00
100	100%	0%	50.36	0.00	-0.35	33.74	0.00	25.68	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	100%	0%	0.00	0.00	0.00	0.00	0.00	0.00	0.00
		Sum of emissions associate with processing of lumber			-1.50	Sum of CO2 equivalent in wood products		110.05	0.00

Far North Tractor Transition Summary		
	Beginning Stocks	Ending Stocks
Emissions Source/Sink/Reservoir	Metric Tonnes CO2 Equivalent Per Acre Basis	
Live Trees (Conifers and Hardwoods)	101.31	228.87
Wood Products		84.99
Site Preparation Emissions		0.00
Non-biological emissions associated with harvesting		-3.35
Non-biological emissions associated with milling		-1.15
Sum of Net Emissions/Sequestration over Identified Harvest Cycles (CO2 metric tonnes)		208.05
Project Summary		
Project Acres	Step 17- Insert the acres that are part of the harvest area.	28
Total Project Sequestration over defined Harvesting Periods (CO2 metric tonnes)		5,825

Years until Carbon Stocks are Recouped from Initial Harvest (Includes Carbon in Live Trees, Harvested Wood Products, and Landfill)
10 Years

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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

Multipliers to Estimate Carbon Tonnes per MBF (Sampson, 2002)

Forest Type	**Step 0.** Identify the approximate percentage of conifers by volume within the harvest plan. Must sum to 100%	Multiplier from Cubic Feet (merchantable) to Total Biomass	Pounds Carbon per Cubic Foot
Douglas-fir	18%	1.675	14.38
Redwood	64%	1.675	13.42
Pines	0%	2.254	12.14
True firs	18%	2.254	11.18
Hardwoods		2.214	11.76
Conversion of Board Feet to Cubic Feet	0.165	Pounds per Metric Tonne	2,204
Multipliers to Estimate Total Carbon Tonnes per MBF	Conifer	1.74	
	Hardwoods	1.95	
Multipliers to Estimate Merchantable Carbon Tonnes per MBF	Conifer	0.99	
	Hardwoods	0.88	

Harvest Periods		Inventory		Growth Rates		Harvest Volume	
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)
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 1.	**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 available.	**Step 7.** Enter estimated hardwood basal area harvested/treated per acre
User must enter harvest cycles to 100 years and/or at least three entry cycles.	0	13	34	363	0.670547262	4	13
	20	16.25500111	34.41094525	454	0.619807438	5	15
	40	20.32778395	31.807094	537	0.536664327	7	15
	60	24.07146033	27.54038054	648	0.400424859	8	15
	80	29.02684507	20.54887373	767	0.336834209	10	10
	100	34.36459863	17.28555792	901	0.392287963	12	5
	0	0	0	0	0	0	0
	0	0	0	0	0	0	0
	0	0	0	0	0	0	0
	0	0	0	0	0	0	0
	0	0	0	0	0	0	0

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	23	5	83	18	None	0
20	28	5	104	18	None	0
40	35	5	130	17	None	0
60	42	4	154	15	None	0
80	51	3	185	11	none	0
100	60	3	220	9	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		137	-8.97	Sum of emissions (Metric Tonnes CO2e) per acre	0

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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	(0.01)	24	1	-0.01	-0.06	2	-0.05	-0.19	0	0.00	0.00	-0.01	**Step 13.** Enter Estimated Load Average: MBF/Truck	4.3	-0.092947318
20	(0.01)	24	1	-0.01	-0.07	2	-0.05	-0.23	0	0.00	0.00	-0.01			-0.116184148
40	(0.02)	24	1	-0.01	-0.10	2	-0.05	-0.33	0	0.00	0.00	-0.01	**Step 14.** Enter Estimated Round Trip Haul in Hours	6	-0.162657807
60	(0.02)	24	1	-0.01	-0.12	2	-0.05	-0.37	0	0.00	0.00	-0.01			-0.185894637
80	(0.02)	24	1	-0.01	-0.15	2	-0.05	-0.47	0	0.00	0.00	-0.02			-0.232368296
100	(0.03)	0	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	-0.02			-0.278841955
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	**-0.11**				**-0.51**			**-1.59**			**0.00**	**-0.07**			**-1.07**

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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%	14.50	0.00	-0.10	9.71	0.00	7.39	0.00
20	100%	0%	18.12	0.00	-0.13	12.14	0.00	9.24	0.00
40	100%	0%	25.37	0.00	-0.18	17.00	0.00	12.93	0.00
60	100%	0%	28.99	0.00	-0.20	19.42	0.00	14.78	0.00
80	100%	0%	36.24	0.00	-0.25	24.28	0.00	18.48	0.00
100	100%	0%	43.49	0.00	-0.30	29.14	0.00	22.17	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
		Sum of emissions associate with processing of lumber			-1.15	Sum of CO2 equivalent in wood products		84.99	0.00

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Far North Cable Transition Summary		
	Beginning Stocks	Ending Stocks
Emissions Source/Sink/Reservoir	Metric Tonnes CO2 Equivalent Per Acre Basis	
Live Trees (Conifers and Hardwoods)	101.31	228.87
Wood Products		84.99
Site Preparation Emissions		0.00
Non-biological emissions associated with harvesting		-2.27
Non-biological emissions associated with milling		-1.15
Sum of Net Emissions/Sequestration over Identified Harvest Cycles (CO2 metric tonnes)		209.13
Project Summary		
Project Acres	Step 17- Insert the acres that are part of the harvest area.	13
Total Project Sequestration over defined Harvesting Periods (CO2 metric tonnes)		2,719

