

Central Timber Production Zone

The Sea Ranch

Forest Management Plan

2009

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Introduction

In 2008 Edward A. Tunheim was commissioned to develop a Forest Management Plan for The Sea Ranch Association located in northwestern Sonoma County. The purpose of the Forest Management Plan is to provide the Association, and its Board with the necessary information and guidelines to make decisions about forest resource management and to implement California Forest Improvement Program (CFIP) projects. In particular this Forest Management Plan addresses the Central Timber Production Zone.

Sources of information used to develop this Forest Management Plan included: data from the field review, aerial photo interpretation, information from the Association, USDA soil survey for Sonoma County, The Guide to Wildlife Habitats of California, the California Code of Regulations for Forest Practices, the California Forest Improvement Program User's Guide 2008, California Forest Stewardship Program, additional professional literature and the combined knowledge of Edward A. Tunheim RPF #79 and Matt Greene RPF #2747. Additional sources of information are included in the Appendix of this Plan.

Landowner Definitions

Anadromous: Refers to fish that are born and reared in freshwater, move to the ocean to mature, and then return to freshwater to spawn. Steelhead and salmon.

Basal Area: The cross sectional area of tree stems (trunks) measured in square feet per acre; a measure of the level of tree stocking.

Board feet: A unit of measure of timber products; a sawn board 1 inch X 12 inches X 12 inches (often written as BD FT).

Class I Watercourse: A watercourse that is used for domestic water supplies or a watercourse that supports fish for at least part of the year.

Class II Watercourse: A watercourse that supports aquatic nonfish species (i.e. frogs, salamanders, and other aquatic species). Must have continuous running water for at least 3 months of the year.

Class III Watercourse: A watercourse that has the potential to deliver sediment to a class I or II watercourse and has no associated aquatic nonfish species.

Conifer: Redwood, Douglas-fir, grand fir, Western hemlock and Bishop pine trees.

Cord: A unit of measure of fuelwood; 128 cubic feet (4ft. x 4ft. x 8ft.)

Cutting Cycle: Interval of time between selective harvests and re-entry into a specific area.

DBH: Tree diameter in inches, measured outside the bark at a point 4.5 ft. above the ground.

Erosion control structure: A drainage facility in roads, landings or skid trails that assists in proper road drainage (waterbars, berms, & rolling dips). Rolling dips should be used on roads under 8% in grade. Waterbars should be installed on steeper roads and on skid trails.

Forest Canopy or Crown Cover: More or less continuous cover of foliage formed collectively by the crowns of adjacent trees.

Fuelwood: Firewood, usually hardwood trees.

Girdling: Method of creating a snag by cutting a ring through the bark around the tree.

Hardwoods: Tan oak, Live oak, Madrone, Bay, Big-leaf maple, & White alder trees.

Inner Gorge: A geomorphic feature formed by coalescing scars originating from landsliding and erosional processes caused by active stream erosion. The feature is identified as that area beginning immediately adjacent to the stream channel below the first break in slope.

Ladder Fuels: Trees, shrubs and other vegetation capable of carrying a ground fire up into the tree canopy.

LTO: Licensed timber operator, logger.

Mature: Economic maturity: conifer trees over 18 inches DBH and 40 to 60 years old.

Physiological maturity: conifer trees 28 to 36 inches DBH and 60 to 150 years old.

MBF: thousand board feet.

Merchantable: Sound conifer trees 18 in. or greater DBH.

Midden: Dark colored, silty, soil found at prehistoric occupation sites. Typically, midden deposits contain quantities of ash, soot, and broken fire cracked rocks, indicative of intensive occupation of a site. Dry midden soil has a sooty feel and sticks to the hand.

Net volume: Log volume remaining after deductions have been made for defect and operations damage.

NTMP: Non-industrial Timber Management Plan

Old Growth: A tree that meets most or all of the following criteria:

- 1) a diameter at breast height (dbh) of at least 60"
- 2) a growth rate that indicates a probable age of 200 years or greater
- 3) a dominant or co-dominant role in the forest structure
- 4) thick pleated bark
- 5) a flat top
- 6) ecological function of late seral stages
- 7) little or no anthropogenic disturbance

Perched fill: Dirt and spoils from road construction that are left on the outside edge of the road.

Productive Potential: The maximum a forest system can sustainably produce when functioning at its peak.

Pruning: Cutting of the lower branches of a tree at an early age to produce knot-free wood or to reduce fuel ladders.

Regeneration: The new growth of redwood and Douglas fir trees. Trees less than 12” in diameter.

Residual tree: A tree, which was alive during the initial harvesting of the old growth forest, but either was too young (small) to be harvested or was a suppressed tree in the initial forest.

RPF: Registered Professional Forester.

Selection Method: Harvesting or regeneration method where individual or small groups of trees are removed and regeneration occurs in their place.

Shaded Fuel Break: Strip of vegetation managed to reduce fuel load and continuity usually adjacent to a road. It is made by removing ladder fuels and fuel concentrations.

Site Index: Productive capacity of an area to produce forest crops related to climate and soil factors; expressed by a site index based in height of trees at a certain age.

Site Class: A grouping of site indexes. There are five groups ranging from I to V, with I being the best site group and V being the poorest.

Snag: A dead tree that is still standing.

Stand: Community of trees possessing sufficient uniformity in composition or structure to be distinguished from adjacent forest communities.

Stocking: The number or density of trees in a given area.

Sub-merchantable: A sound conifer tree 12-16” diameter at 4.5 ft. height (DBH).

Sustainable Yield: A yield of timber that a forest can continually produce at a given length of time at a given intensity.

Thinning: Harvesting trees with the goal of redistributing growth potential or improving the quality of the remaining trees.

Understory: The area near the forest floor under the forest canopy.

WLPZ: Watercourse & Lake Protection Zone

General Property Description

The Sea Ranch is located in the German Rancho, which is part of an old Spanish Land Grant. The entire Sea Ranch property is 3,900 acres and comprises both residential lots and open space common areas. The Commons encompass 2,245 acres including 285 acres of the Central Timber Production Zone.

The Central TPZ is located in what would be Sections 7, 8, and 17 Range 14 West, and Township 10 North MDB&M if the property were not in a Rancho. The Central TPZ is located just west of the Gualala River on the first ridge above the Pacific Ocean.

The vegetation is typical of forest areas along the north coast; a healthy stand of redwood, with a component of Douglas-fir, white fir, and hemlock. Bishop pine are present in areas of extreme coastal influence and on poorer sites within the forest. There are some hardwoods in the forest especially on the north end of the property; mainly madrone, tan oak, chinquapin, wax myrtle, and bay. The understory includes juveniles of the above species in addition to huckleberry, manzanita, rhododendron, various forbs, grasses, and ferns. The non-forested areas within the Central TPZ are mix of grass and chaparral. Slopes within the areas are predominantly gentle 0 to 35 percent with steeper slopes in the northern portion of the forest.

There are many water resources associated with the Central TPZ. They consist of springs, minor coastal streams, and sag ponds associated with the San Andreas Fault. The watercourses all have low gradients and stable banks with the exception of the main draw in the middle of the property. This large draw in the middle of the property is a deep incised inner gorge that is actively downcutting and scouring its banks. The resources associated with productive stream habitat all appear present (woody debris, pools, gravel, under-cut banks).

The timber stand conditions on the property are good. There is some heart rot on the Douglas-fir and Grand fir, but it is not a significant forest health problem at this time. The stand was selectively harvested in 1991-92. A large amount of the Grand fir blew down following the 1991-92 timber harvest on the property. Most of the remaining Grand fir trees are in decline. Sudden oak death has begun to kill trees on the property.

Landowner Goals and Objectives

The following are the current Permitted uses for the Central TPZ under Section 7.3.03 of The Sea Ranch Association CC&R:

1. Hiking and horseback riding on designated trails.
2. Bicycling on fire access trails that are designated for bicycling.
3. Picnicking.

Under Section 7.3.02 of The Sea Ranch Association CC&R, the following uses are not allowed on the Central TPZ:

1. Camping.
2. Cutting or gathering of wood.
3. Cutting trees except that TSRA may remove or prune trees in connection with an approved view maintenance or restoration program or approved fire management program.

4. Smoking.
5. Building fires, except that TSRA may build fires in connection with an approved fire management program.
6. Bicycling, skateboarding, and roller-skating (except as provided for in section 7.3.03 hereof).

The main goals for the Central TPZ are listed below.

1. Provide access and recreation for the benefit of the members of TSRA.
2. Provide good stewardship for the land.
3. Grow and maintain a healthy forest.
4. Create and maintain a forest that is more fire resistant.
5. Maintain the watershed to provide water for municipality purposes.
6. Maintain and upgrade the existing infrastructure to reduce erosion problems.
7. Enhance wildlife habitat and opportunities for viewing on the property.
8. Provide educational opportunities on and about the property to members of TSRA and the general public.
9. Be recognized as a Model Forest, which is an Example of Sustainable Forestry.

Land and Timber Resource History

This part of northwestern Sonoma County was originally inhabited by the Pomo Indians, beginning perhaps as early as 13,000 years ago. The Pomo were very active land managers. Fire was used to shape and manipulate the landscapes where they lived. The Pomo were nomadic. During the spring and summer when weather conditions were nice, they moved to seasonal villages near the ocean. During the fall and winter, they would move to much more protected sites to get out of the weather that can be rough on the coast. Native American issues will be discussed in more detail further on in the Management Plan.

By the 1850's cattle grazing had begun on and around The Sea Ranch. Cattle ranchers wanted as much land open for grazing as possible. Land was cleared and/or burned to remove competing vegetation and trees to make way for more grassland. Sheep were later introduced to the area.

It is believed that a fire may have burned part or all of the Central TPZ in the 1920's. Studies in the area indicate a fire return interval of approximately 29 years. Fire has been a major factor in shaping the current landscape and will be in the future as well.

Logging appears to have begun between 1897 and 1898 on the northern part of The Sea Ranch. Logging began on the rest of the property as early as 1903. Logging during this time period was very labor intensive. Trees were felled by hand and logs were skidded by oxen. Later on steam power gave rise to more mechanized logging methods. Skid trails were created in the path of least resistance, which was usually in the creek bottoms and logs were skidded downhill to the flats where steam powered trains waited to take the logs to the sawmill.

During the early part of the 20th century, redwood was turned into split products (shingles, fence posts, railroad ties) and tanoak bark was harvested and used for tanning leather. The redwood that was logged during the original logging was of the highest and best quality. The straightest

grained lumber was preferred to make split products. Later on the remaining old growth that was left was logged for lumber. A lumber mill existed near the Del Mar Center as early as 1903. This mill burned down in 1910 according to records. Several other sawmills were located nearby at different times in history.

Between 1910 and the 1970's not much harvesting happened on the property and the forest developed into an even aged forest. There are a few remaining residual trees within the Central TPZ that may have been alive when the original redwoods were harvested. It appears that some parts of the Central TPZ were logged in the 1970's.

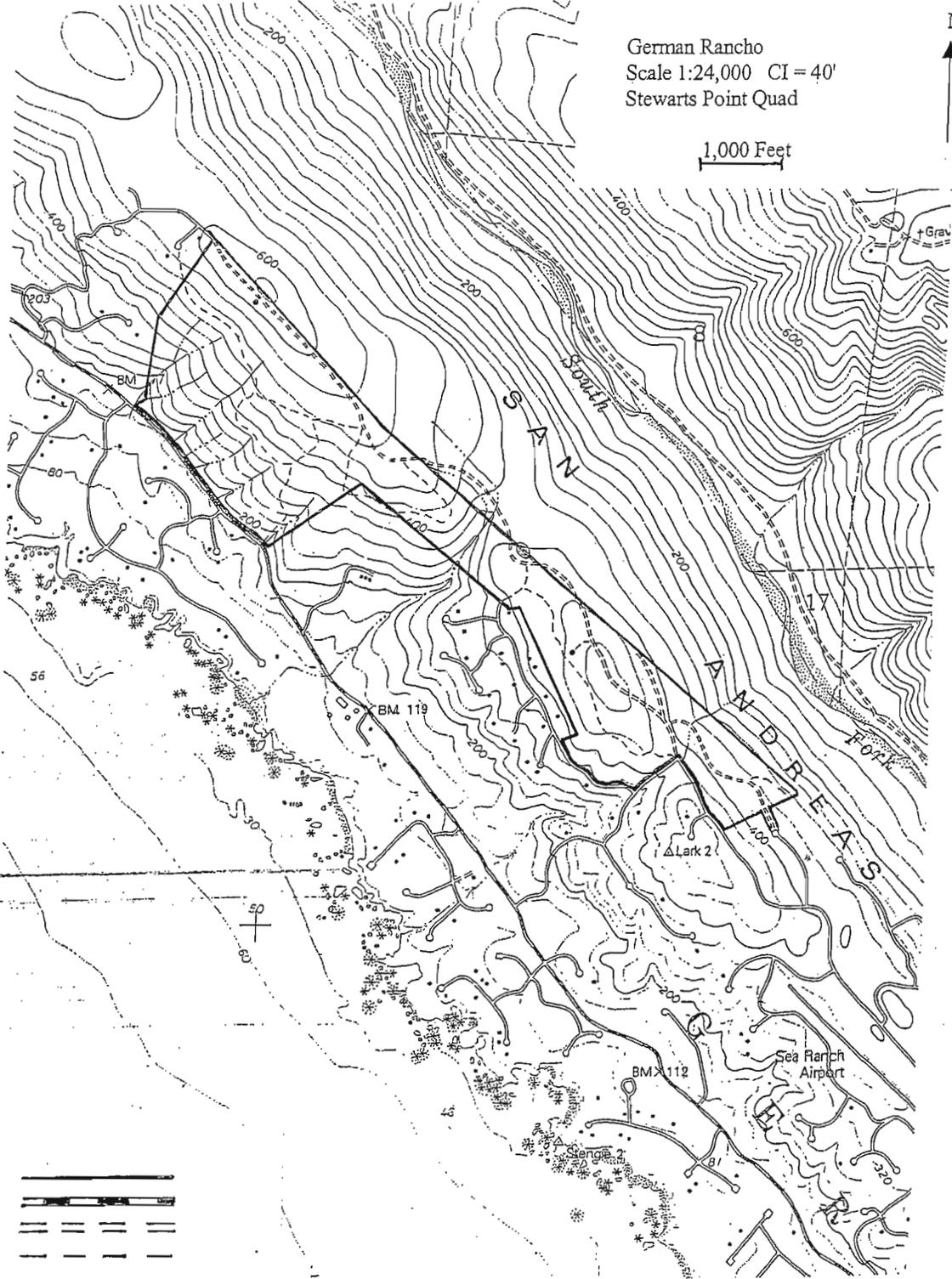
In 1990 & 91 the Central TPZ, under the ownership of Travelers Insurance was logged selectively. The northern 154 acres were logged under THP 1-90-383 SON and the southern 80 acres were logged under THP 1-91-225 SON. Approximately 40% of the trees over 18 inches dbh and 50% of the trees between 12" – 18" were harvested during this operation.

The Sea Ranch
 Central TPZ
 Sonoma County, California

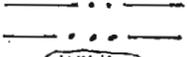
Location Map

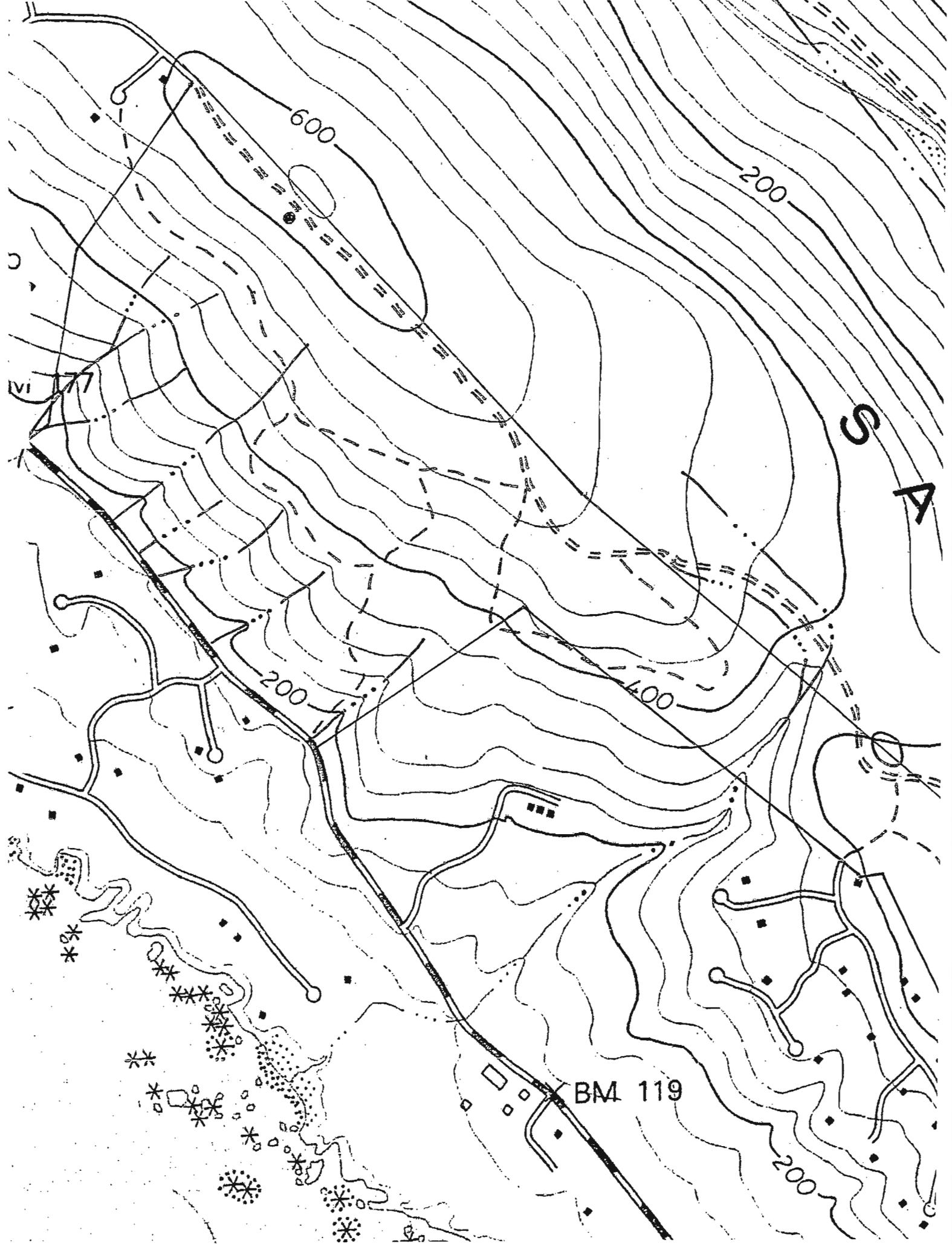
German Rancho
 Scale 1:24,000 CI = 40'
 Stewarts Point Quad

1,000 Feet



Legend

- Property Boundary 
- Highway 1 
- Seasonal Roads 
- Hiking Trails 
- Class II Watercourse 
- Class III watercourse 
- Sag Pond 
- Water Tank 



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The Sea Ranch
Central TPZ
Sonoma County, California

Property Map

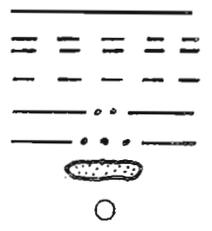
German Rancho
Scale 1" = 660' CI = 40'
Stewarts Point Quad

660 Feet

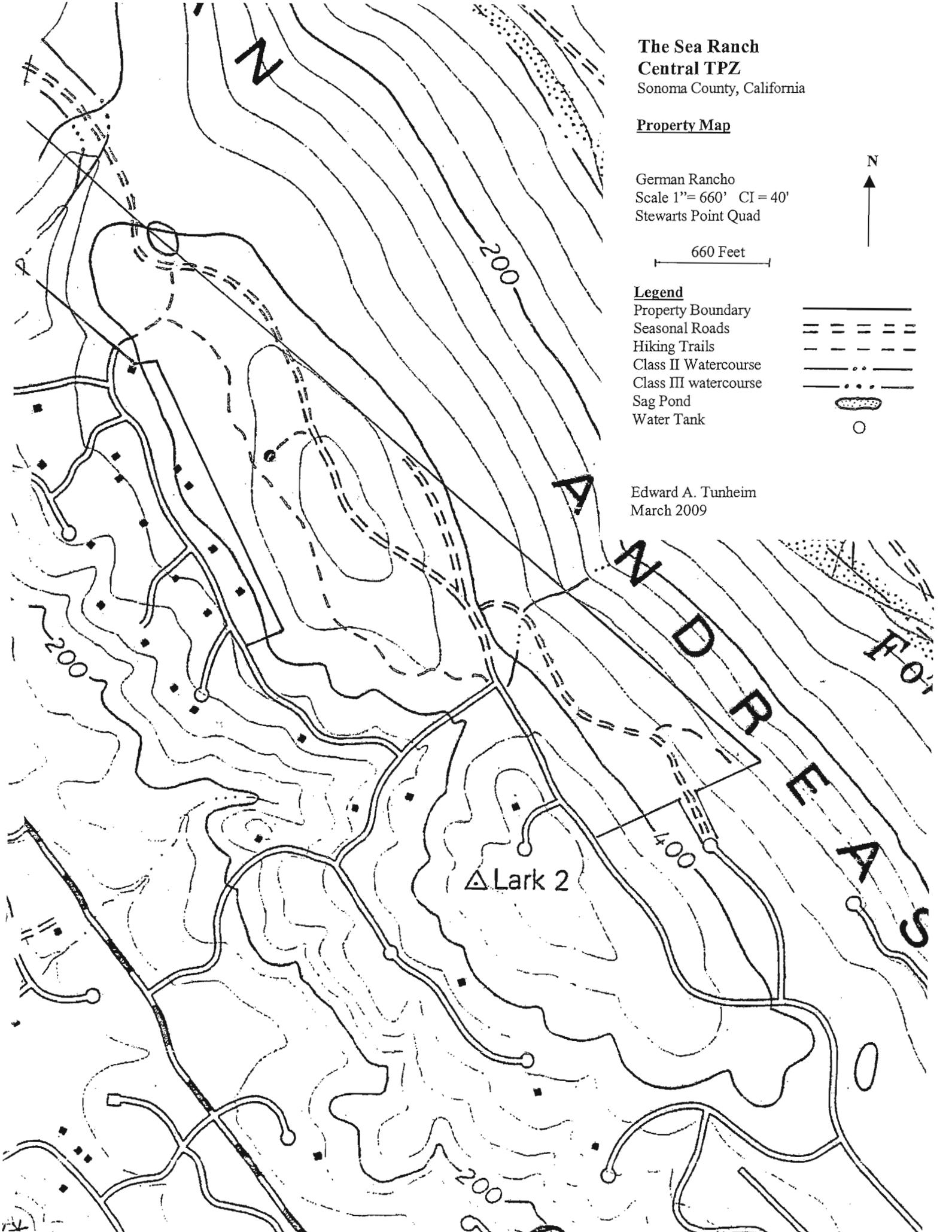


Legend

- Property Boundary
- Seasonal Roads
- Hiking Trails
- Class II Watercourse
- Class III watercourse
- Sag Pond
- Water Tank



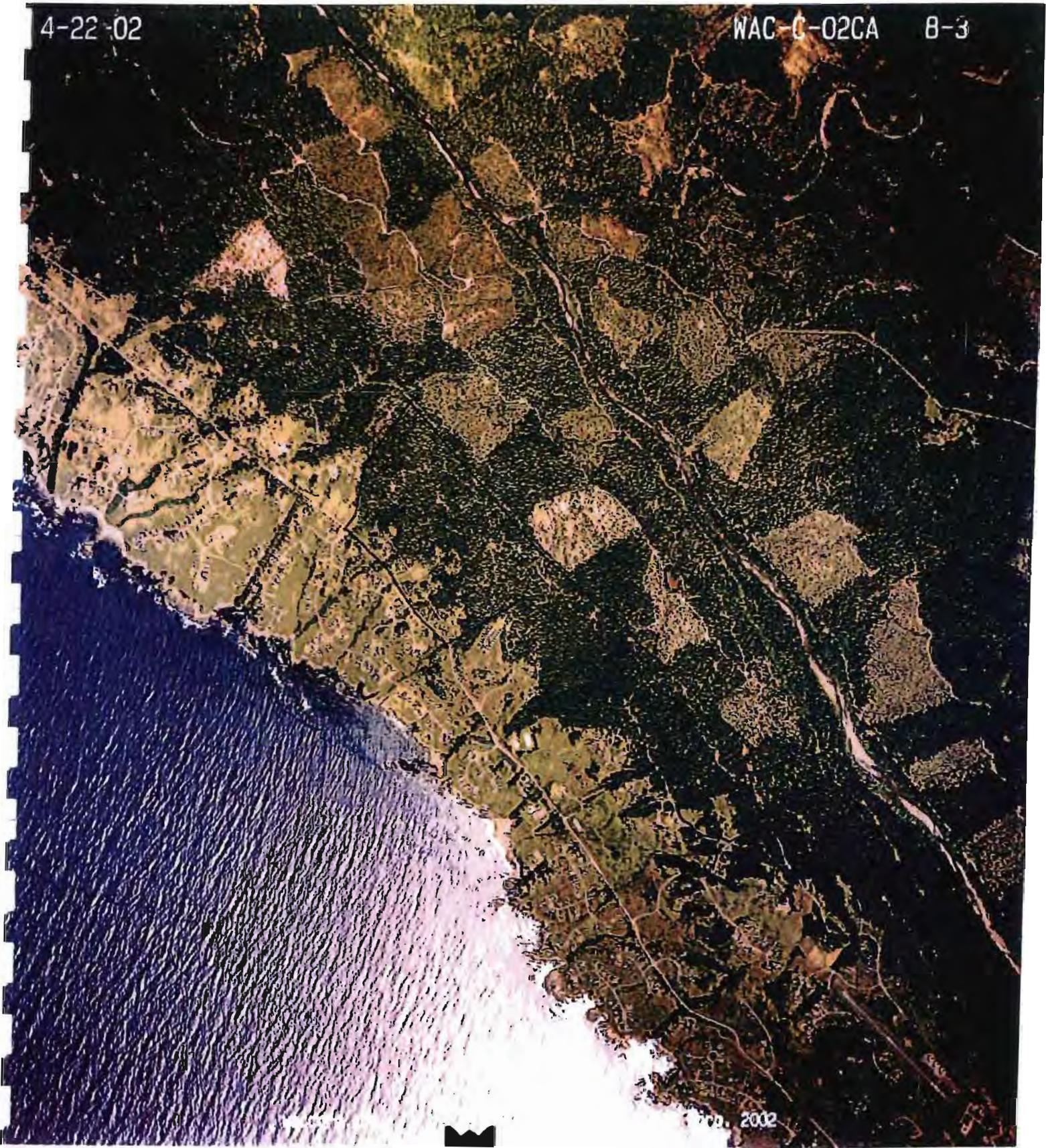
Edward A. Tunheim
March 2009



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Apr. 2002

Soils and Geology

There are six soil types within the Central TPZ. All six soils are loamy soil types.

Caspar sandy loam 15% to 30% (CaE)

This soil type consists of well-drained sandy loams. The soil is derived from sedimentary marine terraces. This soil type is 45 to 60 inches deep. The permeability is moderate and the runoff rate is medium to rapid. The erosion hazard is medium to high depending on the slopes. The primary vegetation growing in the soil is Douglas-fir, but redwood, tanoak, bay, and madrone are all capable of growing as well.

Caspar sandy loam 30% to 50% (CaF)

This soil type consists of well-drained sandy loams. The soil is derived from sedimentary marine terraces. This soil type is 45 to 60 inches deep. The permeability is moderate and the runoff rate is medium to rapid. The erosion hazard is medium to high depending on the slopes. The primary vegetation growing in the soil is Douglas-fir, but redwood, tanoak, bay, and madrone are all capable of growing as well.

Empire loam 30% to 50% (EmF)

This soil type consists of well-drained loams. The soil is derived from soft sedimentary rocks and sedimentary marine terraces. This soil type is 45 to 60 inches deep. The permeability is moderate and the runoff rate is medium to rapid. The erosion hazard is high. The primary vegetation growing in the soil is Douglas-fir, but redwood, tanoak, bay, and madrone are all capable of growing as well.

Josephine loam 30% to 50% (JoF)

This soil type consists of well-drained loams. The soil is derived from weathered fine-grained sandstone and shale. This soil type is 40 to 50 inches deep. The permeability is moderate and the runoff rate is moderate. The erosion hazard is high. The primary vegetation growing in the soil are redwood and Douglas-fir. Tanoak, bay, and madrone are all capable of growing as well.

Mendocino sandy clay loam 30% to 50% (MmF)

This soil type consists of moderately well drained loams. The soil is derived from weathered coarse-grained sandstone and shale. This soil type is 40 to 60 inches deep. The permeability is moderately slow and the runoff rate is rapid. The erosion hazard is high. The primary vegetation growing in on this soil are redwood and Douglas-fir. Tanoak, bay, and madrone are all capable of growing as well.

Rohnerville loam 0% to 9% (RrC)

This soil type consists of moderately well drained loams. The soil is derived from weathered soft sandstone. This soil type is 35 to 60 inches deep. The permeability is moderately slow and the runoff rate is medium. The erosion hazard is slight to moderate. The primary vegetation growing associated with this soil type is annual and perennial grasslands. There are currently some scattered bishop pine and redwoods growing in this soil type.

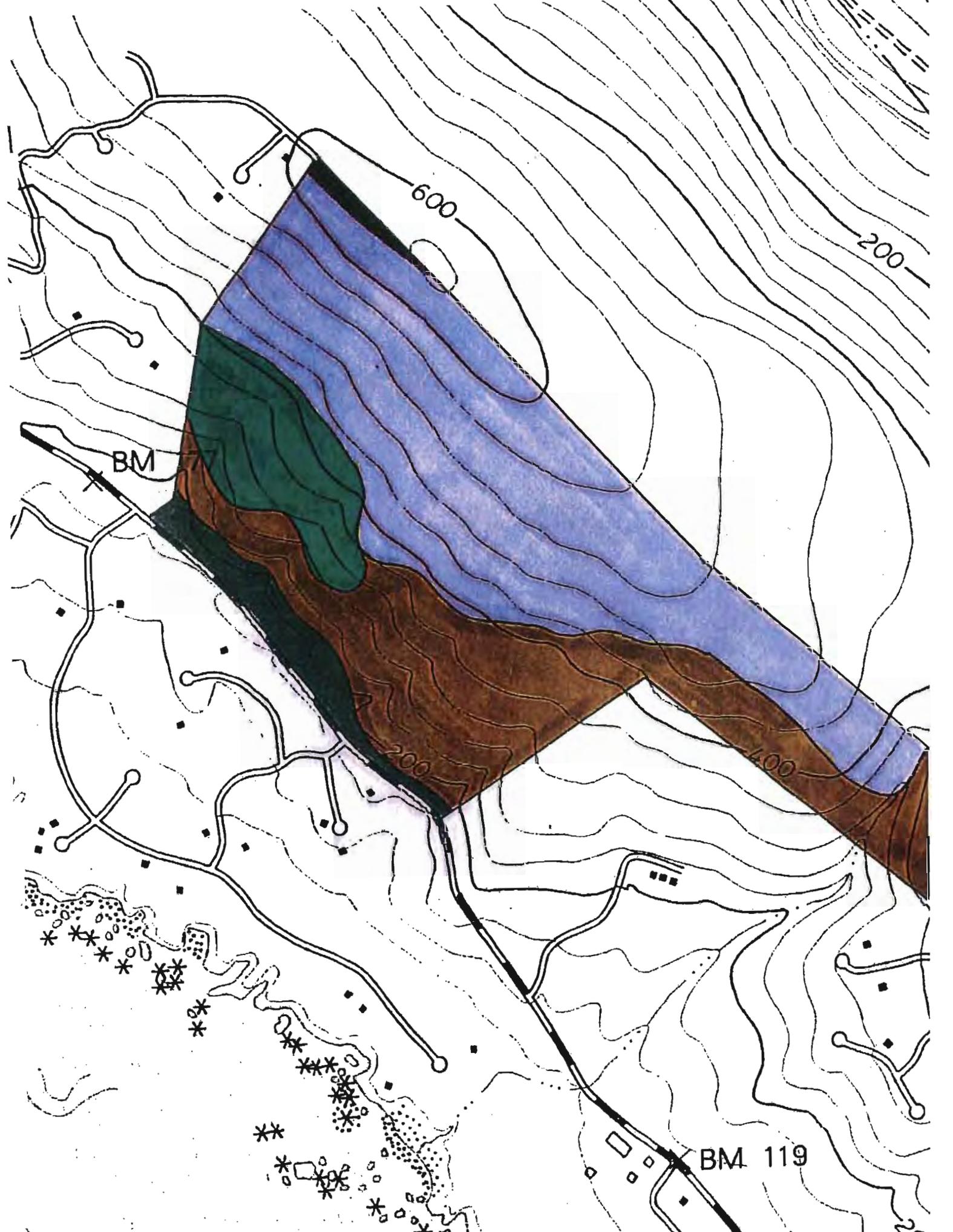
With the exception of the Rohnerville loam, all of these soils are good conifer growing soil types. These soils can support planting of additional conifers. Care must be taken on the

Mendocino and Josephine soil types not to cause erosion problems with roads, trails and other operations on the property. These two soil types have a high erosion hazard and need to have erosion control structures spaced at closer intervals than the other soil types.

There is a small meadow along Longmeadow and Schooner Drives. This meadow is the result of a soil type (probably of the Kneeland soil series) that is not mapped on the current soil survey maps. The meadow is slowly being taken over by Douglas-fir and grand fir. This is a sensitive area and should not be planted. See discussion of sensitive species below.

Geology

The San Andreas Fault zone runs through the Central TPZ. There are several sag ponds that have been caused by the fault over time located on the Central TPZ and the entire Sea Ranch. According to the California Geological Survey's Special Report 120 there are no major landslides within the Central TPZ. Along the main draw that separates the north end of the property from the south end, there is some heavy streambed downcutting that is currently occurring. Please see the geological map in the appendix.



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The Sea Ranch
Central TPZ
Sonoma County, California