Years until Carbon Stocks are Recouped from Initial Harvest (Includes Carbon in Live Trees, Harvested Wood Products, and Landfill)
10 Years

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

Multipliers to Estimate Carbon Tonnes per MBF (Sampson, 2002)

Forest Type	Step 0. Identify the approximate percentage of conifers by volume within the harvest plan. Must sum to 100%	Multiplier from Cubic Feet (merchantable) to Total Biomass	Pounds Carbon per Cubic Foot
Douglas-fir	18%	1.675	14.38
Redwood	64%	1.675	13.42
Pines	0%	2.254	12.14
True firs	18%	2.254	11.18
Hardwoods		2.214	11.76
Conversion of Board Feet to Cubic Feet	0.165	Pounds per Metric Tonne	2,204
Multipliers to Estimate Total Carbon Tonnes per MBF	Conifer	1.74	
	Hardwoods	1.95	
Multipliers to Estimate Merchantable Carbon Tonnes per MBF	Conifer	0.99	
	Hardwoods	0.88	

Harvest Periods / Inventory / Growth Rates / Harvest Volume

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

Harvest Periods: Time of Harvest (years from project approval)	Inventory: Conifer Live Tree Volume (MBF/Acre) - Prior to Harvest	Inventory: Hardwood Live Tree Volume (BA square feet/Acre) - Prior to Harvest	Growth Rates: Conifer Growth Rate BF/Acre/Year	Growth Rates: Hardwood Growth Rate BA/Acre/Year	Harvest Volume: Conifer Harvest Volume (MBF/acre)	Harvest Volume: Hardwood Harvested / Treated Basal Area (BA/Acre)
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 1.	**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 available.	**Step 7.** Enter estimated hardwood basal area harvested/treated per acre
0	13	34	363	0.670547262	4	13
20	16.25500111	34.41094525	454	0.619807438	5	15
40	20.32778395	31.807094	537	0.536664327	7	15
60	24.07146033	27.54038054	648	0.400424859	8	15
80	29.02684507	20.54887373	767	0.336834209	10	10
100	34.36459863	17.28555792	901	0.392287963	12	5
0	0	0	0	0	0	0
0	0	0	0	0	0	0
0	0	0	0	0	0	0
0	0	0	0	0	0	0
0	0	0	0	0	0	0

Inventory Conversion to Carbon / Carbon Dioxide Equivalent (prior to harvest) / Site Preparation

Harvest Periods	Inventory Conversion to Carbon (prior to harvest): Conifer Live Tree Tonnes (C/acre)	Inventory Conversion to Carbon (prior to harvest): Hardwood Live Trees Tonnes (C/acre)	Inventory Conversion to Carbon Dioxide Equivalent (prior to harvest): Conifer Live Tree Tonnes (CO_2 equivalent/acre)	Inventory Conversion to Carbon Dioxide Equivalent (prior to harvest): Hardwood Live Tree Tonnes (CO_2 equivalent/acre)	Site Preparation: 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	23	5	83	18	None	0
20	28	5	104	18	None	0
40	35	5	130	17	None	0
60	42	4	154	15	None	0
80	51	3	185	11	none	0
100	60	3	220	9	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		137	-8.97	Sum of emissions (Metric Tonnes CO2e) per acre	0

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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	(0.01)	24	2	-0.03	-0.12	0	0.00	0.00	0	0.00	0.00	-0.01	**Step 13.** Enter Estimated Load Average: MBF/Truck	4.3	-0.092947318
20	(0.01)	24	2	-0.03	-0.15	0	0.00	0.00	0	0.00	0.00	-0.01			-0.116184148
40	(0.02)	24	2	-0.03	-0.21	0	0.00	0.00	0	0.00	0.00	-0.01	**Step 14.** Enter Estimated Round Trip Haul in Hours	6	-0.162657807
60	(0.02)	24	2	-0.03	-0.24	0	0.00	0.00	0	0.00	0.00	-0.01			-0.185894637
80	(0.02)	24	2	-0.03	-0.30	0	0.00	0.00	0	0.00	0.00	-0.02			-0.232368296
100	(0.03)	0	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	-0.02			-0.278841955
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	-0.11				-1.01			0.00			0.00	-0.07			-1.07

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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. 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 weighted average carbon remaining in use at year 100 is 46.3% **Estimate.** The carbon in landfills at year 100 is 29.8% of the initial carbon produced in wood products.	**Estimate.** The weighted average carbon remaining in use at year 100 is 23.0% **Estimate.** The carbon in landfills at year 100 is 29.8% of the initial carbon produced in wood products.
0	100%	0%	14.50	0.00	-0.10	9.71	0.00	7.39	0.00
20	100%	0%	18.12	0.00	-0.13	12.14	0.00	9.24	0.00
40	100%	0%	25.37	0.00	-0.18	17.00	0.00	12.93	0.00
60	100%	0%	28.99	0.00	-0.20	19.42	0.00	14.78	0.00
80	100%	0%	36.24	0.00	-0.25	24.28	0.00	18.48	0.00
100	100%	0%	43.49	0.00	-0.30	29.14	0.00	22.17	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
		Sum of emissions associate with processing of lumber			-1.15	Sum of CO2 equivalent in wood products		84.99	0.00