Soils Map

German Rancho
Scale 1" = 660' CI = 40'
Stewarts Point Quad

660 Feet



Legend

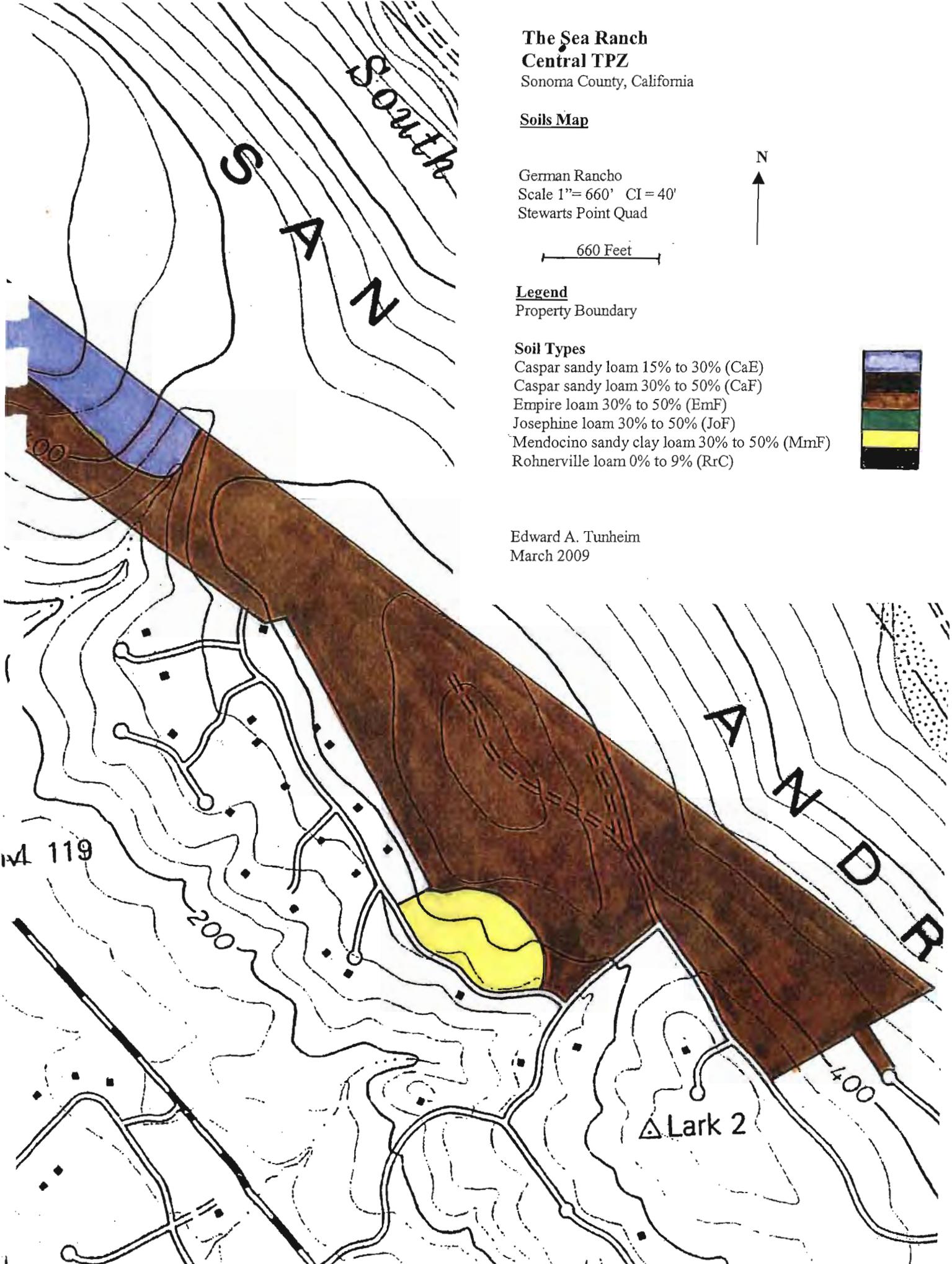
Property Boundary

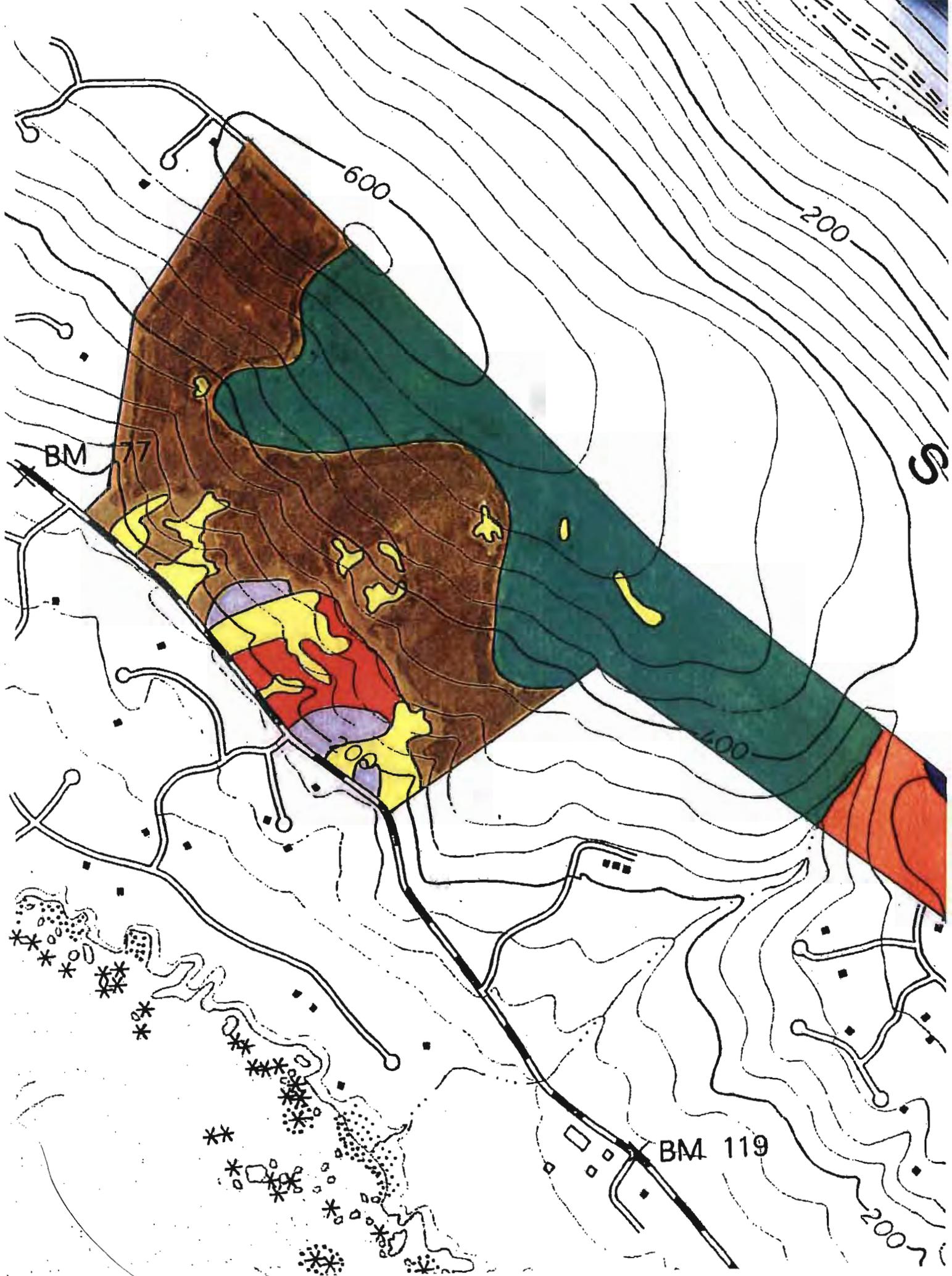
Soil Types

- Caspar sandy loam 15% to 30% (CaE)
- Caspar sandy loam 30% to 50% (CaF)
- Empire loam 30% to 50% (EmF)
- Josephine loam 30% to 50% (JoF)
- Mendocino sandy clay loam 30% to 50% (MmF)
- Rohnerville loam 0% to 9% (RrC)



Edward A. Tunheim
March 2009





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The Sea Ranch
Central TPZ
Sonoma County, California

Vegetation Type Map

German Rancho
Scale 1" = 660' CI = 40'
Stewarts Point Quad

660 Feet



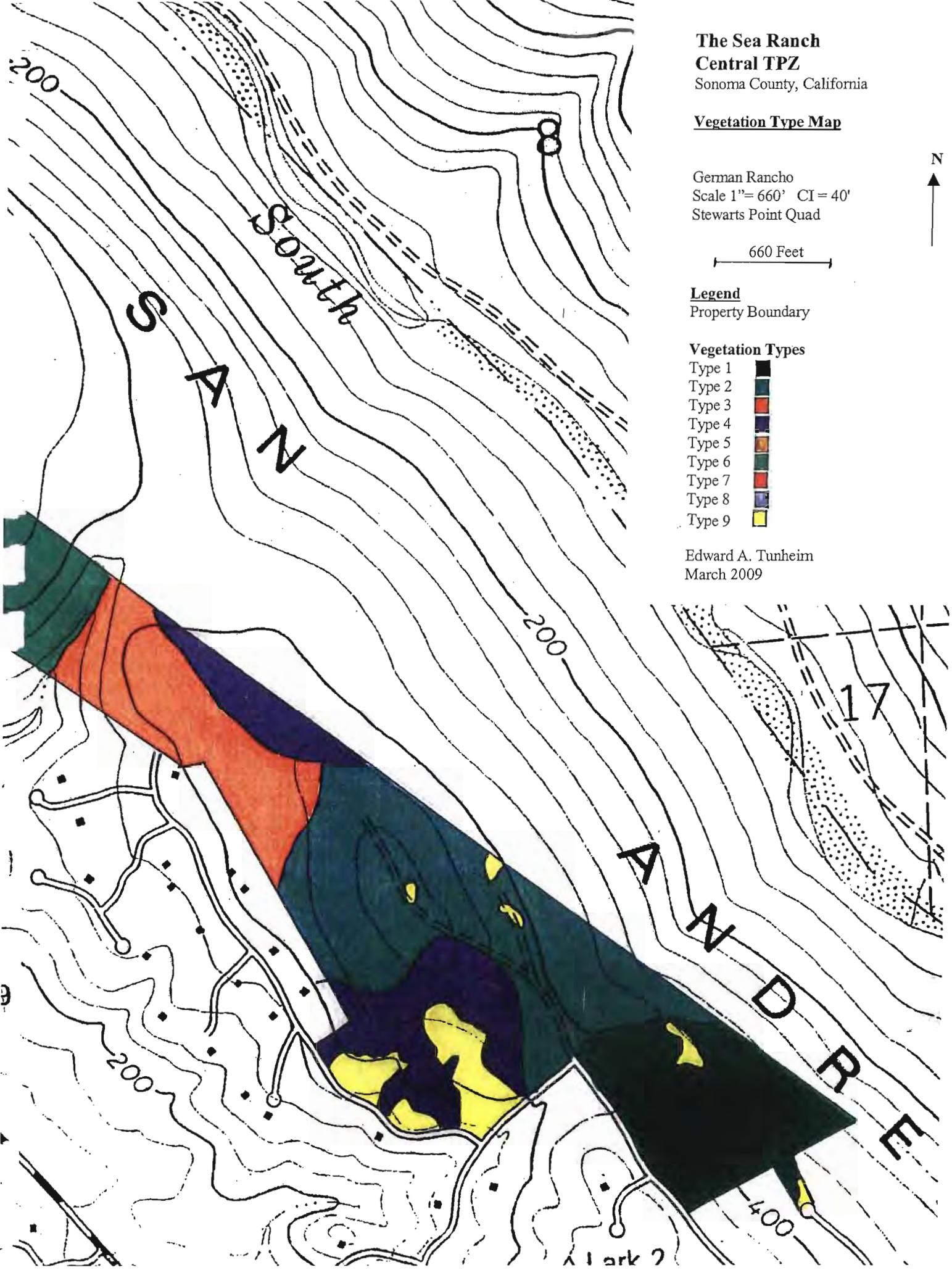
Legend

Property Boundary

Vegetation Types

- Type 1 
- Type 2 
- Type 3 
- Type 4 
- Type 5 
- Type 6 
- Type 7 
- Type 8 
- Type 9 

Edward A. Tunheim
March 2009



Vegetation Type Discussion

For the purposes of this discussion the Central TPZ has been broken up into two parts, one part north of the large draw in the middle of the property and the other part south of the large draw. This is partly due to the management history of the two pieces. They were harvested under two different logging plans with two different treatments that resulted in different conditions. For the most part the forest on the south side of the draw is void of hardwoods in the overstory. There are some small hardwoods that sprouted or seeded in following the 1992 harvest. It appears that hardwoods were harvested south of the draw, but not on the north side where there are several mature hardwoods per acres.

The forest has been broken up into 9 vegetation types. These 9 vegetation types are based on species composition, the size distribution of the trees, volume per acre, the site index, and management history.

2009 Vegetation Types	
Vegetation Type	Acres
Type 1	20
Type 2	37
Type 3	19
Type 4	22
Type 5	75
Type 6	70
Type 7	5
Type 8	10
Type 9	27
Total	285

Vegetation Description

Definitions:

Tree Class	Tree Diameter (at DBH)
Regeneration (Regen)	< 2"
Seedling	2" – 10"
Sub-Merchantable	12" – 16"
Merchantable	18" – 50"+
Old Growth	No DBH limit, but older than 200 years

Forest Type 1

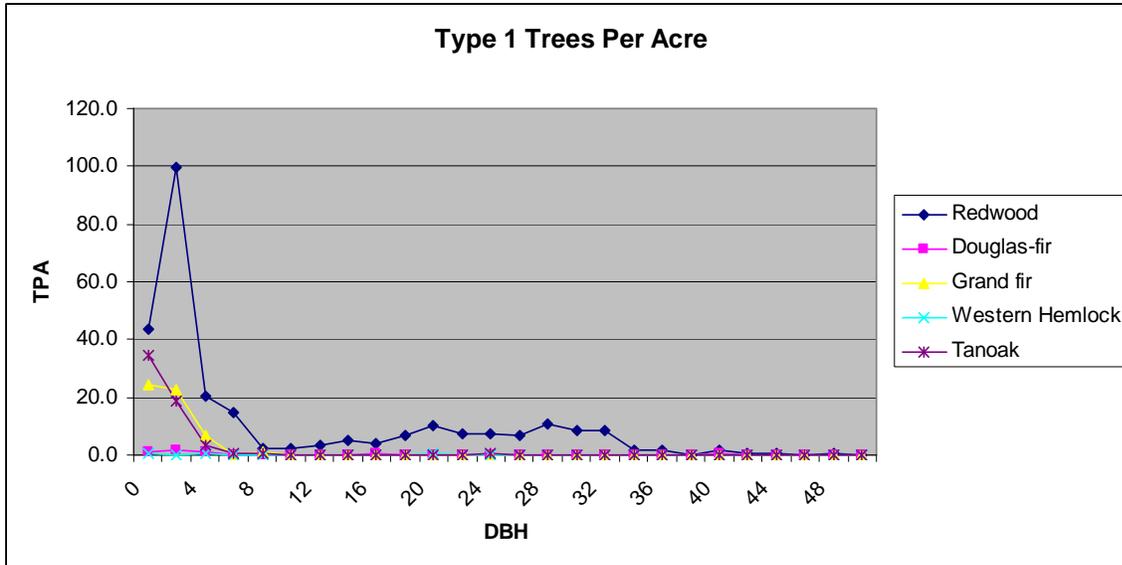
This forest type is located on the far southern end of the Central TPZ and occupies 20 acres. This forest type is located on site II ground. There are three age classes within this forest type. The dominant trees are between 70 and 90 years old. A second age class is approximately 30 to 40 years old and the result of a harvest in the 1970’s, and the final age class is approximately 17 years old and is the result of the thinning in 1992. This forest type is mainly comprised of redwoods with a few scattered Douglas-fir, grand fir, and western hemlock. There are almost no hardwoods found in this type. Some of the older trees in this type show signs damage from a fire, which probably occurred within the last 40 to 50 years.

2009 FOREST TYPE 1 BOARD FEET PER ACRE BY DIAMETER CLASS, TIMBER TYPE, AND SPECIES (NET VOLUMES)						
Type	12-16"	18-24"	26-34"	36-50"	Stranding	Merch
Redwood	900	9,300	30,600	9,900	50,700	49,800
Douglas-fir	100	-	-	1,200	1,300	1,200
Grand fir	-	400	-	-	400	400
					52,400	51,400

2009 FOREST TYPE 1 TOTAL BOARD FOOT VOLUME BY DIAMETER CLASS, AND SPECIES (NET VOLUMES)							
Type	Acres	12-16"	18-24"	26-34"	36-50"	Stranding	Merch
Redwood	20	18,000	186,000	612,000	198,000	1,014,000	996,000
Douglas-fir	20	2,000	-	-	24,000	26,000	24,000
Grand fir	20	-	8,000	-	-	8,000	8,000
						1,048,000	1,028,000

There is approximately 51,000 board feet of merchantable timber per acre within this type. Merchantable trees are those trees 18 inches in diameter and greater. There is approximately 1,028,000 board feet of merchantable timber across the 20 acres of this type. There is 338 square feet of conifer basal area per acre and a total of 344 square feet (including bishop pine and hardwoods). There are a total of 3.1 snags per acre, which is normal for this part of the county and the target goal of the Department of Fish & Game.

Redwood is the dominant species in this type. Redwood and Douglas-fir are the only merchantable conifers found in this type, and hardwoods are almost absent. Submerchantable trees (trees between 12 – 16 inches DBH) are growing at a rate of 24% while merchantable trees are growing at 3.2%, a very good growth rate. Over a 10-year period this type is growing approximately 16,000 board feet per acre or 320,000 board feet on the 20 acres.



Forest Type 2

This type is located on the southeast side of the Central TPZ. The type is very similar to Type 1, but has shorter trees due to being on high site III ground. There are three age classes within this forest type. The dominant trees are between 70 and 90 years old. A second age class is approximately 30 to 40 years old and the result of a harvest in the 1970's, and the final age class is approximately 17 years old and is the result of the thinning in 1992. This forest type is comprised of redwood with a few scattered Douglas-fir, young grand fir, and western hemlock, with few hardwoods found in this type.

**2009 FOREST TYPE 2
BOARD FEET PER ACRE BY DIAMETER CLASS, TIMBER TYPE,
AND SPECIES (NET VOLUMES)**

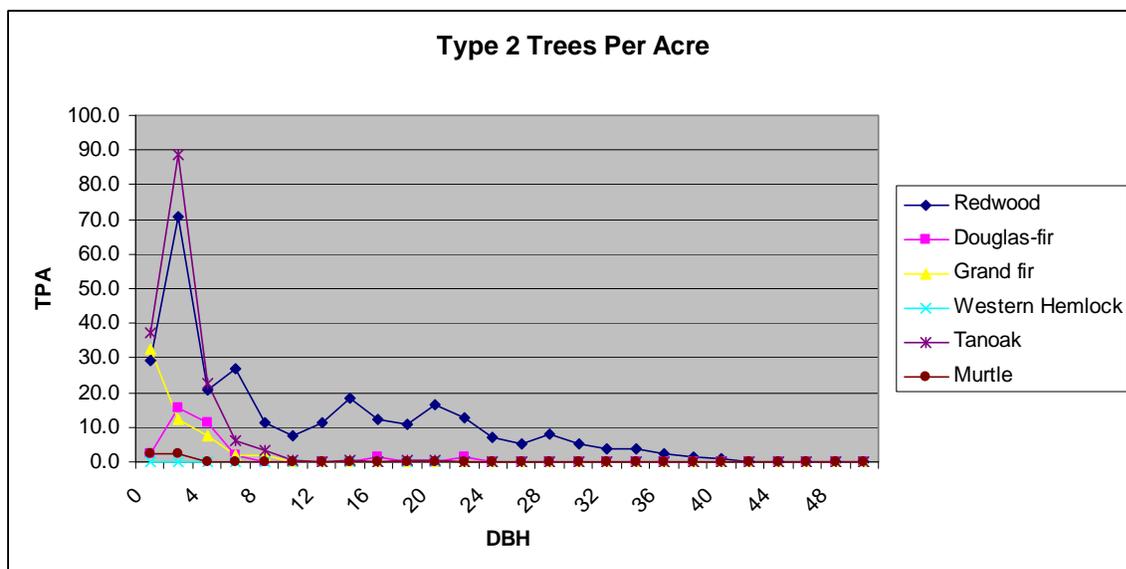
Type	12-16"	18-24"	26-34"	36-48"	Stranding	Merch
Redwood	3,000	12,000	20,900	5,900	41,800	38,800
Douglas-fir	100	400	-	-	500	400
					42,300	39,200

**2009 FOREST TYPE 2
TOTAL BOARD FOOT VOLUME BY DIAMETER CLASS,
AND SPECIES (NET VOLUMES)**

Type	Acres	12-16"	18-24"	26-34"	36-48"	Stranding	Merch
Redwood	37	111,000	444,000	773,300	218,300	1,546,600	1,435,600
Douglas-fir	37	3,700	14,800	-	-	18,500	14,800
Grand fir	37	-	-	-	-	-	-
						1,565,100	1,450,400

There is approximately 39,000 board feet of merchantable timber per acre and 1,450,000 board feet for this 37 acre type. This type has 381 square feet of conifer basal area per acre and a total of 391 square feet (including bishop pine and hardwoods). There are a total of 8.1 snags per acre which is high, the result of most of the grand fir being dead or dying.

Redwood is the dominant species in this type, along with Douglas-fir make up the merchantable trees volume. There are a few mature hardwoods and a lot of small tanoak, the result of the 1992 timber harvest. Submerchantable trees (trees between 12 – 16 inches DBH) are growing at 13% while merchantable trees are growing at 5.3%, a very good growth rate. Over a 10-year period this type is growing approximately 18,000 board feet per acre or just under 700,000 board feet on the 37 acres.



Forest Type 3

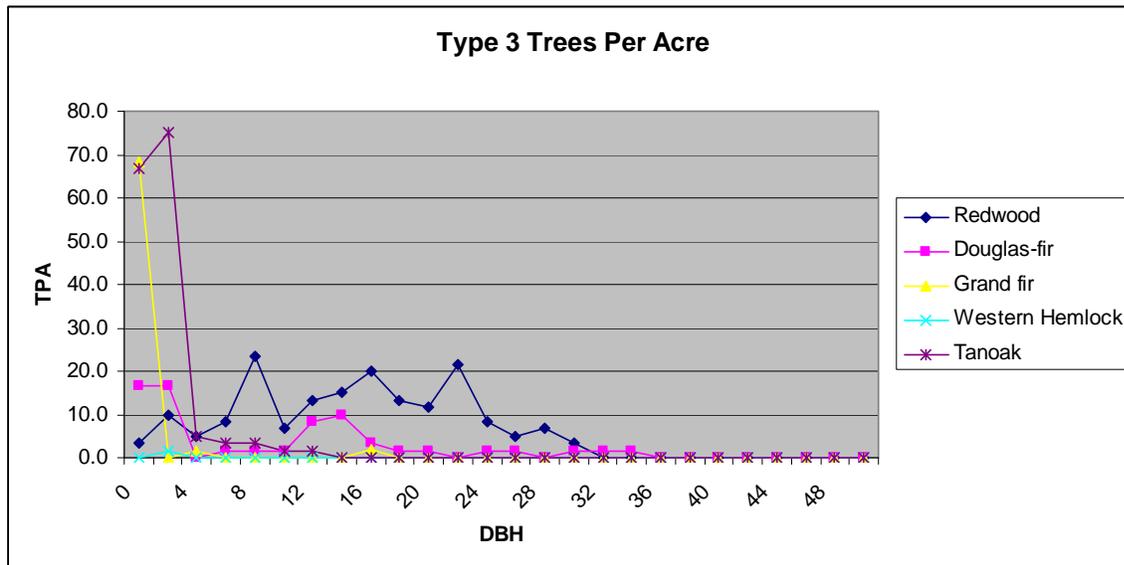
This type is located near the middle of the Central TPZ and is associated with the large draw that splits the northern side of the property from the southern side. This 19-acre forest type is located on site III ground. There are at least two age classes within this forest type. The dominant trees are between 70 and 90 years old. A second age class is approximately 17 years old and is the result of the thinning in 1992. There was no sign of this area being harvested in the 1970's. This area is steeper and may not have been ready to log in the 70's or the large amount of Douglas-fir might have been a factor. This forest type is comprised of redwood and Douglas-fir, with a few young scattered grand fir. This type appears to have had a larger percentage of grand fir as well, but most have blown down or fallen apart. There are a lot of small hardwoods found in this type that sprouted or seeded in following the 1992 harvest.

There is approximately 30,000 board feet of merchantable timber per acre and approximately 573,000 board feet for this 19 acres type. There is 408 square feet of conifer basal area per acre

and a total of 433 square feet (including bishop pine and hardwoods). There are a total of 16.7 snags per acre, which is exceptionally high, the result of most of the grand fir being dead or dying.

2009 FOREST TYPE 3 BOARD FEET PER ACRE BY DIAMETER CLASS, TIMBER TYPE, AND SPECIES (NET VOLUMES)						
Type	12-16"	18-24"	26-34"	36-48"	Stranding	Merch
Redwood	3,300	14,400	9,200	-	26,900	23,600
Douglas-fir	2,200	100	6,500	-	8,800	6,600
Grand fir	100	-	-	-	100	-
					35,800	30,200

2009 FOREST TYPE 3 TOTAL BOARD FOOT VOLUME BY DIAMETER CLASS, AND SPECIES (NET VOLUMES)							
Type	Acres	12-16"	18-24"	26-34"	36-48"	Stranding	Merch
Redwood	19	62,700	273,600	174,800	-	511,100	448,400
Douglas-fir	19	41,800	1,900	123,500	-	167,200	125,400
Grand fir	19	1,900	-	-	-	1,900	-
						680,200	573,800



Redwoods (71% by volume) and Douglas-fir (27% by volume) are the main conifer species in this type, with a few scattered grand fir. There are a few mature hardwoods and a lot of small

tanoaks the result of the 1992 timber harvest. Submerchantable trees (trees between 12 – 16 inches DBH) are growing at 2.4% and merchantable trees are growing at 2.8%, a fair growth rate. Over a 10-year period this type is growing approximately 10,000 board feet per acre, just under 191,000 board feet for the 19 acres.

Forest Type 4

This type is located uphill of the Longmeadow-Schooner Roads grassland. This type is similar to Type 5 on the north end of the property. Following the last harvest, most of the grand fir trees were blown down. This type also has a Bishop pine component that is associated with the marine influence and the soil type. There is a significant amount of downed logs (large woody debris) that is in various stages of decomposition. This forest type is located on site III ground, and has three age classes. The dominant trees are between 70 and 90 years old. A second age class is 30 to 40 years old and the final age class is approximately 17 years old. There are a lot of small hardwoods found in this type that sprouted or seeded in following the 1992 harvest.

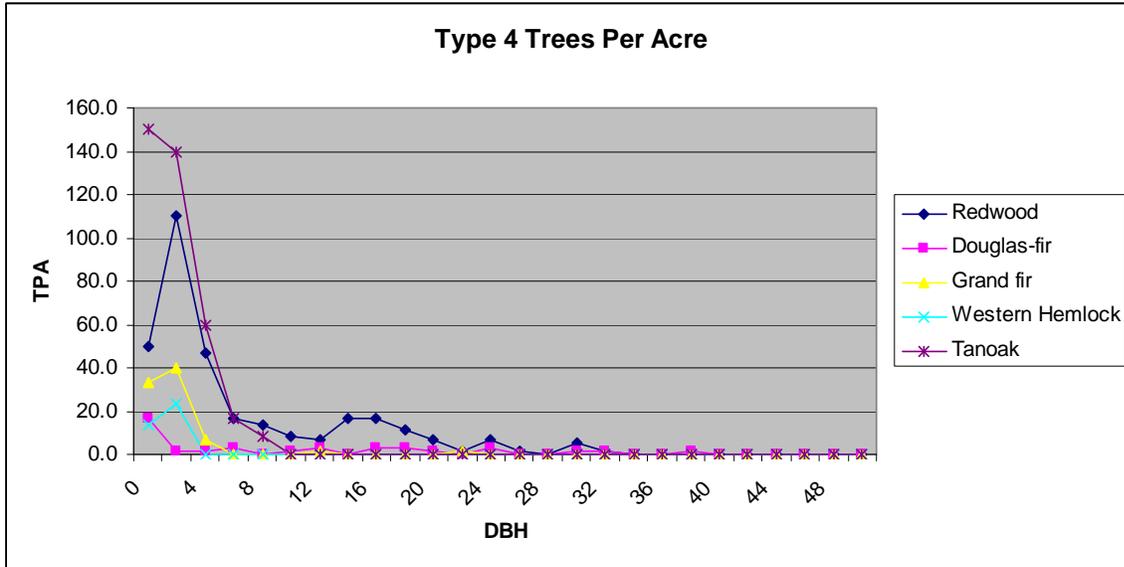
2009 FOREST TYPE 4 BOARD FEET PER ACRE BY DIAMETER CLASS, TIMBER TYPE, AND SPECIES (NET VOLUMES)						
Type	12-16"	18-24"	26-34"	36-48"	Stranding	Merch
Redwood	2,900	5,200	6,000	-	14,100	11,200
Douglas-fir	1,200	2,100	2,900	2,200	8,400	7,200
Grand fir	-	400	-	-	400	400
					22,900	18,800

2009 FOREST TYPE 4 TOTAL BOARD FOOT VOLUME BY DIAMETER CLASS, AND SPECIES (NET VOLUMES)							
Type	Acres	12-16"	18-24"	26-34"	36-48"	Stranding	Merch
Redwood	22	63,800	114,400	132,000	-	310,200	246,400
Douglas-fir	22	26,400	46,200	63,800	48,400	184,800	158,400
Grand fir	22	-	8,800	-	-	8,800	8,800
						503,800	413,600

There is approximately 18,000 board feet of merchantable timber per acre and approximately 413,000 board feet for the 22 acre type. The trees in this type are much shorter in height due to ocean winds and salt spray. There is 208 square feet of conifer basal area per acre and a total of 217 square feet (including bishop pine and hardwoods). There are a total of 6.7 snags per acre, which is high, the result dead and dying grand fir damaged by the windfall following the 1992 timber harvest.

Redwoods and Douglas-fir are the main conifer species with a few scattered grand fir. There are a few mature hardwoods and a lot of small tanoak, the result of the 1992 timber harvest. Submerchantable trees (trees between 12 – 16 inches DBH) are growing at 2.4% while

merchantable trees are growing at 2.8%, a fair growth rate. Over a 10-year period this type is growing approximately 5,000 board feet per acre, just under 110,000 board feet for the 22 acres.



Forest Type 5

This type is located on the northwest end of the property and is similar to Type 4 but has more Bishop pine and mature hardwoods trees. There are a significant amount of downed logs in various stages of decomposition. This forest type is located on low site III ground and at least three age classes. The dominant trees are between 70 and 90 years old. A second age class is 30 to 40 years old and the result of a harvest in the 1970's, and the final age class is 17 years old and is the result of the thinning in 1992. This conifer stand is less dense than the stands to the south, with a large component of tanoak and madrone.

2009 FOREST TYPE 5 BOARD FEET PER ACRE BY DIAMETER CLASS, TIMBER TYPE, AND SPECIES (NET VOLUMES)						
Type	12-16"	18-24"	26-34"	36-48"	Stranding	Merch
Redwood	700	3,200	900	1,100	5,900	5,200
Douglas-fir	500	1,400	800	-	2,700	2,200
					8,600	7,400
Bishop pine	700	1,400	1,200	-	3,300	2,600
Total					11,900	10,000

**2009 FOREST TYPE 5
TOTAL BOARD FOOT VOLUME BY DIAMETER CLASS,
AND SPECIES (NET VOLUMES)**

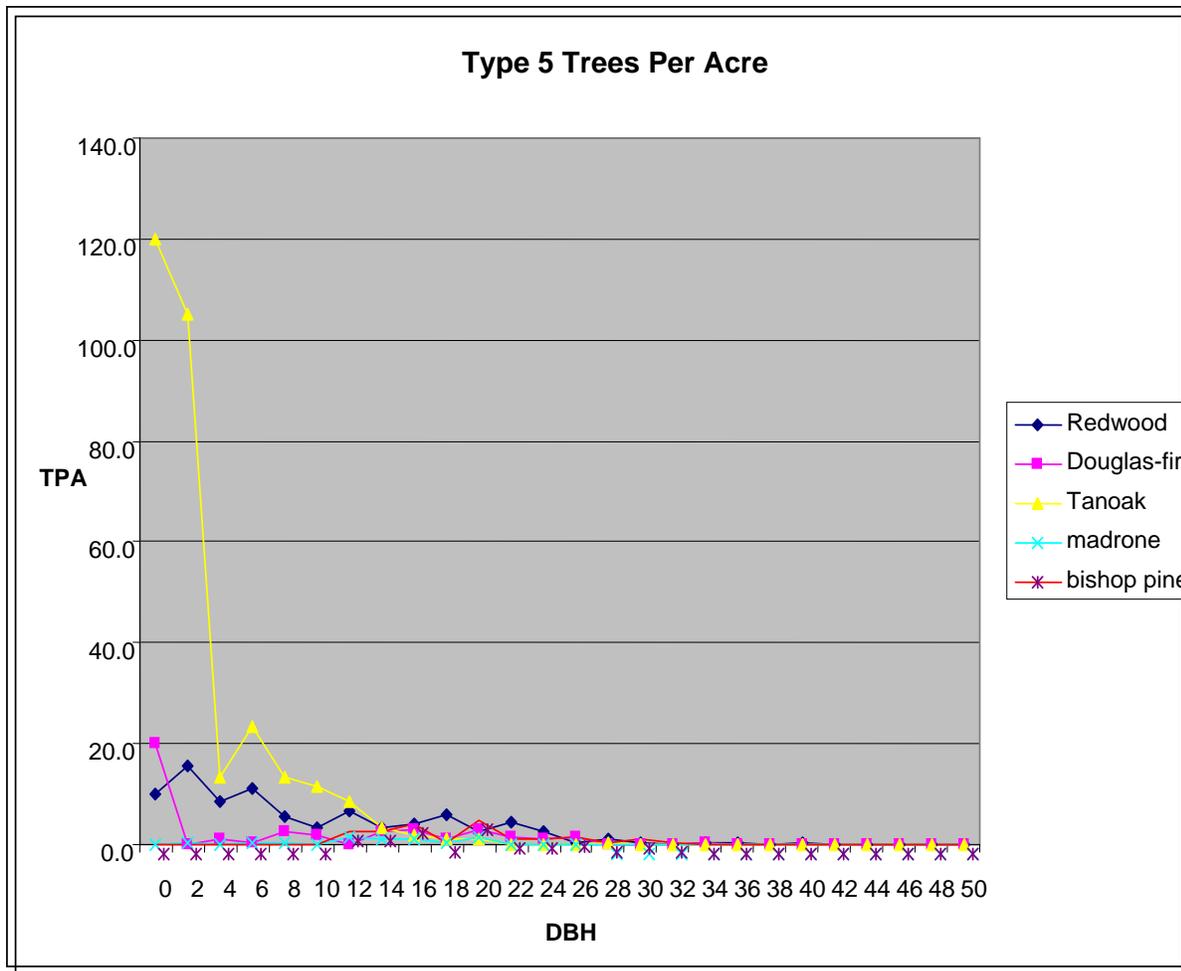
Type	Acres	12-16"	18-24"	26-34"	36-48"	Stranding	Merch
Redwood	75	52,500	240,000	67,500	82,500	442,500	390,000
Douglas-fir	75	37,500	105,000	60,000	-	202,500	165,000
						645,000	555,000

Bishop pine	75	52,500	105,000	90,000	-	247,500	195,000
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Total	75					892,500	750,000
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There is approximately 10,000 board feet of merchantable timber per acre and approximately 750,000 board feet for the 75 acre type. The trees are much shorter in height than Type 6 due to ocean winds and salt spray. There is 120 square feet of conifer basal area per acre and a total of 265 square feet (including bishop pine and hardwoods). There are a total of 9 grand fir and Bishop pine snags per acre, which is high.

Redwoods and Douglas-fir are the main conifer species. Submerchantable trees (trees between 12 – 16 inches DBH) are growing at 10% while merchantable trees are growing at 4.8%, a good growth rate. Over a 10 year period this type is growing approximately 3,000 board feet per acre or under 239,000 board feet for the 75 acres.



Forest Type 6

This type is located on the north end of the Central TPZ, on site III ground. It is 70 acres in size and very similar to Type 3, having 77% redwood and 16% Douglas-fir, mature tanoak and a lot of young trees from the 1992 harvest. There are three age classes; the dominant trees are between 70 and 90 years old with a few over mature grand fir. A second age class is 30 to 40 years old and the result of a harvest in the 1970's, and the final age class is 17 years old and is the result of the thinning in 1992.

There is approximately 33,000 board feet of merchantable timber per acre and approximately 2,352,000 board feet for the 70 acre type. There is 325 square feet of conifer basal per acre and a total of 441 square feet (including bishop pine and hardwoods). There are a total of 1.3 snags per acre, which is low. Most of the mature grand fir was blown down following the last harvest entry.

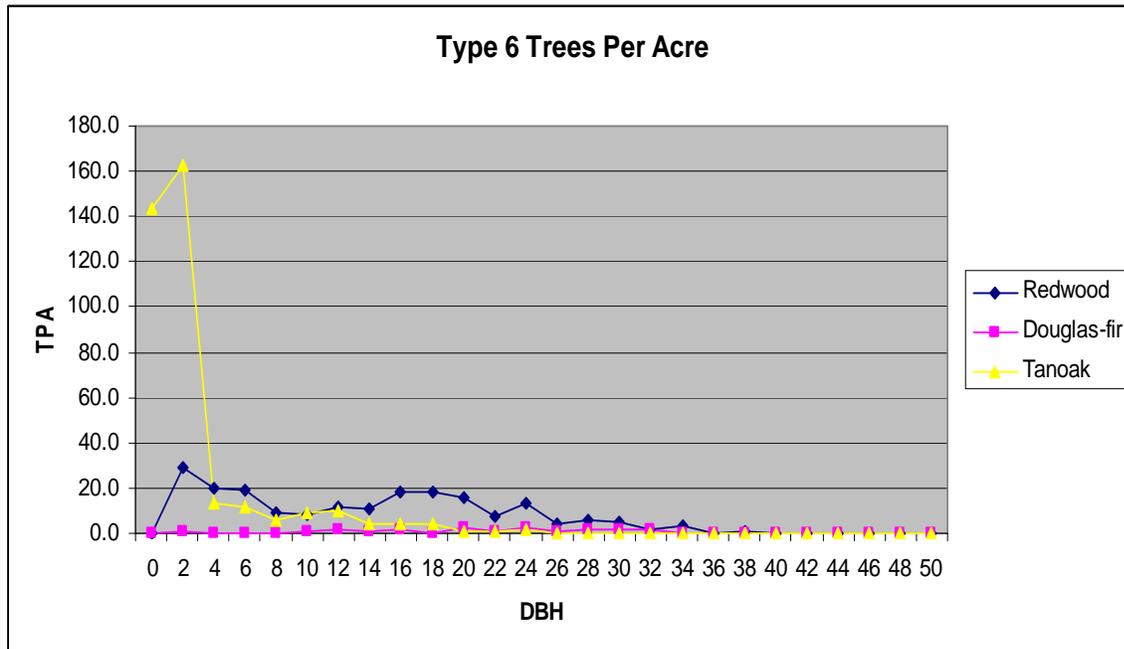
**2009 FOREST TYPE 6
BOARD FEET PER ACRE BY DIAMETER CLASS, TIMBER TYPE,
AND SPECIES (NET VOLUMES)**

Type	12-16"	18-24"	26-34"	36-48"	Stranding	Merch
Redwood	2,400	11,900	13,000	600	27,900	25,500
Douglas-fir	200	1,400	4,100	-	5,700	5,500
Grand fir	-	-	1,700	900	2,600	2,600
					36,200	33,600

**2009 FOREST TYPE 6
TOTAL BOARD FOOT VOLUME BY DIAMETER CLASS,
AND SPECIES (NET VOLUMES)**

Type	Acres	12-16"	18-24"	26-34"	36-48"	Stranding	Merch
Redwood	70	168,000	833,000	910,000	42,000	1,953,000	1,785,000
Douglas-fir	70	14,000	98,000	287,000	-	399,000	385,000
Grand fir	70	-	-	119,000	63,000	182,000	182,000
						2,534,000	2,352,000

Redwoods and Douglas-fir are the main conifer species. There is an overstory composition of grand fir. Submerchantable trees (trees between 12 – 16 inches DBH) are growing at 10% while merchantable trees are growing at 4.8%, a good growth rate. Over a 10-year period this type is growing approximately 14,000 board feet per acre, just under 1,002,000 board feet for the 75 acres.