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Far North Tractor Group Selection Summary		
	Beginning Stocks	Ending Stocks
Emissions Source/Sink/Reservoir	Metric Tonnes CO2 Equivalent Per Acre Basis	
Live Trees (Conifers and Hardwoods)	165.90	313.88
Wood Products		141.21
Site Preparation Emissions		0.00
Non-biological emissions associated with harvesting		-5.05
Non-biological emissions associated with milling		-1.90
Sum of Net Emissions/Sequestration over Identified Harvest Cycles (CO2 metric tonnes)		282.24
Project Summary		
Project Acres	Step 17- Insert the acres that are part of the harvest area.	47
Total Project Sequestration over defined Harvesting Periods (CO2 metric tonnes)		13,265

Years until Carbon Stocks are Recouped from Initial Harvest (Includes Carbon in Live Trees, Harvested Wood Products, and Landfill)
10 Years

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

Multipliers to Estimate Carbon Tonnes per MBF (Sampson, 2002)

Forest Type	Step 0. Identify the approximate percentage of conifers by volume within the harvest plan. Must sum to 100%	Multiplier from Cubic Feet (merchantable) to Total Biomass	Pounds Carbon per Cubic Foot
Douglas-fir	17%	1.675	14.38
Redwood	67%	1.675	13.42
Pines	4%	2.254	12.14
True firs	12%	2.254	11.18
Hardwoods		2.214	11.76
Conversion of Board Feet to Cubic Feet	0.165	Pounds per Metric Tonne	2,204
Multipliers to Estimate Total Carbon Tonnes per MBF	Conifer	1.74	
	Hardwoods	1.95	
Multipliers to Estimate Merchantable Carbon Tonnes per MBF	Conifer	0.99	
	Hardwoods	0.88	

Harvest Periods / Inventory / Growth Rates / Harvest Volume

	Harvest Periods	Inventory		Growth Rates		Harvest Volume	
	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)
	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 1.	**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 available.	**Step 7.** Enter estimated hardwood basal area harvested/treated per acre
User must enter harvest cycles to 100 years and/or at least three entry cycles.	0	22	47	605	0.862132194	7	20
	20	27.09166852	44.24264389	729	0.774087547	9	20
	40	32.67556577	39.72439483	833	0.629816141	12	20
	60	37.34237162	32.32071764	941	0.553064752	14	15
	80	42.15891962	28.38201269	1054	0.427298665	16	15
	100	47.24591861	21.927986	1179	0.380870398	18	10
	0	0	0		0	0	0
	0	0	0	0	0	0	0
	0	0	0	0	0	0	0
	0	0	0	0	0	0	0
	0	0	0	0	0	0	0

Inventory Conversion / Site Preparation

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	38	7	141	25	None	0
20	47	6	173	24	None	0
40	57	6	209	21	None	0
60	65	5	239	17	None	0
80	73	4	270	15	none	0
100	82	3	302	12	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		161	-13.45	Sum of emissions (Metric Tonnes CO2e) per acre	0

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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	(0.02)	28	1	-0.01	-0.09	2	-0.04	-0.28	0	0.00	0.00	-0.01	**Step 13.** Enter Estimated Load Average: MBF/Truck	4.5	-0.155428571
20	(0.02)	28	1	-0.01	-0.11	2	-0.04	-0.36	0	0.00	0.00	-0.01			-0.199836735
40	(0.03)	28	1	-0.01	-0.15	2	-0.04	-0.48	0	0.00	0.00	-0.02	**Step 14.** Enter Estimated Round Trip Haul in Hours	6	-0.26644898
60	(0.03)	28	1	-0.01	-0.18	2	-0.04	-0.56	0	0.00	0.00	-0.02			-0.310857143
80	(0.04)	28	1	-0.01	-0.20	2	-0.04	-0.64	0	0.00	0.00	-0.02			-0.355265306
100	(0.04)	0	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	-0.03			-0.399673469
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	**-0.19**				**-0.74**			**-2.32**			**0.00**	**-0.12**			**-1.69**

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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%	25.51	0.00	-0.18	17.09	0.00	13.01	0.00
20	100%	0%	32.80	0.00	-0.23	21.97	0.00	16.72	0.00
40	100%	0%	43.73	0.00	-0.30	29.30	0.00	22.30	0.00
60	100%	0%	51.02	0.00	-0.35	34.18	0.00	26.01	0.00
80	100%	0%	58.31	0.00	-0.40	39.06	0.00	29.73	0.00
100	100%	0%	65.59	0.00	-0.45	43.95	0.00	33.44	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
		Sum of emissions associate with processing of lumber			-1.90	Sum of CO2 equivalent in wood products		141.21	0.00

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Far North Group Cable Selection Summary		
	Beginning Stocks	Ending Stocks
Emissions Source/Sink/Reservoir	Metric Tonnes CO2 Equivalent Per Acre Basis	
Live Trees (Conifers and Hardwoods)	165.90	313.88
Wood Products		141.21
Site Preparation Emissions		0.00
Non-biological emissions associated with harvesting		-5.79
Non-biological emissions associated with milling		-1.90
Sum of Net Emissions/Sequestration over Identified Harvest Cycles (CO2 metric tonnes)		281.50
Project Summary		
Project Acres	Step 17- Insert the acres that are part of the harvest area.	41
Total Project Sequestration over defined Harvesting Periods (CO2 metric tonnes)		11,542

Years until Carbon Stocks are Recouped from Initial Harvest (Includes Carbon in Live Trees, Harvested Wood Products, and Landfill)
10 Years

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

Multipliers to Estimate Carbon Tonnes per MBF (Sampson, 2002)

Forest Type	Step 0. Identify the approximate percentage of conifers by volume within the harvest plan. Must sum to 100%	Multiplier from Cubic Feet (merchantable) to Total Biomass	Pounds Carbon per Cubic Foot
Douglas-fir	17%	1.675	14.38
Redwood	67%	1.675	13.42
Pines	4%	2.254	12.14
True firs	12%	2.254	11.18
Hardwoods	[redacted]	2.214	11.76
Conversion of Board Feet to Cubic Feet	0.165	Pounds per Metric Tonne	2,204
Multipliers to Estimate Total Carbon Tonnes per MBF	Conifer	1.74	
	Hardwoods	1.95	
Multipliers to Estimate Merchantable Carbon Tonnes per MBF	Conifer	0.99	
	Hardwoods	0.88	

Harvest Periods / Inventory / Growth Rates / Harvest Volume

Harvest Periods		Inventory		Growth Rates		Harvest Volume	
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)
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 1.	**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 available.	**Step 7.** Enter estimated hardwood basal area harvested/treated per acre
User must enter harvest cycles to 100 years and/or at least three entry cycles.	0	22	47	605	0.862132194	7	20
	20	27.09166852	44.24264389	729	0.774087547	9	20
	40	32.67556577	39.72439483	833	0.629816141	12	20
	60	37.34237162	32.32071764	941	0.553064752	14	15
	80	42.15891962	28.38201269	1054	0.427298665	16	15
	100	47.24591861	21.927986	1179	0.380870398	18	10
	0	0	0		0	0	0
	0	0	0	0	0	0	0
	0	0	0	0	0	0	0
	0	0	0	0	0	0	0
	0	0	0	0	0	0	0

Inventory Conversion / Site Preparation

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	38	7	141	25	None	0
20	47	6	173	24	None	0
40	57	6	209	21	None	0
60	65	5	239	17	None	0
80	73	4	270	15	none	0
100	82	3	302	12	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		161	-13.45	Sum of emissions (Metric Tonnes CO2e) per acre	0

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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	(0.02)	28	2	-0.03	-0.18	0	0.00	0.00	0	0.00	0.00	-0.01	**Step 13.** Enter Estimated Load Average: MBF/Truck	4.5	-0.155428571
20	(0.02)	28	2	-0.03	-0.23	0	0.00	0.00	0	0.00	0.00	-0.01			-0.199836735
40	(0.03)	28	2	-0.03	-0.31	0	0.00	0.00	0	0.00	0.00	-0.02	**Step 14.** Enter Estimated Round Trip Haul in Hours	6	-0.26644898
60	(0.03)	28	2	-0.03	-0.36	0	0.00	0.00	0	0.00	0.00	-0.02			-0.310857143
80	(0.04)	28	2	-0.03	-0.41	0	0.00	0.00	0	0.00	0.00	-0.02			-0.355265306
100	(0.04)	0	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	-0.03			-0.399673469
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	**-0.19**				**-1.48**			**0.00**			**0.00**	**-0.12**			**-1.69**

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 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 weighted average carbon remaining in use at year 100 is 46.3% **Estimate.** The carbon in landfills at year 100 is 29.8% of the initial carbon produced in wood products.	**Estimate.** The weighted average carbon remaining in use at year 100 is 23.0% **Estimate.** The carbon in landfills at year 100 is 29.8% of the initial carbon produced in wood products.
0	100%	0%	25.51	0.00	-0.18	17.09	0.00	13.01	0.00
20	100%	0%	32.80	0.00	-0.23	21.97	0.00	16.72	0.00
40	100%	0%	43.73	0.00	-0.30	29.30	0.00	22.30	0.00
60	100%	0%	51.02	0.00	-0.35	34.18	0.00	26.01	0.00
80	100%	0%	58.31	0.00	-0.40	39.06	0.00	29.73	0.00
100	100%	0%	65.59	0.00	-0.45	43.95	0.00	33.44	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
		Sum of emissions associate with processing of lumber			-1.90	Sum of CO2 equivalent in wood products		141.21	0.00

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Far North STR Tractor Summary		
	Beginning Stocks	Ending Stocks
Emissions Source/Sink/Reservoir	Metric Tonnes CO2 Equivalent Per Acre Basis	
Live Trees (Conifers and Hardwoods)	102.56	247.48
Wood Products		100.24
Site Preparation Emissions		0.00
Non-biological emissions associated with harvesting		-3.95
Non-biological emissions associated with milling		-1.35
Sum of Net Emissions/Sequestration over Identified Harvest Cycles (CO2 metric tonnes)		239.86
Project Summary		
Project Acres	Step 17- Insert the acres that are part of the harvest area.	8
Total Project Sequestration over defined Harvesting Periods (CO2 metric tonnes)		1,919

Years until Carbon Stocks are Recouped from Initial Harvest (Includes Carbon in Live Trees, Harvested Wood Products, and Landfill)
12 Years