Forest Type 7

This is a 5-acre type that exists along the western edge of the northern part of the property. It is almost entirely Douglas-fir with a few redwood trees. This type is the result of the Douglas-fir encroaching on native grasslands. Part of this type has burned in the last 10 to 20 years killing several trees and creating many snags per acre.

2009 FOREST TYPE 7 BOARD FEET PER ACRE BY DIAMETER CLASS, TIMBER TYPE, AND SPECIES (NET VOLUMES)						
Type	12-16"	18-24"	26-34"	36-48"	Stranding	Merch
Redwood	-	-	700	-	700	700
Douglas-fir	800	2,300	4,900	-	8,000	7,200
					8,700	7,900

2009 FOREST TYPE 7 TOTAL BOARD FOOT VOLUME BY DIAMETER CLASS, AND SPECIES (NET VOLUMES)							
Type	Acres	12-16"	18-24"	26-34"	36-48"	Stranding	Merch
Redwood	5	-	-	3,500	-	3,500	3,500
Douglas-fir	5	4,000	11,500	24,500	-	40,000	36,000
						43,500	39,500

This 5-acre type dominated by Douglas-fir has less than 8,000 board feet per acre and a total of less than 40,000 board feet. Growth rates are similar to Type 5. Submerchantable trees (trees between 12 – 16 inches DBH) are growing at 10% while merchantable trees are growing at 4.8%, a good growth rate. Over a 10-year period this 5-acre type is growing approximately 3,000 board feet per acre or just under 15,000 board feet.

Forest Type 8

This is a pure 10-acre Bishop pine stand that is found on the west side of the property near Highway 1. The sandy soils and proximity to the ocean are the limiting factors on this type.

Vegetation Type 9

There are 27 acres within the Central TPZ of grassland with scattered chaparral species, including coyote brush, manzanita, blue blossom and toyon.

In Summary, there are there are 248 acres of productive timberland within the Central TPZ that have been divided up into 7 vegetation types. At this point, there is no merchantable timber in Type 8. There are approximately 6,000,000 board feet of timber on those 248 acres. Redwood makes up 89% of the volume, while Douglas-fir accounts for 7% and grand fir 3%. Bishop pine is not a commercially viable species at this time.

**2009 TOTAL BOARD FOOT VOLUME BY DIAMETER CLASS,
AND SPECIES (NET VOLUMES)**

Species	12-16"	18-24"	26-34"	36-48"	Stranding	Merch
Redwood	505,800	2,126,700	2,682,600	547,100	5,862,200	5,356,400
Douglas-fir	139,100	307,800	56,600	72,800	576,300	437,200
Grand fir	4,300	18,100	125,300	67,300	215,000	210,700
					6,653,500	6,004,300

Analysis of Timber Types

Forest managers use several quantitative factors to describe the forest stands, stand stocking, stand growth, stand diameter distribution and species composition.

Stand Stocking is typically measured in board feet and basal area per acre (sq. ft.), which are expressed as the average site index or site class for a type.

Stand Growth is measured both in terms of percent growth and as a volume growth per acre per year figure. Growth rates are divided into pre-merchantable and merchantable classes to give a more accurate growth projection.

Stand Diameter Distribution is measured and tallied in the number of trees per acre by diameter class. The resulting table is useful for doing rough stand projection calculations and identifying stand structure.

Stand Species Composition is recorded in three ways; trees per acre, volume per acre and in the basal area per acre. Species composition affects stand treatments and stand values.

During the timber cruise portion of the Management Plan development, these factors (as well as other factors) were measured and compiled into the tables above.

Growth

The Central TPZ has 248 acres of productive forestland. This acreage is growing approximately 7,200 board feet per year. Across the 248 acres over a 10-year period the property is growing 2,600,000 board feet of merchantable timber. This is a very high growth rate and will not be sustainable in the future if future timber harvests activities do not occur. The growth rates were higher in the first 10 years following the last harvest entry.

The current growth rate is good, and can be improved by expanding it to more of the total acreage. Several forest management practices, which may be used to improve forest growth, are discussed below.

1. **Selective harvesting** will thin the conifer clumps, increase growth rate and improve stand quality. Harvesting at a rate below the sustainable yield value will help build standing volume per acre in the forest.
2. **Hardwood removal** releases adjacent conifers and thus increases conifer growth. Hardwood cutting also creates openings in which to plant more conifers. This will increase the stocking of conifers on the property.
3. **Pre-commercial thinning and release** of conifers will also increase the sustainable yield of the property by increasing the growth rate in the preferred trees. This shortens the amount of time it takes to grow a mature tree. This is typically done three to four years after harvest.
4. **Planting** conifer seedlings will expand the distribution of conifers on the property and will increase the future volume of timber.
5. **Harvesting** at a rate below the sustainable yield value will help build standing volume per acre in the forest.
6. **Harvest cycle adjustments** vary the amount of time between re-harvest of units to increase the standing volume. Stands are allowed to grow a certain period of time to increase tree size and volume per acre.

By incorporating all of the above tools in the appropriate situations (as well as the activities listed under Forest Improvement), the property will move toward producing at its full potential and will increase in productivity.

Forest Improvement

Planting

Following fuelwood or timber harvest operations, the small openings created by these activities should be planted with conifer seedlings. Planting should be done the first winter after operations are completed.

Natural openings or openings created by site preparation should be planted to expand the conifer distribution on the forest. These areas should be closely analyzed prior to planting or clearing to determine if they will support conifers and which species should be planted.



Photo #1: Eight year old redwood trees growing in a converted grassy opening. These trees have also been pruned once.

Seedlings should be genetically matched to the site and be grown from a local seed source. Two year old, bare root stock (2-0) is preferred for redwood and Douglas-fir. Grand fir and hemlock will naturally seed in and it is not necessary to plant these two species following harvest operations. Scalping (clearing away debris and vegetation from the immediate area where the seedling is to be planted) is important to reduce competition and give the seedling an immediate advantage. Seedlings should be planted in the winter when the soil is moist. Two-year-old bare rootstock should be planted with a hoedad, which is a planting tool that can make a hole the ideal size for these seedlings.

A good tree planting program will expand the acreage covered in conifer (particularly redwood) and will increase the percentage of redwood in the stand. Seedlings are planted at a rate of 300 per open acre (12 by 12 foot spacing).

In addition to planting after a timber harvest, planning should be done in the event that Sudden Oak Death spreads across the property. Openings created by dead/dying trees should be planted.

Timber Stand Improvement (TSI)

Following harvesting and planting operations (after 4 to 5 years) the areas should be checked for excessive competition between small trees. TSI practices that could be implemented include the following:

Thinning of stump sprouts

In uneven-aged managed stands it has been shown that early thinning of stump sprouts (within 2 years) will not provide much benefit. It is better to wait 4 or 5 years to thin redwood stump sprouts. At that time the sprouts could be thinned to the best 2 or 3 sprouts around each stump. Trees growing directly out of the top of old stumps should also be removed. These trees have a weak connection to the root system, often have slower growth and are the most vulnerable to falling over before they reach maturity.

Thinning of natural regeneration and planted trees

When thinning stands of trees that are growing too close together, the most vigorous and best formed of the young trees are selected as leave trees. Less vigorous and poorer quality trees are removed. When this practice is implemented 4 to 5 years after harvest the trees should not be thinned to more than 8 to 10 feet apart. Later when the trees are 6 to 10 inches in diameter they can be thinned to 12 to 14 feet apart.

Removing hardwood competition

Small pre-merchantable hardwood trees competing with the conifers should be removed during a TSI project. These trees can be lopped in place and left to decompose or piled in a safe place to burn. When planted trees are about 3 to 5 years old it is a good time to remove the hardwood competition. By the time the hardwood sprouts grow back again the conifers can more easily out compete them.

TSI work is normally performed by hand, with chain saws. Occasionally some of the cut trees can be salvaged for use as firewood, fence poles or Christmas trees. These small products generally have low economic value. TSI work increases the growth of the preferred trees and improves the over all quality of the timber stands.

Pruning

In high use and high aesthetic value areas, pruning the lower limbs to as high as 16 feet greatly improves aesthetics. Trees between 3 and 16 inches in diameter can be pruned. Pruning will raise the economic value of trees when they become fully grown and will increase fire protection by reducing ladder fuels.

No more than 50 percent of the tree crown by volume or one-third by height should be removed at one time. Remove the highest branch you wish to remove prior to pruning the lower branches. This prevents over pruning. Limbs should be cut flush to the bark or limb collar, but not into the bark or limb collar.

Shaded Fuelbreaks

All roads can be treated as fuelbreaks. This involves removing brush and dead or dying trees, pruning limbs up to 16 feet and thinning thickets of small trees, both conifers and hardwoods. All of these activities should be done for 30 feet on each side of the road. All debris generated should be piled and burned, lopped, to the ground, or chipped.

The benefit of a shaded fuelbreak is the reduction of a fire hazard by breaking the continuity of fuels on the lower portion of the canopy. This provides a place where a fire can be slowed down

and then contained where fire equipment has access. Aesthetic benefits are also achieved by creating a shaded fuelbreak, a more open and park-like stand.



Photo #2-3: Heavy combustible fuels prior to treatment.



Photo #4-5: Treated shaded fuelbreak.



Fuel breaks

Roads should be kept open and passable for fire protection. Some skid trails used for logging can also be kept open for fire trails. The fire roads and trails provide added access to areas not reachable with truck roads (see fire management section).



Photo #6 This is a roadside fuelbreak on a driveway into a residence that was completed two years earlier. All of the trees have been pruned up however there is still a continuous canopy overhead to limit sprouting and seedlings.

Exotic Species Control

There are several undesirable plant species in the area. These species are non-native and they often compete with native vegetation and degrade wildlife habitat. Many have the propensity to spread rapidly. Below is a list of the most common local exotic plants:

- Algerian ivy (*Hedera canariensis*)
- Bailey acacia (*Acacia baileyana*)
- English ivy (*Hedera helix*)
- French broom (*Cytisus monspessulanus*)
- German ivy (*Senecio mikanioides*)
- pampas grass (*Cortaderia jubata*)
- periwinkle (*Vinca major*)
- Monterey pine (*Pinus radiata*)

- Scotch broom (*Cytisus scoparius*)
- Gorse (*ulex europaea*)
- Santa Cruz cypress (*Cupressus abramsiana*)

These plants especially broom and pampas grass should attempt to be manually cleared. Where manually clearing is not feasible herbicides application (by a licensed contractor) may be appropriate. Both pampas grass and broom are growing in limited quantities on the property. It generally takes three to four years of active management to eliminate these exotics.



Photo #7: Pampas grass in the center surrounded by French broom.



Photo #8 German Ivy growing in a redwood tree.

Government Cost-Sharing Programs

Many of the forest improvement projects discussed above are eligible for cost sharing from the California Forest Improvement Program (CFIP). When funds are available, current rates pay up to 75 percent of projects costs of planting, thinning and release, pruning and stream restoration. Actual cost share percentages and rates per acre range from year to year. A Forest Management Plan is necessary to obtain cost shares from the CFIP program.

Planting, thinning and release, roadwork, and some farm projects are also eligible for cost shares up to 75 percent from the Environmental Quality Incentive Program (EQIP) that is managed by the Natural Resource Conservation Service (NRCS). The California Department of Forestry or your Consulting Forester should be contacted for current information on these programs.

In the past TSR has applied for cost shares for thin and release and pruning on other parts of the forest. The location is not known as the projects were completed sometime in the mid 1980's.

Roads and Access

Access is the key to almost all recreation and management activities. Roads are also valuable for fire suppression. Road maintenance must be performed regularly to insure their long term stability and benefit. Road maintenance work includes:

- install, replace and maintain culverts as needed
- maintain waterbars, ditches and rolling dips
- eliminate road berms
- clear bank slumps on roads
- close secondary roads in the winter that are susceptible to vehicle damage

All encroachments should be gated and posted "Authorize Users Only" or to that affect to control unwanted uses of the property and protect the property owners' rights against trespassers. Exterior gates and fences must be maintained. Gates should be kept closed and locked. The Sonoma County sheriff's department has developed a program to help landowner's who are victims of rural crimes including trespassing, theft of agricultural and forest products, vandalism, etc. and should be contacted if such events occur.

Annual Road Maintenance and Erosion Control Monitoring

An annual road maintenance evaluation and monitoring program should be implemented following timber harvest operations. Roads and trails need be shaped and erosion control structures installed and maintained. Roads should be outslopped and perched fill should be reincorporated back into the road surface. Roads with a grade of 8% or less should have rolling dips installed and skid trails and steeper roads should have waterbars installed at a minimum of Forest Practice Regulations. In some places it may be necessary to have erosion control structures at closer spacing. Rolling dips and waterbars should be permanent features and not removed each year. Any road or trail work requiring equipment should be completed before the onset of the rainy season, prior to the first four inches of rain.

Annual road maintenance should include the following:

- Clean out culverts, this includes trash racks, downspouts and any other energy dissipation device.
- Make sure that rolling dips and waterbars are open and properly functioning.
- Clean out inside ditches.

TSR's erosion control maintenance should be annual. The California Department of Forestry and Fire Protection (CDF) and the California Geological Survey (CGS), have found that most of the erosion in most watersheds comes from roads and skid trails that are not properly maintained.



Photo # 9: A properly built rolling dip.

An annual monitoring program should address the following issues:

- Inspect, clean and/or open up all erosion control structure (rolling dips, waterbars, culvert and berms) of leaves, sticks and debris, and sediment that have accumulated prior to the onset of winter.
- During the winter inspections should be made 2 or 3 times during peak events to ensure that erosion control structures are properly functioning.
- The need for any additional structures or facilities should be assessed (like culverts, downspouts, & trash racks).
- Clean up any slides or failures that may occur.



Photo #10: This is a photo of the main road that runs along the east ridge of the property. Due to years of improper maintenance this road has become a through cut. Water cannot drain off of the road and is forced to run down the middle of the road. This can lead to erosion problems when a significant amount of water builds up force. By removing the berm that has been build up or in some drastic instances by moving the road a few feet, water can be disbursed and allowed to sheet across the road and not run down it.

Any road that requires winter use should be rocked with at least 4 inches of competent rock. If heavy equipment is used on these roads, then more rock should be added. The rock should be rolled in with a roller and watered to help compact the surface.

Hiking Trails

There are several hiking trails in the Central TPZ. Many of these trails are old logging skid trails. Care should be taken to not create problems with these trails through annual maintenance. Old trails that have been bladed repeatedly will begin to form through cut where there is no place for water to drain except down the trail, causing erosion. Through cuts should be broken open if possible so that water can be shed off of the trail rather than running down it. Hiking trails should be monitored to make sure that the walking traffic is not compacting the soil near the trees. Over use of hiking trails can cause compaction and kill trees especially redwoods. This has been documented in Armstrong Woods State Park.

If necessary hiking trails should be moved away from any sensitive areas. Trails that are contributing to erosion should be corrected. Trails should not be built or maintained that run

through watercourses or wet areas. Small walking bridges should be built over these areas so that the watercourses are not being impacted.

Neighbor Relations

There are approximately 55 lots neighboring the Central TPZ. These 55 lots should not be affected by any level of management activity on the Central TPZ. If a residence is located on one these lots, then a periodic visit should be made to ensure that there are no issues with snags, dying trees, or potentially threatening trees. Any tree that poses a serious threat to personal property should be removed. Enforcement of Cal Fire Residence codes should apply to this interface area. Specific residence safety information is located later on in this document.

These neighboring lots may also pose a risk by being a potential source of fire ignition (fire places, BBQ's, vehicles, electricity, etc.). The establishment of shaded fuel breaks and maintenance of all other fuelbreaks will help to keep the area safe by providing access for fire suppression efforts.

Gualala Redwoods Inc. is adjacent to the Central TPZ to the east. This landowner is an industrial timberland owner and harvests timber from time to time. Meeting directly with GRI to discuss any potential issues should continue to be done prior to their plans being finalized. Any meeting with GRI should also stress the need for them to maintain their roads and firebreaks that boarder and encroach not just the Central TPZ, but the entire property.

Records of Forest Activities

Keeping accurate records of forest stand data and forest treatments is a key component of good forest management. A large portion of this management plan is focused on organizing and documenting current stand condition and related information. Our office keeps records and maps of various management activities. The landowner should keep records of forest activities as; planting areas and numbers of trees, areas where tree and stand improvement projects have been done, areas pruned and firebreak construction locations.

Forest Certification

Forest certification is a method for identifying well-managed sustainable forestlands. Certification is done by an accredited, independent, "third-party" certification body that assesses the forest management using the certification principles, criteria, and standards, developed by The Forest Stewardship Council. Entities like SmartWood and Scientific Certification Systems are the third-party certifiers that evaluate both forest management activities (forest certification) and tracking of forest products (chain-of-custody certification). Forest products from certified forests go through a chain of custody and receive a labeling that allows customers to know that the product came from a well managed forest. In Sonoma County, certified lumber can be used in building houses and has the highest points to obtain the counties necessary point total for new construction.

Edward A. Tunheim's practices are certified by the SmartWood Program under the direction of the Forest Stewardship Council. The practices employed by Edward Tunheim as a forest manager have been assessed and found to maintain the vitality and functioning of the ecosystems

and protect the balance and diversity of the native species of the forestland. Through certification, and use of the SmartWood label, the program provides a market incentive for forest managers to adopt sustainable forestry practices. The forest products sold from the any property under the management of Edward Tunheim are eligible to carry the SmartWood certified label.

As a certified forest manager the following standards have been met:

- long term security for the forest (i.e. it will not be cleared or its use changed in the foreseeable future)
- maintenance of environmental functions, including watershed stability and biological conservation
- sustained yield forestry production
- positive impact on local communities
- the existence of a system for long-term forest planning, management and monitoring (i.e. the Forest Management Plan and record keeping program.)

Conservation Easements

A conservation easement is a legal agreement that transfers usage and or development rights and creates a legally enforceable land preservation agreement between a landowner and a state, federal or other government agency or a qualified land conservation organization like a land trust or open space district, for the purposes of conservation. Depending on the easement, a conservation easement can restrict real estate development, uses, and other activities on a property to a level that is mutually agreeable. Under a conservation easement, the property is still owned by the landowner however the conservation organization holds title to certain rights for future consideration. The owner of the property is paid for giving up their development rights on the property. By having a conservation easement on a property doesn't prevent timber harvesting from occurring, but special care must be made when developing the conservation easement to allow for forest management activities.