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

Multipliers to Estimate Carbon Tonnes per MBF (Sampson, 2002)

Forest Type	Step 0. Identify the approximate percentage of conifers by volume within the harvest plan. Must sum to 100%	Multiplier from Cubic Feet (merchantable) to Total Biomass	Pounds Carbon per Cubic Foot
Douglas-fir	22%	1.675	14.38
Redwood	61%	1.675	13.42
Pines	0%	2.254	12.14
True firs	17%	2.254	11.18
Hardwoods		2.214	11.76
Conversion of Board Feet to Cubic Feet	0.165	Pounds per Metric Tonne	2,204
Multipliers to Estimate Total Carbon Tonnes per MBF	Conifer	1.74	
	Hardwoods	1.95	
Multipliers to Estimate Merchantable Carbon Tonnes per MBF	Conifer	0.99	
	Hardwoods	0.88	

Harvest Periods / Inventory / Growth Rates / Harvest Volume

Harvest Periods		Inventory		Growth Rates		Harvest Volume	
	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)
	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 1.	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 available.	Step 7. Enter estimated hardwood basal area harvested/treated per acre
User must enter harvest cycles to 100 years and/or at least three entry cycles.	0	12	48	400	0.925993838	6	19
	20	14	47.51987677	524	0.878732287	7	20
	40	17.47944605	45.09452251	624	0.801288732	8	20
	60	21.95760142	41.12029714	784	0.674388449	9	20
	80	28.2395369	34.60806612	937	0.626101889	11	15
	100	35.97318869	32.13009951	1168	0.546978158	13	15
	0	0	0	0	0	0	0
	0	0	0	0	0	0	0
	0	0	0	0	0	0	0
	0	0	0	0	0	0	0
	0	0	0	0	0	0	0

Inventory Conversion / Site Preparation

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 bast 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	21	7	77	26	None	0
20	24	7	90	25	None	0
40	30	7	112	24	None	0
60	38	6	141	22	None	0
80	49	5	181	19	none	0
100	63	5	230	17	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		153	-8.51	Sum of emissions (Metric Tonnes CO2e) per acre	0

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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 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	(0.02)	24	1	-0.01	-0.09	2	-0.05	-0.28	0	0.00	0.00	-0.01	**Step 13.** Enter Estimated Load Average: MBF/Truck	4.6	-0.13322449
20	(0.02)	24	1	-0.01	-0.10	2	-0.05	-0.33	0	0.00	0.00	-0.01			-0.155428571
40	(0.02)	24	1	-0.01	-0.12	2	-0.05	-0.37	0	0.00	0.00	-0.01	**Step 14.** Enter Estimated Round Trip Haul in Hours	6	-0.177632653
60	(0.02)	24	1	-0.01	-0.13	2	-0.05	-0.42	0	0.00	0.00	-0.01			-0.199836735
80	(0.03)	24	1	-0.01	-0.16	2	-0.05	-0.51	0	0.00	0.00	-0.02			-0.244244898
100	(0.03)	0	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	-0.02			-0.288653061
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	**-0.14**				**-0.61**			**-1.91**			**0.00**	**-0.09**			**-1.20**

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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%	21.84	0.00	-0.15	14.64	0.00	11.14	0.00
20	100%	0%	25.48	0.00	-0.18	17.07	0.00	12.99	0.00
40	100%	0%	29.12	0.00	-0.20	19.51	0.00	14.85	0.00
60	100%	0%	32.76	0.00	-0.23	21.95	0.00	16.71	0.00
80	100%	0%	40.05	0.00	-0.28	26.83	0.00	20.42	0.00
100	100%	0%	47.33	0.00	-0.33	31.71	0.00	24.13	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
		Sum of emissions associate with processing of lumber			-1.35	Sum of CO2 equivalent in wood products		100.24	0.00

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Far North STR Cable Summary		
	Beginning Stocks	Ending Stocks
Emissions Source/Sink/Reservoir	Metric Tonnes CO2 Equivalent Per Acre Basis	
Live Trees (Conifers and Hardwoods)	102.56	247.48
Wood Products		100.24
Site Preparation Emissions		0.00
Non-biological emissions associated with harvesting		-2.75
Non-biological emissions associated with milling		-1.35
Sum of Net Emissions/Sequestration over Identified Harvest Cycles (CO2 metric tonnes)		241.05
Project Summary		
Project Acres	Step 17- Insert the acres that are part of the harvest area.	29
Total Project Sequestration over defined Harvesting Periods (CO2 metric tonnes)		6,991

Years until Carbon Stocks are Recouped from Initial Harvest (Includes Carbon in Live Trees, Harvested Wood Products, and Landfill)
12 Years

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

Multipliers to Estimate Carbon Tonnes per MBF (Sampson, 2002)

Forest Type	Step 0. Identify the approximate percentage of conifers by volume within the harvest plan. Must sum to 100%	Multiplier from Cubic Feet (merchantable) to Total Biomass	Pounds Carbon per Cubic Foot
Douglas-fir	22%	1.675	14.38
Redwood	61%	1.675	13.42
Pines	0%	2.254	12.14
True firs	17%	2.254	11.18
Hardwoods	[redacted]	2.214	11.76
Conversion of Board Feet to Cubic Feet	0.165	Pounds per Metric Tonne	2,204
Multipliers to Estimate Total Carbon Tonnes per MBF	Conifer	1.74	
	Hardwoods	1.95	
Multipliers to Estimate Merchantable Carbon Tonnes per MBF	Conifer	0.99	
	Hardwoods	0.88	