Carbon Credits/ Sequestration

Carbon sequestration is the uptake and storing of carbon dioxide from the atmosphere by trees in the photosynthesis process. Carbon credits can be gained through a process of additionality. Additionality only occurs when you increase the amount of ground on which you are producing trees. This is a very new and very rapidly changing item in forestry. It will take two to three years before all of the protocol is ironed out.

The process has the following outline: a landowner will be under contract with a willing buyer to grow X amount of biomass a year which in turn will absorb X amount of carbon from the environment. Contracts will vary from one-year deals up to 100 years. Care must be taken when entering a contract of this nature, as the market can be very volatile.

Hazard Trees

Trees around/among the houses, ancillary structures, and high use areas have the potential for causing severe damage if they fall or if big limbs fall off. Dying or diseased trees can be uprooted and fall over, during big storms or high winds. Trees that lean, have defects, big, broken limbs or other deformities present a hazard to existing structures, people and high use areas. Such trees should be continually evaluated and removed as needed.

Removal of hazard trees will also help break up fuel ladders and fuel continuity to decrease fire hazard. Hazard tree removal will help the remaining stand maintain health and vigor. Larger trees in the stand will become more visible and smaller trees will be encouraged to grow making the stand more aesthetically pleasing.

Hazard trees in the residential and recreation areas should be continually evaluated in order to eliminate their risk before damage is done. Hazard tree removal should be combined with periodic harvesting operations when possible. Individual trees in many areas may need to be monitored, pruned, or removed for any increased hazardous characteristics.

Fish and Wildlife

The California Department of Fish and Game maintains a database that records all of the known and documented occurrences of rare, threatened, and endangered species.

The following is a list of all of the species that have been found within 5 miles of the Central TPZ according to DFG:

QUADNAME	SCIENTIFIC NAME	COMMON NAME	FEDSTATUS	CALSTATUS	CDFG	CNPSTLIST
Stewarts Point	<i>Actinemys marmorata marmorata</i>	northwestern pond turtle	None	None	SC	
Plantation & Stewarts Point	<i>Agrostis blasdalei</i>	Blasdale's bent grass	None	None		1B.2
Stewarts Point	<i>Agrostis blasdalei</i>	Blasdale's bent grass	None	None		1B.2
Stewarts Point	<i>Agrostis clivicola</i> var. <i>punta-reyesensis</i>	Point Reyes bent grass	None	None		
Annapolis, Gualala, McGuire Ridge, Plantation & Stewarts Point	<i>Arborimus pomo</i>	Sonoma tree vole	None	None	SC	
Gualala & Saunders Reef	<i>Astragalus agnicidus</i>	Humboldt County milk-vetch	None	Endangered		1B.1
Gualala	<i>Astragalus rattanii</i> var. <i>rattanii</i>	Rattan's milk-vetch	None	None		4.3
Gualala, Plantation, & Stewarts Point	<i>Calamagrostis bolanderi</i>	Bolander's reed grass	None	None		4.2
Gualala, Plantation, & Stewarts Point	<i>Callitropsis pygmaea</i>	pygmy cypress	None	None		1B.2
Gualala, Plantation, Saunders Reef, & Stewarts Point	<i>Calystegia purpurata</i> ssp. <i>saxicola</i>	coastal bluff morning-glory	None	None		1B.2
Annapolis, Gualala, McGuire Ridge, Plantation, Saunders Reef, & Stewarts Point	<i>Campanula californica</i>	swamp harebell	None	None		1B.2
Stewarts Point	<i>Carex saliniformis</i>	deceiving sedge	None	None		1B.2
Plantation	<i>Carterocephalus palaemon magnus</i>	Sonoma arctic skipper	None	None		
Gualala & Saunders Reef	<i>Castilleja mendocinensis</i>	Mendocino Coast paintbrush	None	None		1B.2
Gualala & Stewarts Point	<i>Ceanothus gloriosus</i> var. <i>gloriosus</i>	Point Reyes ceanothus	None	None		4.3
Gualala	<i>Cerorhinca monocerata</i>	rhinoceros auklet	None	None		
Plantation	<i>Chorizanthe valida</i>	Sonoma spineflower	Endangered	Endangered		1B.1
Gualala	Coastal and Valley Freshwater Marsh	Coastal and Valley Freshwater Marsh	None	None		
Gualala	Coastal Brackish Marsh	Coastal Brackish Marsh	None	None		
Plantation	Coastal Terrace Prairie	Coastal Terrace Prairie	None	None		
Gualala	<i>Corynorhinus townsendii</i>	Townsend's big-eared bat	None	None	SC	

QUADNAME	SCIENTIFIC NAME	COMMON NAME	FEDSTATUS	CALSTATUS	CDFG	CNPSSLIST
Gualala, Plantation & Stewarts Point	<i>Danaus plexippus</i>	monarch butterfly	None	None		
Gualala	<i>Erigeron biolettii</i>	streamside daisy	None	None		3
Gualala, Plantation, Saunders Reef, & Stewarts Point	<i>Erigeron supplex</i>	supple daisy	None	None		1B.2
Gualala	<i>Fratercula cirrhata</i>	tufted puffin	None	None	SC	
Gualala & Saunders Reef	<i>Fritillaria roderickii</i>	Roderick's fritillary	None	Endangered		1B.1
Saunders Reef	<i>Gilia capitata</i> ssp. <i>pacifica</i>	Pacific gilia	None	None		1B.2
Plantation & Stewarts Point	<i>Gilia capitata</i> ssp. <i>tomentosa</i>	woolly-headed gilia	None	None		1B.1
Plantation	<i>Gilia millefoliata</i>	dark-eyed gilia	None	None		1B.2
Plantation, Saunders Reef, & Stewarts Point	<i>Hesperevax sparsiflora</i> var. <i>brevifolia</i>	short-leaved evax	None	None		1B.2
Gualala	<i>Horkelia marinensis</i>	Point Reyes horkelia	None	None		1B.2
Annapolis & Gualala	<i>Horkelia tenuiloba</i>	thin-lobed horkelia	None	None		1B.2
Gualala, Plantation & Saunders Reef	<i>Lasthenia californica</i> ssp. <i>bakeri</i>	Baker's goldfields	None	None		1B.2
Gualala, Plantation & Saunders Reef	<i>Lasthenia californica</i> ssp. <i>macrantha</i>	perennial goldfields	None	None		1B.2
Gualala	<i>Lathyrus palustris</i>	marsh pea	None	None		2.2
Annapolis, Gualala, & Stewarts Point	<i>Lavinia symmetricus</i> <i>parvipinnis</i>	Gualala roach	None	None	SC	
Plantation	<i>Leptosiphon rosaceus</i>	rose leptosiphon	None	None		1B.1
Gualala, Plantation, Saunders Reef, & Stewarts Point	<i>Lilium maritimum</i>	coast lily	None	None		1B.1
Gualala & Stewarts Point	<i>Lotus formosissimus</i>	harlequin lotus	None	None		4.2
McGuire Ridge	<i>Lycopodium clavatum</i>	running-pine	None	None		4.1
Plantation	Mendocino Pygmy Cypress Forest	Mendocino Pygmy Cypress Forest	None	None		
Plantation	<i>Pandion haliaetus</i>	osprey	None	None		
Gualala	<i>Pinus radiata</i>	Monterey pine	None	None		1B.1
Annapolis	<i>Piperia candida</i>	white-flowered rein orchid	None	None		1B.2
Annapolis, McGuire Ridge, Plantation, & Stewarts Point	<i>Rana boylei</i>	foothill yellow-legged frog	None	None	SC	
Gualala & McGuire Ridge	<i>Rana draytonii</i>	California red-legged frog	Threatened	None	SC	
Saunders Reef & Stewarts Point	<i>Sidalcea calycosa</i> ssp. <i>rhizomata</i>	Point Reyes checkerbloom	None	None		1B.2
Gualala & Stewarts Point	<i>Sidalcea malachroides</i>	maple-leaved checkerbloom	None	None		4.2
Gualala, Plantation, Saunders Reef, & Stewarts Point	<i>Sidalcea malviflora</i> ssp. <i>purpurea</i>	purple-stemmed checkerbloom	None	None		1B.2
Gualala & Stewarts Point	<i>Speyeria zerene behrensii</i>	Behren's silverspot butterfly	Endangered	None		
Annapolis, Plantation & Stewarts Point	<i>Usnea longissima</i>	long-beard lichen	None	None		
Gualala, Plantation & Stewarts Point	<i>Veratrum fimbriatum</i>	fringed false-hellebore	None	None		4.3

Botanical Species of Concern

Of the plant species listed above, the following species could likely be found within the Central TPZ based on the proximity to known populations and similar habitat conditions: Humboldt County milk-vetch, Bolander's reed grass, swamp harebell, deceiving sedge, Point Reyes ceanothus, Roderick's fritillary, Pacific gilia, thin-lobed horkelia, Baker's goldfields, marsh pea, coast lily, harlequin lotus, marsh microseris, Point Reyes checkerbloom, maple-leaved checkerbloom, long-beard lichen, fringed false-hellebore, and supple daisy.

Below is a chart that details the time in which these species (in which the necessary habitat requirements are present within the Central TPZ) are most readily visible (during the blooming season) and what type of habitat types and special requirements are necessary for the species to proliferate. Some of these species can and have been found outside of the listed habitat types and requirements.

COMNAME	Blooming Period	Habitat Types	Habitat Requirement
Humboldt County milk-vetch	April - August	NCCF & BUF	old road, trails and other disturbed area
Bolander's reed grass	June - August	CCF, CS, M, & NCCF	bogs, fens, and marshes
swamp harebell	July - August	NCCF & BUF	bogs, swamps, drainage ditches and seepage areas with specialized soil types
deceiving sedge	June	CP, CS, M	seeps, marshes and swamps
Point Reyes ceanothus	March - May	CCF, CBS, CD, CP, & CS	
supple daisy	May - July	CBS & CP	
Roderick's fritillary	March - May	CBS, CP, V&FG	
Pacific gilia	May - August	CBS & CP	
thin-lobed horkelia	May - July	BUF, V&FG, C	mesic openings and sandy soils
Baker's goldfields	April - October	G, CCF	openings
marsh pea	March - August	CP, CS, NCCF	bog, fens marshes and swamps
coast lily	May - July	NCCF & BUF	bogs and marshes
harlequin lotus	March - July	CCF & NCCF	openings with seeps, marshes and swamps
Marsh microseris	April - September	CCF & V&FG	bogs and fens
Point Reyes checkerbloom	April - September	W	freshwater swamps and marshes near sea level
maple-leaved checkerbloom	April - August	NCCF	Near openings that have frequent disturbances
long-beard lichen	N/A	NCCF	open areas with good mixing of air flow
fringed false-hellebore	April - June	NCCF	Openings near watercourses
Symbols	Habitat Type		
G	grasslands		
NCCF	north coast coniferous forests		
BUF	broadleaf upland forests		
CS	coastal scrub		
M	meadows		
CP	coastal prairie		
CCF	closed-cone coniferous forests		
CBS	coastal bluff scrub		
CD	coastal dunes		
V&FG	valley & foothill grasslands		
C	chaparral		
W	water		

When dealing with plants that are rare, threatened or endangered, the California Department of Fish & Game recommends avoidance. However sometimes avoidance is not possible. Special care should be taken when grading roads, trails, constructing new roads or trails, working around sag ponds and watercourses, or any of activity that may disturb the ground or vegetation. Several species on this list are known to exist on the property and within the Central TPZ. When working in areas where rare, threatened or endangered species exist, The California Department of Fish & Game or a qualified botanist should be consulted.

Mammals

The Sonoma tree vole (formally the red tree vole) is located throughout Sonoma County. It inhabits young Douglas-fir stands. Nests can be located in Douglas-fir trees in the mid canopy region of the trees. This species is critical to the success of the Northern spotted owl as it is its primary food source. Its primary food source is the needles of young Douglas-fir trees. Tree vole nests look very similar to small woodrats or large bird nests and often times they will take over abandoned nests from other species.



Photo #11: The Sonoma tree vole.

Birds

Two of the previously listed species the tufted puffin and the rhinoceros auklet, are sea birds, in which no habitat elements are present within a forest or within the Central TPZ.

Northern spotted owls are known to breed in the county and utilize both old growth and young growth forests. There are several known nest locations nearby. No Northern spotted owls were observed while fieldwork was completed on this management plan, however the entire Central TPZ is suitable habitat and likely occupied by one or more pairs.



Photo #12: Male Northern spotted owl.

It is unknown whether or not marbled murrelets are present in the area. The species is listed as state endangered and federally threatened. Marbled murrelets have been seen flying around the Clipper Mill Bridge and Twin Bridges along the Gualala River. Marbled murrelets utilize existing depressions in large sheltered limbs, or limb clusters. The primary requirement for marbled murrelet habitat is limb size. They require limbs at least 4" in diameter on which to nest. Murrelets utilize the forests during the breeding season and return to the sea during the rest of the year. One adult will fly from the nest location to the ocean for food and back to the nest each day. The breeding season for marbled murrelets is from April to August. The information available on the marbled murrelets is very limited, but is increasing.

Osprey are common residents to coastal Sonoma County. They nest in large broken top trees or those, which offer a good vantage point to water. Osprey are very vocal birds and can be heard from great distances. They have a very distinct call. Nests are very large and used for several years. Osprey are common during the spring and summer, and may migrate to southern warmer areas in winter.

Amphibians

California red-legged frogs (RLF's) inhabit natural and artificial ponds rivers, creeks, reservoirs, deepwater marshes, and coastal freshwater lagoons. Breeding pools must be at least 2 feet deep throughout the breeding season. Following the first rain of the year (usually requiring more than

¼ inch of rain) the frogs will leave the water and move upslope in search of breeding partners. This dispersal can be as great as 2 miles, but most frogs are found within 300 feet of water.

California Red-legged frogs are likely found in the Gualala River Watershed. It is very possible that they exist within the property or nearby. The ponds and sag pools on the property offer less than ideal but still suitable habitat for the species to survive and persist and the forest itself offers suitable upslope habitat during the winter. This species has just been reclassified to add populations north of San Francisco County to the California red-legged frog population (which is federally protected) and not the northern red-legged frog population.

Foothills yellow legged frogs are a California species of concern and a candidate for Federal Listing. These amphibians are found near rocky streams in a variety of habitats including mixed conifer, coastal scrub, and wet meadows. Potential habitat for this species may be along any of class III watercourses within the Central TPZ.

Reptiles

The Northwest pond turtle is associated with slow moving or lentic waters. Juvenile habitats include low flowing regions or rivers, channels and backwater areas. No turtles have been observed, but sag ponds could offer suitable habitat.

Fish

There are no fish bearing watercourses within the Central TPZ.

When working with equipment care should be taken to not disturb any of the species listed above. Equipment work includes road and trail construction, maintenance, and decommissioning, fuelbreak work, any TSI work, planting, pruning, and any other time that equipment is used to disturb soil or vegetation. Equipment work should be done following the breeding season/blooming season for all of the species listed above and before the onset of rain in the fall if species-specific surveys aren't conducted by qualified biologists/botanists. If site-specific surveys are conducted, then the mitigations developed should be followed. In the event that logging occurs, site-specific surveys will be required by the State as part of the harvest plan.

Besides the rare, threatened and endangered species mentioned above, there are numerous other wildlife species that utilize the forests within the Central TPZ. The vegetation types of the property provide an excellent mosaic of diverse habitat for wildlife. They provide habitat for black-tailed deer (*Odocoileus hemionus columbianus*), dusky-footed woodrats (*Neotoma fuscipes*), Western gray squirrel (*Sciurus griseus*), brush rabbits (*Sylvilagus bachmani*), raccoon (*Procyon Lotor*), band-tailed pigeons (*Columba fasciata*), California valley quail (*Callipepla californica*), red-tailed hawks (*Buteo jamaicensis*), red shouldered hawk (*Buteo lineatus*), American kestrel (*Falco sparverius*), turkey vulture (*Cathartes aura*), acorn woodpeckers (*Melanerpes formicivorus*), flickers (*Colapets auratus*), Northern mockingbird (*Mimus polyglottos*), steller's jay (*Cyanocitta stelleri*), scrub jay (*Aphelocoma coerulescens*), common raven (*Corvus corax*), American crow (*Corvus brachyrhynchos*), American robin (*Turdus migratorius*), dark-eyed junco (*Junco hyemalis*), nuthatches, chickadee, thrushes, various other song birds and passerines, and several owls species. Less commonly seen may be coyote (*canis latrans*), osprey (*Pandion haliaetus*), gray fox (*Urocyon cinereoargenteus*), golden eagles (*Aquila*

chrysaetos), bobcat (*Felis rufus*), striped (*Mephitis mephitis*) and spotted skunks (*Spilogale gracilis*) and mountain lions (*Felis concolor*).

Wildlife Habitat Improvements

Wildlife habitat diversity and improvement is an important consideration in all forest management activities. Opportunities for improving habitat should be exercised when possible. Habitat improvement is a by-product of other forest management activities at little or no extra cost. Additional wildlife habitat projects can be budgeted and carried out as the need is identified, such as stream habitat improvement projects.

The inventory in 2009 indicates a very high occurrence of snags on the property. There is currently no need to create more snags on the property. In the future to increase the occurrence of snags, dead trees are left in the stand and large trees with high wildlife value are also left to be utilized and to develop into snags. Snags are only cut when necessary for fire prevention and to protect the safety of residents, forest workers and buildings. Many animals den in snags, raptors use them for perching, and woodpeckers feed on insects associated with them. Where snags are lacking they can be created by girdling hardwoods or cull softwoods. Large cull trees with big limbs are left in the stand for live habitat and to provide large snags in the future.

Hardwood trees are an important component of the forest for wildlife use. Rotten cavities in large hardwood trees are excavated by woodpeckers and used by small birds and mammals as denning sites. Hardwood trees provide potential for cavity nesting species including several owl species, woodpeckers, and other birds, which require cavities. Raptors, like sharp shinned hawks (*Accipiter striatus*), and Cooper's hawks (*Accipiter cooperii*), often nest in hardwood trees and hardwood stands.

Hardwood forests are home to many different types of songbirds, mice and rats, and other animals on which raptors depend for survival. Hardwood trees themselves provide a major food source for many of the animals that inhabit the forest. Tanoak acorns are an important food for most all forest herbivores and omnivores. These animals include deer, squirrels, woodpeckers, turkeys, many songbirds and several other animals. Madrone berries provide another very important food source as well. The continued management of hardwood trees creates a new cohort of trees that represent the future of hardwood forests.