Harvest Periods / Inventory / Growth Rates / Harvest Volume

Harvest Periods		Inventory		Growth Rates		Harvest Volume	
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)
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 1.	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 available.	Step 7. Enter estimated hardwood basal area harvested/treated per acre
User must enter harvest cycles to 100 years and/or at least three entry cycles.	0	12	48	400	0.925993838	6	19
	20	14	47.51987677	524	0.878732287	7	20
	40	17.47944605	45.09452251	624	0.801288732	8	20
	60	21.95760142	41.12029714	764	0.674388449	9	20
	80	28.2395369	34.60806612	937	0.626101669	11	15
	100	35.97318869	32.13009951	1168	0.546978158	13	15
	0	0	0	0	0	0	0
	0	0	0	0	0	0	0
	0	0	0	0	0	0	0
	0	0	0	0	0	0	0
	0	0	0	0	0	0	0

Inventory Conversion / Site Preparation

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	21	7	77	26	None	0
20	24	7	90	25	None	0
40	30	7	112	24	None	0
60	38	6	141	22	None	0
80	49	5	181	19	none	0
100	63	5	230	17	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		153	-8.51	Sum of emissions (Metric Tonnes CO2e) per acre	0

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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.

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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	(0.02)	22	2	-0.03	-0.19	0	0.00	0.00	0	0.00	0.00	-0.01	**Step 13.** Enter Estimated Load Average: MBF/Truck	4.5	-0.13322449
20	(0.02)	22	2	-0.03	-0.23	0	0.00	0.00	0	0.00	0.00	-0.01			-0.155428571
40	(0.02)	22	2	-0.03	-0.26	0	0.00	0.00	0	0.00	0.00	-0.01	**Step 14.** Enter Estimated Round Trip Haul in Hours	6	-0.177632653
60	(0.02)	22	2	-0.03	-0.29	0	0.00	0.00	0	0.00	0.00	-0.01			-0.199836735
80	(0.03)	22	2	-0.03	-0.36	0	0.00	0.00	0	0.00	0.00	-0.02			-0.244244898
100	(0.03)	0	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	-0.02			-0.288653061
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	**-0.14**				**-1.33**			**0.00**			**0.00**	**-0.09**			**-1.20**

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	
from Inventory, Growth, and Harvest Page (Time of Harvest as years from project approval)	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
	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%	21.84	0.00	-0.15	14.64	0.00	11.14	0.00
20	100%	0%	25.48	0.00	-0.18	17.07	0.00	12.99	0.00
40	100%	0%	29.12	0.00	-0.20	19.51	0.00	14.85	0.00
60	100%	0%	32.76	0.00	-0.23	21.95	0.00	16.71	0.00
80	100%	0%	40.05	0.00	-0.28	26.83	0.00	20.42	0.00
100	100%	0%	47.33	0.00	-0.33	31.71	0.00	24.13	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
		Sum of emissions associate with processing of lumber			-1.35	Sum of CO2 equivalent in wood products		100.24	0.00

H. Wildfire Risk and Hazard Reduction

912.9 Technical Rule Addendum #2 states the following concerning analysis of Wildfire Risk and Hazard Reduction impacts:

H. WILDFIRE RISK AND HAZARD
Cumulative increase in wildfire risk and hazard can occur when the Effects of two or more activities from one or more Projects combine to produce a significant increase in forest fuel loading in the vicinity of residential dwellings and communities. The following elements may be considered in the assessment of potential Cumulative Impacts:

1. Fire hazard severity zoning.
2. Existing and probable future fuel conditions including vertical and horizontal continuity of live and dead fuels.
3. Location of known existing public and private fuel breaks and fuel hazard reduction activities.
4. Road access for fire suppression resources.

The assessment area for wildfire risk and hazard reduction is the THP area, plus the area within one half mile of the THP boundaries. The assessment area as described seems appropriate for an assessment of potential significant effects which may occur in the vicinity of the plan area based on surrounding land use, local weather patterns and fire suppression response times associated with the project area.

1 The project area benefits from the heavy influence of the cool marine climate of the Mendocino coast which reduces fire hazard significantly over drier hotter inland sites. According to published reports the California Department of Forestry and Fire Protection maps areas of significant fire hazards based on fuels, terrain, weather, and other relevant factors. GIS data accessed at https://osfm.fire.ca.gov/divisions/wildfire-planning-engineering/wildland-hazards-building-codes/fire-hazard-severity-zones-maps/ on 5/25/2020 shows the area located in the vicinity of the project as "High" (on a ranking system of Moderate, High or Very High). The "High" ranking is applied to 73 percent of the area classified in Mendocino County by CalFire. CalFire posts the following disclaimer on the above cited web page "The State of California and the Department of Forestry and Fire Protection make no representations or warranties regarding the accuracy of data or maps."

2 Both vertical and horizontal continuity of fuels is reduced through harvesting. The proposed logging activities in this project will create a temporary increase in fuel loading near landings where slash is piled. There will be some additional slash scattered about the harvest units which will decay quickly in the moist coastal climate.

3 The project area and surrounding area is a mixed use landscape and is expected to remain so into the foreseeable future.

4 There are no known existing public fuel breaks or fuel hazard reduction activities in the vicinity of the project area. So long as the requirements of the FPR and THP are properly implemented there will be no long term increase in wildfire risk due to the proposed project. Fire protection zone requirements apply adjacent to residences and public roads as shown on the THP Map.

5 One significant benefit of the proposed harvest is that the existing road extending north from the Owner's residence will be re-opened and rehabilitated. This improved access would reduce response time should wildfire break out on the east facing slope above the Little North Fork Gualala River.

Impacts Evaluation
Will the proposed project, as presented, in combination with the impacts of past and future projects, as identified in Parts A through C above, have a reasonable potential to cause or add to significant cumulative impacts to Wildfire Risk and Hazard Reduction?

Yes, after mitigation .... ______
No, after mitigation .... XXX /
No: no reasonably potential significant effects .... ______

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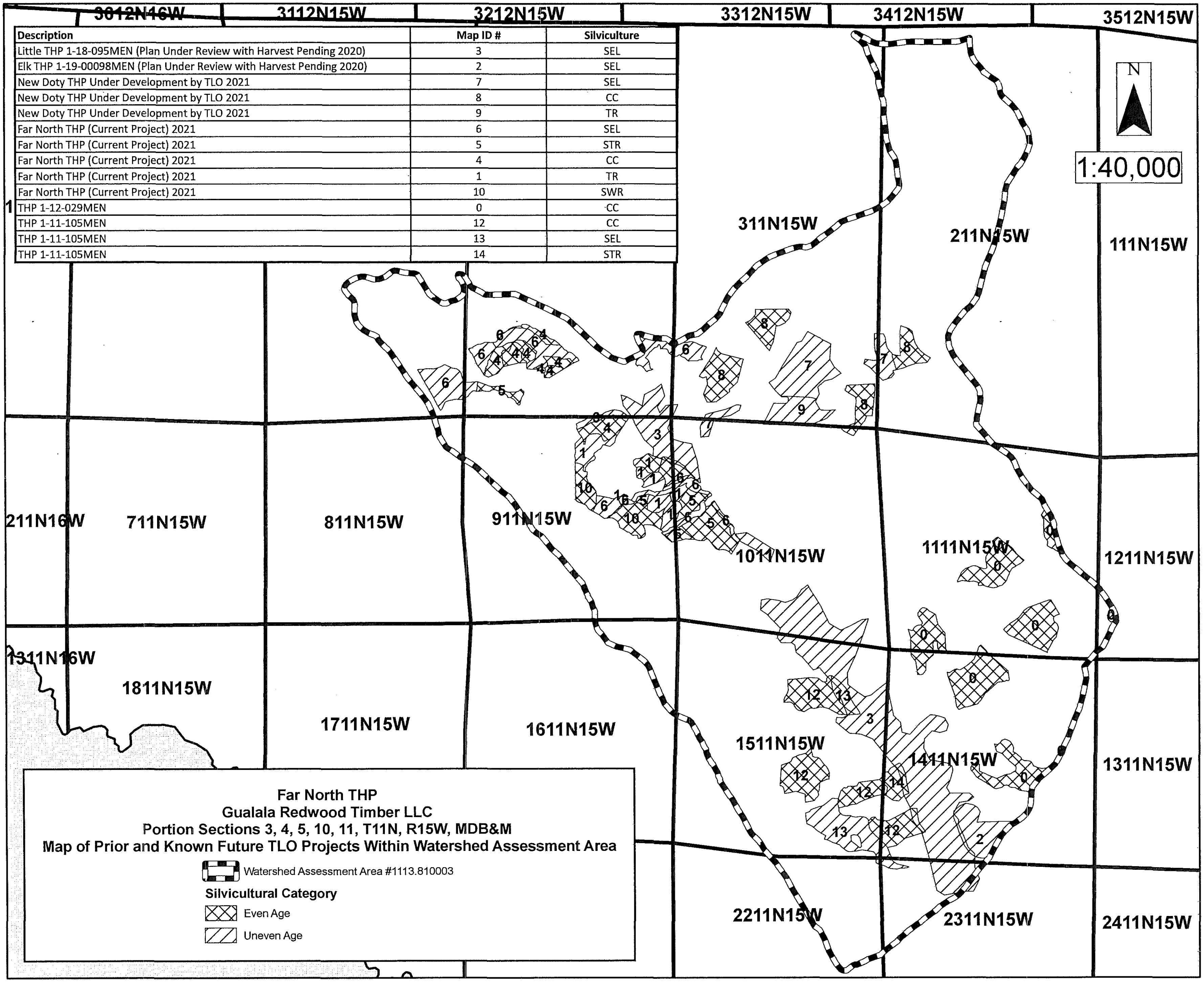
Description	Map ID #	Silviculture
Little THP 1-18-095MEN (Plan Under Review with Harvest Pending 2020)	3	SEL
Elk THP 1-19-00098MEN (Plan Under Review with Harvest Pending 2020)	2	SEL
New Doty THP Under Development by TLO 2021	7	SEL
New Doty THP Under Development by TLO 2021	8	CC
New Doty THP Under Development by TLO 2021	9	TR
Far North THP (Current Project) 2021	6	SEL
Far North THP (Current Project) 2021	5	STR
Far North THP (Current Project) 2021	4	CC
Far North THP (Current Project) 2021	1	TR
Far North THP (Current Project) 2021	10	SWR
THP 1-12-029MEN	0	CC
THP 1-11-105MEN	12	CC
THP 1-11-105MEN	13	SEL
THP 1-11-105MEN	14	STR