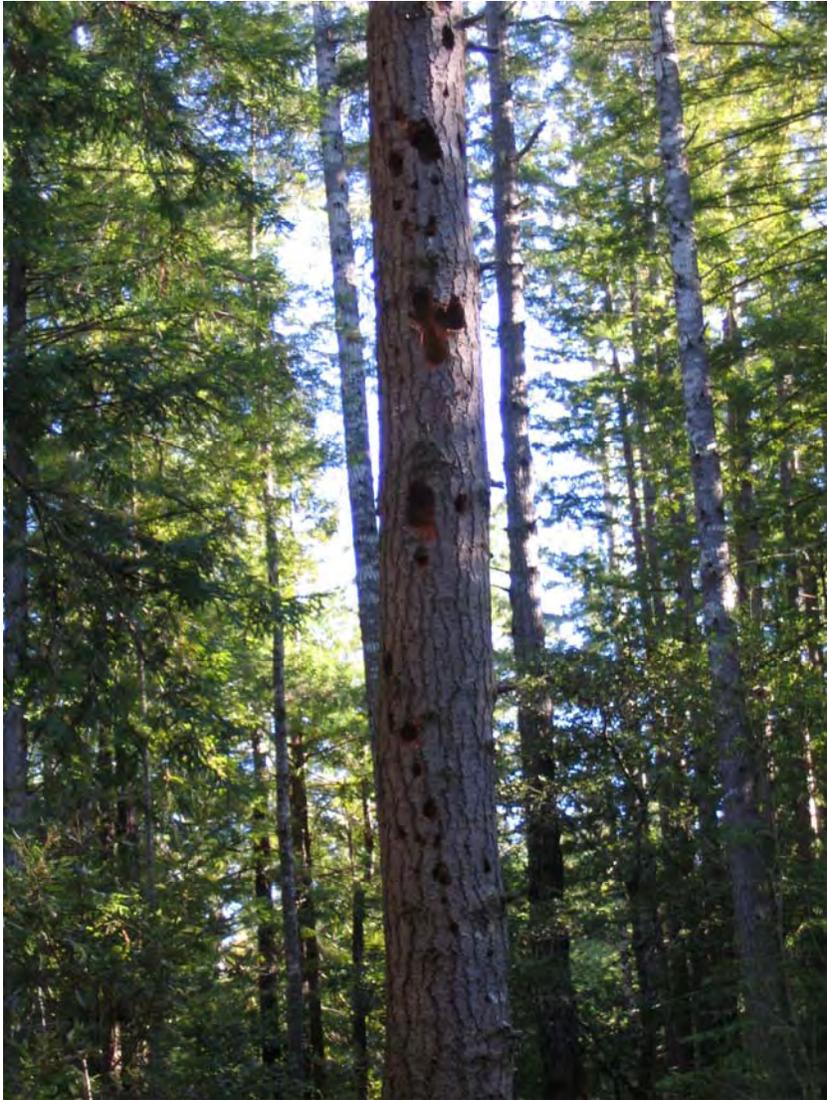


Photo #13: Large fir snag with multiple cavities.

Downed logs are referred to as woody debris. Reptiles, amphibians and small wildlife live and feed around old downed logs. Wildlife value is proportional to log diameter and length. Logs on the contour are utilized more than logs parallel to the slope. Large woody debris is increased by leaving unmerchantable material scattered throughout the forest during harvesting operations. Unmerchantable material is not removed from the forest. No broadcast burning is done after timber operations. Limbs, small logs and slash are left scattered in the woods along with large woody debris of conifers and hardwood species.

Other elements that can be found in the coniferous forest that should be protected and managed to promote wildlife include woodpecker granary trees, large residual trees (especially Douglas fir which produce good nesting platforms), and snags which provide homes for several species of birds and mammals and will be the future source of large woody debris.

As Forest Managers we utilize practices which will reduce the potential adverse impacts to fish, such as retaining shade canopy over streams, retaining and recruiting large woody debris in

stream channels where appropriate, stabilizing stream banks to prevent siltation and bank erosion, rocking sections of road, maintaining roads and watercourse crossings to minimize erosion, and special projects to eliminate migration barriers and establish in-stream habitat enhancement.

Forest Diseases/Problems

Phellinus pini (*Fomes pini*) is a heart rot that attacks many trees on the west coast, especially Douglas fir. This pathogen enters the tree through living and dead branches. In the field, an indication that a tree is infected is the presence of its fruiting body, or conk. This conk appears at a branch collar, as a dark brown mushroom.

Heartwood of an infected tree begins to deteriorate causing a tree to eventually rot. This becomes a problem when selling Douglas fir to a sawmill. Wood quality is one of many things that a mill estimates when scaling volume upon delivery. As a result, defect decreases the price of a log. One of your goals is to increase forest health. This means removing as many infected trees as possible. Trees that are no longer merchantable will be left to provide habitat for wildlife, as these trees provide excellent habitat for various species.

Another problem that heart rot causes is degradation in wood strength. These trees become more susceptible to windfall and other natural events. Trees that are infected near structures and other high use area will be watched carefully and removed when necessary.



Photo #14: A Douglas-fir infected with *Phellinus pini* (*Fomes pini*).



Photo #15: Up close view of what the conks of *Phellinus pini* look like.

Sudden Oak Death (*Phytophthora ramora*) is a pathogen that is already on the property. This pathogen is a new and very rapidly spreading disease that affects primarily coast live oak, black oak, tanoak, bay, huckleberry, and rhododendrons. There are over 50 species that are affected by this pathogen currently and the list continues to grow. Many of these species show no effects; others just show some foliage dieback. This disease has the capability to destroy entire hardwood forests. It's not fully known how this disease is spread. Trees (primarily tanoak) infected with this pathogen have varied reactions, but most are killed very rapidly. Individual tree immunity is not known at this time. Bay is the species that spreads the pathogen primarily through the forest.

As this pathogen is already on the property, several things should be done to help improve the forest. No firewood should be taken off of the property without proper treatment, to prevent spreading of the pathogen to uninfected areas. If firewood is removed, it should be dried on the property for at least 1 year (2009 Forest Practice Rule).

There are a large number of trees that have been killed by SOD already on the property and this has led to an increase in fuels available to spread a wildfire. Dead trees can be cut down to reduce the fuel loads.

With numerous trees dying, this is an opportunity to plant conifers. Redwoods should be planted in the understory where hardwoods have been killed. This will increase the stocking of conifers on the property and help to establish another age class.



Photo # 16: A young tanoak tree killed by Sudden Oak Death.

Pine Pitch Canker is a disease caused by *Fusarium moniliforme* var. *subglutinans* a fungus that affects Bishop and Monterey pine trees. Foliage of infected trees begins to wilt at first and then die. Whole branches may begin to die and cankers can form on needles, branches, trunk and roots. Often times sap will bleed from the tree as well.

Signs of pitch canker have been observed on the property, but nothing has been confirmed. This pathogen is spread mostly by infected material that is left in large concentrations which causes insect outbreaks to begin. Insects can carry spores of the disease to healthy trees. Any tree that appears to be infected should have material that falls to the ground, cut up into small pieces and either scattered, burned or chipped.

Western Gall rust is a disease that can be destructive to young trees and damage mature trees. Galls will form on limbs or on the stem of trees and begin to girdle the transportation of water and nutrients. In young trees, the disease will likely kill the tree. In older trees, the galls can kill limbs, but most of the time won't kill the tree. The disease is spread by spores from galls on other trees. There is no real successful way to stop this disease as it can be spread for several miles by air.

Within the Central TPZ and on other parts of the property bark beetle infestations have been observed. In some places these outbreaks have killed trees outright and in other locations, bark beetles have killed trees weakened by construction activities or other human disturbances. This has been observed in Douglas-fir and bishop pine trees.

Recreation

Recreation is the primary use of the Central TPZ. Any level of management that occurs in the future on the Central TPZ should maintain or increase the aesthetics of the property as well as enhance other attributes like fire protection, wildlife habitat, erosion control, and access.

Archaeological and Historical Resources

At this time, no archaeological surveys have been conducted on the property. If timber harvest activities occur in the future, surveys must be conducted on the property. Road work, trail maintenance, building structures or any other activity that disturbs the ground should be restricted with 100 feet of a Native American site.

The majority of Native American sites in this part of western Sonoma County include midden and village sites, burial sites, grinding rocks, flaking and tool making areas, and rock art.

Any feature older than 45 years is considered a historic site. Historic sites in this part of the county include old logging equipment, train grades, buildings and other structures.

Both historic and Native American sites should be documented and recorded with the Office of Historic Preservation as part of a timber harvest plan. There are documented Native American and/or Historic sites on the Central TPZ.



Photo #17: Example of local Native American hand tools



Photo #18: Local Mendocino and Sonoma County points and flakes.

Fire Protection

Potential for wildfire is increased when the forest is adjacent to developed residential areas, parks or roadways. The degree of damage a wildfire can do is also increased with valuable land, houses and people's lives at stake. It is therefore very important to implement all the fire protection measures possible on the property.

We can take many steps to aid in the early and effective suppression of forest fires. This is accomplished through the creation of fire defense improvements. Some of the best tools for a good fire defense are:

- 1. Monitoring**
- 2. Pre-suppression** including access and fuel modification
- 3. Water Availability**

Monitoring the area leads to early detection of fires. The earlier a fire is detected, the easier it will be to extinguish. The presence and observations of owners, renters, neighbors, and workers is important.

Access routes are extremely important, whether they are Highways, county roads, truck roads, tractor trails or hiking trails; all facilitate the safe and orderly movement of people and/or equipment to a fire front. These access routes typically act as fire suppression points. This is

particularly true if they coincide with or intersect natural or man made fuel breaks also called shaded fuel breaks.

A natural fuelbreak exists where strips of vegetative cover or landscape are un-flammable or less flammable than surrounding vegetation. Such areas are rock out-croppings, creeks, lakes, etc. A man-made fuelbreak is a strip of land between 30 and 300 feet or more wide along which the primary fuel, usually brush or timber, or both, has been reduced in volume to a lighter, less dense fuel type to facilitate fire control. The fuelbreak is a permanent pre-attack facility which includes a road for patrol and fire fighting purposes within the fuelbreak where the topography permits. A fuelbreak may be installed around a compartment or other developed area, or a system of connected fuelbreaks may be constructed to help protect large wildland areas.

Purpose of Fuelbreaks

The basic purpose of a fuelbreak is (1) to divide continuous natural fuels into smaller units for easier and safer suppression of wildfires; (2) to help protect recreation sites, communities and other areas of high value from wildfires; and (3) to aid fuel or vegetation management with prescribed burning.

The fuelbreak is designed to provide:

1. Road access for patrol vehicles, fire fighting vehicles and equipment, and for fire crews.
2. Truck trails for access and movement of personnel and equipment during fires.
3. Reasonable unhindered and safe movement (off-road) of trucks and bulldozers, and of personnel on foot during fires.
4. A place at which a fire fighting line can be established and at which the fire can be extinguished when it reaches the line.
5. A place from which a backfire can be set.
6. Safety zones for fire crews including widened areas at intervals along the strip.

Fuelbreak Location

Fuelbreak location within the property must be carefully planned to retain the scenic quality of the landscape. Consideration must be given to the visual effect of the fuelbreak when viewed, not only from within the fuelbreak itself, but also from other places within the unit (roads, trails, overlook points, etc.), and from communities, highways, and other viewpoints outside the unit.

Treatment of the fuelbreak to blend it into the landscape is even more important than fuelbreak location in reducing the visual impact of fuelbreak construction. The fuelbreak should be placed on ridge-tops where, under favorable conditions, the chances for controlling a fire are best. Fuelbreaks also may be placed around homes, in canyons and valleys to take advantage of natural barriers such as roads and streams or to protect facilities in developed areas.

In planning the location of fuelbreaks, forest stands or other vegetative types that have special scenic or scientific value and areas of historic or archaeological value should have special consideration.



Photo #19: A shaded fuelbreak on the downhill slope of a road. This fuelbreak is located in-between a county road and a ridge top road.

Roads

A single lane dirt road having an 8-foot minimum width and a maximum of 12 feet of wheel surface for patrol, maintenance, and fire fighting purposes, should be within the fuelbreak wherever possible. Turnouts should be installed at reasonable intervals selected by field examination. Roads and turnouts shall be no wider than necessary to provide safe passage of patrol, maintenance, and fire fighting equipment. These roads may be routed outside the fuelbreak for short distances when necessary because of topographic, scenic, or other considerations.

The roads should be maintained in a passable condition and free from deep ruts, down trees, and limbs. Adequate erosion control structures (preferable rolling dips on gentle slope and waterbars on skid trails and steep sections of road) shall be installed and maintained to prevent erosion. A layer of wood chips could be placed on the road to aid in the prevention of erosion in winter and dust in the summer, and to help blend the road into the landscape. Herbicides are not used for the construction of fuelbreaks.

Fuelbreaks alone are not intended to stop the head of a hot, fast-moving fire. They must be manned by fire crews, and further clearing during the time of a fire usually must take place if fuelbreaks are to serve effectively as control lines.

Firebreaks Within Fuelbreaks

The road within the fuelbreak will, in most cases, serve as an adequate firebreak. Where the road is routed outside the fuelbreak due to steep topography or other factors, a 10 foot firebreak could be installed within the roadless portion of the fuelbreak to connect with the road segments within the fuelbreak.

In certain situations, a firebreak will impair scenic qualities, especially where it passes through readily visible grasslands or other areas with low vegetative cover. Therefore, firebreaks cleared to mineral earth may not be desirable in such locations. Instead, low mowing of 6 to 10 foot wide strips through the grasslands or brush adjacent to roads could be done.

Firebreaks are similar to fuelbreaks in many ways including their optimal location and ultimate use. Firebreaks are narrower and bare less soil than fuelbreaks. Firebreaks are often more compatible with forested lands than fuelbreaks. The existing road system within the property functions as a firebreak.

Where truck roads and natural fuelbreaks have not suitably compartmentalized the property into fuel units, additional firebreaks should be constructed. The construction of firebreaks can be done when equipment is on the property to do other road and trail building and maintenance.

Pre-suppression Fire Planning

A pre-suppression fire plan should be developed. A forester has the ability to develop and maintain such a plan. The Cal Fire has information and expertise for helping to develop a plan. The plan should include narrative and maps covering: access, roads, trails, firebreaks and fuelbreaks, their capabilities and limitations; water sources, access routes to water sources as hydrants, water tanks, and creeks; location of buildings, power lines, and water lines; potential helicopter landing areas and staging areas; street, road and trail names; mileage marker locations, and emergency exit routes.

Fire Safe Landscaping

Section 4291 of the California Public Resource Code requires clearing flammable vegetation around structures a minimum of 30 feet, up to 200 feet depending on conditions. According to the Cal Fire, homeowners can substantially increase the chance of their home surviving a wildfire by following these fire safe practices:

- Maintain a "defensible" space around your home by clearing all flammable vegetation a minimum of 30 feet around the structure. Clear dead leaves and branches and leave widely spaced ornamental shrubbery and trees.
- Clean all needles and leaves from the roof, eaves and rain gutters.
- Trim tree limbs within 10 feet of your chimney and trim all dead limbs hanging over your house or garage.
- Cover your chimney outlet or flue with a spark arresting ½ inch mesh screen

- Make sure your address is clearly visible from easy identification in an emergency.
- Make sure you have adequate water storage of at least 2500 gallons for use in emergency situations.
- Stack woodpiles at least 30 feet from buildings, fences and other combustible materials.
- Clear all vegetation and other flammable materials from beneath your deck. Enclose undersides of elevated decks with fire resistive materials.

Roofing material is rated based on its flammability, with class A being the least flammable. Next to a fire-resistant roof, plant selection, landscape design and maintenance are the most critical in providing for fire safety around homes. There are many plants that actually attract fire and these plants should not be planted near houses. Many of these plants are also non-native and invasives. Some plants to keep away from the defensible space around structures are: most conifers, but especially pine and juniper, eucalyptus, acacia, scotch broom, bamboo and pampas grass.

The zone concept is a practical approach to developing defensible space around structures. The innermost zone within 30 feet of a home should be the "greenbelt" of irrigated, low-growing, fire resistant plants. Dead branches should be pruned out and plants should be periodically sheared or pruned to encourage new succulent growth. Rock, brick and concrete pathways, patios, masonry walls and rock gardens can be incorporated into the landscaping to provide to break up fuel continuity.

The mid-zone, 30 to 70 feet from the house should contain mostly low growing, fire resistant plants. Well-spaced, fire resistant trees can be maintained. Plants should be drought tolerant, although periodic watering can improve their fire resistance. In the outermost zone, 70 to 200 feet native vegetation can be maintained. Dense brush should be cleared and crowded trees thinned. Ideally trees should be spaced 20 to 40 feet apart. All lower branches should be pruned and dead branches removed.

It can be very confusing when trying to landscape with plants that are not only fire resistant, but native, drought resistant and/or deer resistant. When selecting landscaping plants select plants that are well-adapted to the local climate, microclimate, aspect and slope. Plants should be low growing with limited spread and not woody material that dies back frequently. Plants should be deep rooted and proficient at water uptake. Plants with relatively fire resistant foliage includes deciduous trees and shrubs, trees and shrubs with large, fleshy leaves, and those lacking volatile chemicals, oils and waxes.

Timber Harvesting

Timber harvests have occurred on the Central TPZ at least three times in the past. The original harvesting occurred between the turn of the century and the 1920's. As was discussed in the sections above, the first harvest was very intense and removed most all of the original old growth redwood. Another timber harvest occurred in the 1970's. This second entry removed some trees, but was not detrimental to the forest. The most recent harvest happened between 1991-92. This harvest was a light selective logging that was done in a manner which removed most of the defective and dying trees, trees of poor quality and spaced out the remaining residual trees. This timber harvest removed approximately 40% of the trees by volume.

Of the 248 acres of conifer forestland, approximately 168 acres are ready for harvest now. For reason that will be discussed below, Forest Type 5, 7, & 8 are not ready for harvest at this time. There is approximately 2,000,000 board feet that is ready for harvest at this time. A harvest of this intensity could be sustainable every 12 years.

The 2,000,000 board feet of available timber could be harvested in several ways. The property could be logged at one time, or it could be broken up into several units. We recommend breaking up the property into smaller units and spread out the harvest over time to allow for a flow of income over time. Not only will this offer a cash flow from the property, but allows you to maintain your infrastructure, control vegetation for fire prevention, put the improved growth rates on the best trees, and have a presence on the property.

Economy of scale is a limiting factor. To be viable a timber sale must cut 200,000 board feet of at a rate of 5,000 board feet per acre. Smaller timber sales will drastically increase logging costs. This means that in order to harvest an acre of ground, there needs to be a minimum of 17,000 board feet of merchantable trees (18 inches and greater) standing. This eliminates Types 5, 7, & 9 (approximately 90 acres) which do not have enough standing volume to currently harvest.

We would propose retaining about 20 percent of the growth in the stand to build the stocking in the forest and gradually increase the harvest amount until the property is growing at its full potential. This practice will keep the forest at a sustainable production level. The maximum harvest given a still high growth rate should not exceed about 2,000,000 board feet for each rotation (12 years). As the density and size of the stand increases, the amount available for harvest will also increase.