Far North THP
Gualala Redwood Timber LLC
Portion Sections 3, 4, 5, 10, 11, T11N, R15W, MDB&M
Map of Prior and Known Future TLO Projects Within Watershed Assessment Area

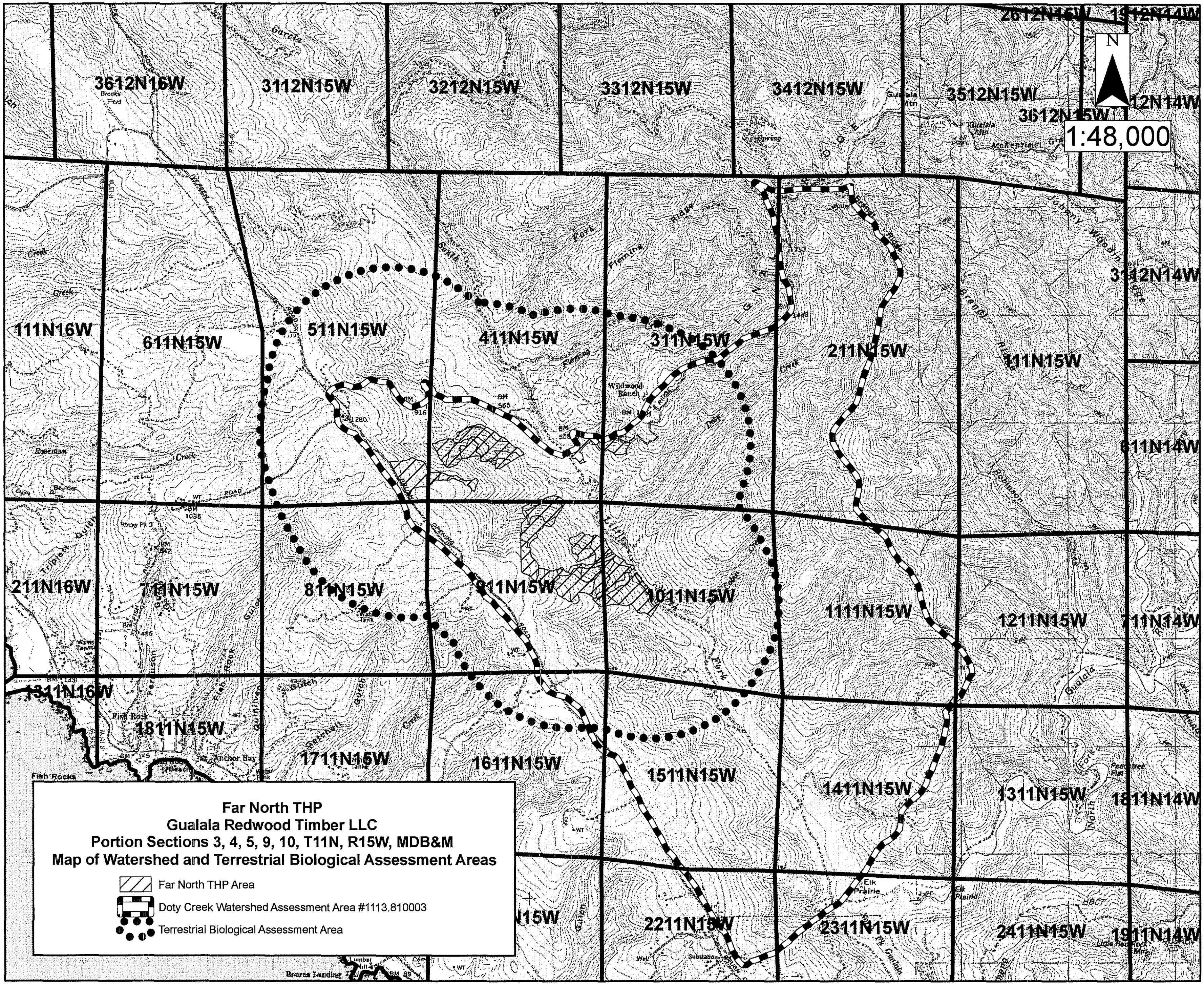
Watershed Assessment Area #1113.810003

Silvicultural Category

Even Age

Uneven Age

241



1:48,000
N
Far North THP
Gualala Redwood Timber LLC
Portion Sections 3, 4, 5, 9, 10, T11N, R15W, MDB&M
Map of Watershed and Terrestrial Biological Assessment Areas
Far North THP Area
Doty Creek Watershed Assessment Area #1113.810003
Terrestrial Biological Assessment Area
3612N16W
3112N15W
3212N15W
3312N15W
3412N15W
3512N15W
3612N15W
111N16W
611N15W
511N15W
411N15W
311N15W
211N15W
111N15W
3112N14W
611N14W
211N16W
711N15W
811N15W
911N15W
1011N15W
1111N15W
1211N15W
711N14W
1311N16W
1811N15W
1711N15W
1611N15W
1511N15W
1411N15W
1311N15W
1811N14W
2211N15W
2311N15W
2411N15W
1911N14W
Wildwood Ranch
Fish Rocks
Anchor Bay
Elk Prairie