With a selective harvest, the overall growth of volume on the property is expected to be maintained as the proposed timber harvest would remove the poor quality conifers, thinning out redwood clumps and thinning out some of the hardwood competition. Planting of trees, expanding the growing stock over more area and implementation of forest improvement projects will increase the overall production level of the forest over the long run. The remaining stand would be able to better utilize the resources for growth on the site and move the forest toward its full productive potential.

We would recommend a harvesting cycle (re-entry period) of 12 years, which provides time for the leave stand to fully respond to the release factor and recover from the harvest, provides time for the redwood stump sprouts and planted trees to grow large enough to survive the next entry (they get big enough to avoid) and provides a larger average harvestable tree.

The trees chosen for removal are chosen to benefit and enhance certain management goals of the forest (sanitation, regeneration, spacing and release). When trees are chosen for removal or retention, volume is not a primary concern. The choice of which trees to harvest is applied on a clump-by-clump or tree-by-tree basis.

Silviculture

Silviculture is the art and science of controlling the establishment, growth, composition, health, and quality of a forest to meet the desired needs and values of a landowner. A silvicultural prescription is a planned series of treatments for managing a forest.

The forest structure that existed on the Central TPZ prior to the 1990's timber harvest was even-aged stand, due to the clearcutting in the early 1900's. All of the trees began growing following that initial clearcut harvest and are roughly the same age.

Some selective logging occurred between the 1950's and 1970's, but no information could be found during this period in the records that were collected.

Following the 1990 and 1991 timber harvests, a second age class was created. These trees are now 18 to 19 years old. Most of the redwoods in this age class are from stump sprouts. There are a few redwoods that seeded in, but not many. The Douglas-fir, grand fir and hemlock are all the result of natural seeding.

A healthy fully functioning forest is a multi-aged forest, which has trees of all ages, sizes and species. Most original old growth redwood forests were of this stand structure. There were a few very large (old growth trees) per acre and from time to time a natural disturbance (fire, wind, or old age) would create an opening in the forest. Within that opening, a new group of trees would become established, and over a new age class was created.

Through proper forest management, a forest can in a very short time period be shaped and modified from an even-aged forest to a multi-aged forest. The single-tree or selection silviculture system creates areas for natural regeneration of conifer seedlings and areas for conifer planting. These young trees introduce a new generation of trees within the stand. Each time the forest is selectively harvested a new generation (age class) is introduced until there are many age groups all intermingled in the forest.

The silviculture prescription that we recommend for the Central TPZ is single-tree (uneven-aged management). Trees of all ages are maintained in the stand. This is accomplished by harvesting individual trees throughout the forest. Our silvicultural goals would be to promote the establishment and growth of conifer trees, improve the quality of trees, and maintain a diverse forest stand in terms of structure, species composition, aesthetics, wildlife opportunities, and safety.

We have found many advantages using this system including: a multi-story canopy provides diversity; maintains aesthetically pleasing site; minimizes impacts on wildlife; minimizes impacts on soil and residual vegetation; maintains a continuous cover over the landscapes to protect the site from environmental hazards like wind; there is a certainty of natural regeneration; fire, disease and insect problems are limited; there is a continuous production of high value product; and there is a periodic economic return. This system also simulates the natural process that would have occurred with wind, and to a lesser extent fire, which creates cavities, hallows, and deformities and burns off the duff layer. However trees aren't blackened and homes aren't

potentially at risk with logging as they are with fire. Logging slash can be cleaned up and will decay into the soil.

Harvesting Standards

In the event that harvest activities occur, the following timber harvesting standards should be followed. The timber should be carefully marked for cutting, with aesthetic and safety as well as economic considerations taken into account. Low quality and defective or dying trees should be selected first. Trees that sit on stumps, are forked or have poor structure are susceptible to storm damage and should be removed in high use areas. However in places that do not pose a significant risk to residences and recreation, trees can be retained to create the next generation of snags. The remaining trees to be harvested should be selected for balancing spacing, tree size and species. Selected large, particularly attractive trees should be identified and preserved as specimen trees for aesthetic and wildlife values. The overall goal should be to leave trees of all sizes for future growth to develop a stand of all sizes from seedlings to over 36 inches in diameter.



Photo #20: A redwood sitting on an old stump. Trees like this often have no support in the ground and can break off in heavy winds.



Photo #21: This fir tree lost its top and a branch has turned up to form a new top. This top is weak and often will fail. Trees with physical defects should be selected for removal.

Logging must conform to the standards required by the California Department of Forestry. Some of these standards include: following the specified measures for watercourse protection zones and building and maintaining trails, roads and crossings as specified in a Non-Industrial Timber Management Plan (NTMP) or Timber Harvest Plan (THP).

In addition to the requirements of the state, in order to maintain the aesthetics and recreational values of the property, we recommend lopping all slash to 30 inches or lower, installing adequate erosion control measures, minimizing damage to the trees that remain after harvest, and cutting stumps as low as possible. Areas of high recreational values can have slash burned or chipped to lessen the visual impacts.

Areas of high use, historical value, archaeological significance, unique wildlife value or particular interest should be identified prior to harvesting and a plan developed which will protect them. Large trees with many large limbs can have high wildlife habitat value and certain ones should be selected and left to become snags and large woody debris. Log landing areas should be clean of slash and seeded to grass following each use in order to make these areas usable between harvests. Soil and residual vegetation should be minimally disturbed. A written logging agreement should be developed for each harvest detailing the specific requirements and

performance standards to be met by the logging contractor. Such items, which must be addressed, are: the payment schedule, downpayment, cash performance bond, insurance certificates, and log scaling requirements. A copy of the timber operator's license shall be required of the timber purchaser. Timber harvesting should be overseen by a licensed Forester and should meet the high standards required by Edward A. Tunheim Consulting Foresters.

Methods and Procedures

The sampling for this plan utilized a stratified double sampling procedure. Forty-three temporary 1/5 acre circular plots were established using a modified grid pattern across the 285 acres of conifer forestland on the property in 2009. This represents a cruise intensity of approximately 3 percent. One third of these plots were additionally measured for growth.

Within the standard 1/5 plot, all conifer trees above 12 inches DBH were measured for diameter to the nearest 2 inches and height to a 6-inch top in 16-foot logs. Conifers under 12 inches were tallied at each plot. Hardwood volumes were visually estimated. At each plot, one tree was additionally measured to attain total height in feet to determine site values. The following parameters were additionally measured or estimated at each plot; overstory cover, understory cover and composition, basal area, woody debris, and snag density and quality.

Every third plot, was designated a growth plot. On these growth plots, all conifer trees over 12 inches DBH were measured to the nearest 1/10th inch DBH. All conifer trees over 12 inches were cored with an increment borer and the last 10 years radial growth was recorded to the nearest 1/20th of an inch.

All of the raw data was synthesized into the orderly tables and narrative contained in this Management Plan. Volume tables were used to calculate a value for each tree measured. These volume tables have been developed for the local area and have been calibrated to reflect our experience in different forest types.

Management Recommendations

Land Use

- Continue to use the property for its main purpose, recreation. This should include hiking, walking, and horse ridding.
- Continue forest improvement activities on the property.
- Protect the riparian areas on the property.

Fire Hazard Reduction and Hazard Trees

- Remove trees that pose a hazard to existing residences or other structures.
- Monitor trees around residences, along roads, near improvements (i.e. water tanks, power lines) for potential hazard and need for removal or modification.
- Implement and maintain defensible space around structures.
- Create shaded fuel breaks along the main ridge road and all hiking trails. This fuel break should be at a minimum 100 feet in width for the roads and 30 feet for the trails. If economically feasible, the roadside fuel break should 300 feet wide. Trees should be limbed

up at least 15 feet. Any snags should be removed from fuel breaks. Clumps of trees under 10 inches DBH should be thinned out, especially hardwoods.

- Pruning and thinning of the forest outside of the fuel breaks can also be completed to clean up the forest and reduce the fire hazards that have been building up.

Fire Prevention

- Periodically re-open firebreaks and roads.
- Pursue mutual agreements with neighbors for extending fuelbreaks and alternative points of access.
- Develop shaded fuelbreak program and general road brushing program to facilitate good access and create potential areas to stop fires.
- Develop fire pre-suppression planning and mapping for the residents and local fire fighting agencies. Include potential water sources for fire fighting, maps of all property roads and trails, potential helicopter landing sites and location of safety zones.

Roads and Trails - Erosion Control

- Install and maintain waterbars, culverts, ditches, down spouts, and trash racks on forest roads.
- Annually inspect all roads and trails prior to the onset of winter for needed corrective activities. Culverts should be cleaned out, erosion control structures should be dug open by removing sediment and leaves that have accumulated, and the infrastructure should be evaluated for additionally needed structures.
- Blade and shape roads to maintain the drainage and hard surface as necessary. Avoid creating through cuts with continuous grading.
- Do not put any type of thin superficial surface (oil and screens, etc.) on any forest road.
- Maintain fire trails within the property and expand the integrated fire trail system as needed.
- Bare soil areas along roads, trails, landings, etc., should be seeded to grass and/or straw mulched as needed.
- Maintain gates and fences. Post signs to prevent unwanted trespass.
- Rock roads where needed.
- * **Site Specific Recommendations:** The culvert at the head of the draw in the middle of the property is failing. The current 24" X 40' culvert should be replaced with a new culvert. This culvert will require a Department of Fish and Game 1600 Permit and should have a 36" X 40' culvert installed.
- * A specific road use agreement should be developed with GRI for using the road when it leaves the property.
- * The table below is from the Forest Practice Rules and is meant as a guideline for installing erosion control structures. These distances should not be exceeded unless there is some physical reason why an erosion control structure can't be built at the below spacing or a reason on how the longer spacing will be more beneficial. See the erosion hazard discussion in the description of each soil type. Most of the forest soils are a moderate to high Erosion Hazard Rating.

MAXIMUM Distance Between Waterbreaks
Gradient of Logging Road or Tractor Skid Trail

<u>EHR Rating</u>	<u>0-10%</u> <u>(Most roads)</u>	<u>11-25%</u> <u>(Some roads)</u>	<u>26-50%</u> <u>(most tractor ground)</u>	<u>>50%</u> <u>(cable & exceptions)</u>
Extreme	100'	75'	50'	50'
High	150'	100'	75'	50'
Moderate	200'	150'	100'	75'
Low	300'	200'	150'	100'

Timber Harvest

- Timber harvesting is a viable option for the property, if done in a manor which is compatible with the primary use of the property, recreation.
- A light intensity thinning could harvest approximately 2,000,000 board feet without significantly altering the main goals and objectives of the property. A harvest of this intensity could help improve forest health, fuel load reductions, erosion control, and access to the property.
- Smaller harvests of 500,000 could be conducted every 3 years to provide a flow of income through time. A smaller area would be harvested under this option. A 12-year re-entry cycle harvesting 2,000,000 board feet can be sustained indefinitely, with some adjusting of the interval to balance growth.
- Use a highly selective tree marking system to constantly improve forest health and vigor.
- Timber operators must be carefully chosen and supervised. Only operators who can follow high harvesting standards set forth in this Forest Management Plan and any timber harvest plan.

Hardwoods

- As sudden oak death (SOD) spreads across the property, dead trees should be removed in high use areas and defensible fuel profile areas.
- Plant conifers trees after SOD has opened up large enough areas to plant.
- Some hardwood can be harvested under sustainable practices if the market is favorable.
- Leave some hardwoods spaced through the stand. Do not clear-cut hardwoods.

Forest Improvement

- Interplant conifers in openings including areas where Sudden Oak Death has killed hardwoods.
- Follow all harvesting and fuelwood cutting with conifer planting.
- Check conifer regeneration from planting and harvest activities at age 4 or 5 for need of thinning and release, particularly in fuelwood areas.
- Develop a shaded fuelbreak program.
- Evaluate and implement desired and appropriate wildlife enhancement projects.
- Prune conifers in high use areas.
- Use government cost share programs to implement projects whenever possible.

- Eradicate exotic species from the forest.

Miscellaneous

- Identify and protect specimen trees and groves, as the landowner desires.
- Identify and maintain property lines and monuments on the property.
- Participate as a Certified Sustainable Forest under the Forest Stewardship Council with Edward A. Tunheim Consulting Forester.
- Update maps and forest management data as needed.
- Maintain a written and mapped record of projects performed on the property.
- Maintain and promote the development of large woody debris and snags for wildlife habitat where needed.
- Monitor sensitive wildlife species and habitats.

Appendix

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2009 Forest Type 1											
Trees Per Acre By Diameter and Species											
Diameters	Redwood	Douglas-fir	Grand fir	Western Hemlock	Tanoak	Myrtle	Bay	Madrone	Bishop pine	Nutmeg	Total
0	43.8	1.3	24.4	0.6	34.4	0.0	1.3	0.0	1.3	0.0	106.9
2	99.4	1.9	22.5	0.0	18.8	0.0	0.0	0.0	0.0	0.6	143.1
4	20.6	1.3	6.9	0.6	3.1	0.0	0.0	0.0	0.0	0.0	32.5
6	15.0	0.0	0.0	0.0	0.6	0.0	0.0	0.0	0.0	0.0	15.6
8	2.5	0.0	1.3	0.0	0.6	0.0	0.0	0.0	0.0	0.0	4.4
10	2.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.5
12	3.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.1
14	5.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.0
16	3.8	0.6	0.0	0.0	0.0	0.0	0.6	0.0	0.0	0.0	5.0
18	6.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.6	7.5
20	10.0	0.0	0.0	0.6	0.0	0.0	0.0	0.0	0.0	0.0	10.6
22	7.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	7.5
24	7.5	0.0	0.0	0.0	0.6	0.0	0.0	0.0	0.0	0.0	8.1
26	6.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6.9
28	10.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	10.6
30	8.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	8.8
32	8.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	8.8
34	1.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.9
36	1.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.9
38	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
40	1.9	0.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.5
42	0.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.6
44	0.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.6
46	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
48	0.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.6
50	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total	270.0	5.6	55.0	1.9	58.1	0.0	1.9	0.0	1.3	1.2	394.9

**2009 Forest Type 2
Trees Per Acre By Diameter and Species**

Diameters	Redwood	Douglas-fir	Grand fir	Western Hemlock	Tanoak	Myrtle	Bay	Madrone	Bishop pine	Nutmeg	Total
0	29.4	2.5	32.5	0.0	37.5	2.5	0.0	0.0	0.0	0.0	104.4
2	70.6	15.6	12.5	0.0	88.8	2.5	0.0	0.0	0.0	0.6	190.6
4	20.6	11.3	7.5	0.0	22.5	0.0	0.0	0.0	0.0	0.0	61.9
6	26.9	1.9	1.9	0.0	6.3	0.0	0.0	0.0	0.0	0.0	36.9
8	11.3	0.0	1.9	0.0	3.1	0.0	0.0	0.0	0.0	0.0	16.3
10	7.5	0.0	0.0	0.0	0.6	0.0	0.0	0.0	0.0	0.0	8.1
12	11.4	0.0	0.0	0.0	0.0	0.0	0.0	0.6	0.0	0.0	12.1
14	18.6	0.0	0.0	0.0	0.6	0.0	0.0	0.0	0.0	0.0	19.2
16	12.1	1.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	13.5
18	10.7	0.0	0.0	0.0	0.6	0.0	0.0	0.0	0.0	0.0	11.3
20	16.4	0.0	0.0	0.0	0.6	0.0	0.0	0.0	0.0	0.0	17.1
22	12.9	1.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	14.3
24	7.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	7.1
26	5.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.0
28	7.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	7.9
30	5.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.0
32	3.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.6
34	3.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.6
36	2.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.1
38	1.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.4
40	0.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.7
42	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
44	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
46	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
48	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
50	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total	284.8	34.1	56.3	0.0	160.6	5.0	0.0	0.0	0.0	0.6	542.0

**2009 Forest Type 3
Trees Per Acre By Diameter and Species**

Diameters	Redwood	Douglas-fir	Grand fir	Western Hemlock	Tanoak	Myrtle	Bay	Madrone	Bishop pine	Nutmeg	Total
0	3.3	16.7	68.3	0.0	66.7	0.0	0.0	0.0	0.0	0.0	155.0
2	10.0	16.7	0.0	1.7	75.0	0.0	0.0	0.0	0.0	0.0	103.3
4	5.0	0.0	1.7	0.0	5.0	0.0	0.0	0.0	0.0	0.0	11.7
6	8.3	1.7	0.0	0.0	3.3	0.0	0.0	0.0	0.0	0.0	13.3
8	23.3	1.7	0.0	0.0	3.3	0.0	0.0	0.0	0.0	0.0	28.3
10	6.7	1.7	0.0	0.0	1.7	0.0	0.0	0.0	0.0	0.0	10.0
12	13.3	8.3	0.0	0.0	1.7	0.0	0.0	0.0	0.0	0.0	23.3
14	15.0	10.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	25.0
16	20.0	3.3	1.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	25.0
18	13.3	1.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	15.0
20	11.7	1.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	13.3
22	21.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	21.7
24	8.3	1.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	10.0
26	5.0	1.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6.7
28	6.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6.7
30	3.3	1.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.0
32	0.0	1.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.7
34	0.0	1.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.7
36	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
38	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
40	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
42	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
44	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
46	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
48	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
50	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total	175.0	71.7	71.7	1.7	156.7	0.0	0.0	0.0	0.0	0.0	476.7

**2009 Forest Type 4
Trees Per Acre By Diameter and Species**

Diameters	Redwood	Douglas-fir	Grand fir	Western Hemlock	Tanoak	Myrtle	Bay	Madrone	Bishop pine	Nutmeg	Total
0	50.0	16.7	33.3	13.3	150.0	0.0	0.0	0.0	0.0	0.0	263.3
2	110.0	1.7	40.0	23.3	140.0	0.0	0.0	0.0	0.0	0.0	315.0
4	46.7	1.7	6.7	0.0	60.0	0.0	0.0	0.0	0.0	0.0	115.0
6	16.7	3.3	0.0	0.0	16.7	0.0	0.0	0.0	0.0	0.0	36.7
8	13.3	0.0	0.0	0.0	8.3	0.0	0.0	0.0	0.0	0.0	21.7
10	8.3	1.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	10.0
12	6.7	3.3	1.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	11.6
14	16.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	16.7
16	16.7	3.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	20.0
18	11.7	3.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	15.0
20	6.7	1.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	8.3
22	1.7	0.0	1.6	0.0	0.0	0.0	0.0	0.0	1.6	0.0	4.9
24	6.7	3.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	10.0
26	1.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.7
28	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
30	5.0	1.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6.7
32	1.7	1.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.3
34	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
36	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
38	0.0	1.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.7
40	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
42	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
44	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
46	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
48	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
50	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total	320.0	45.0	83.2	36.7	375.0	0.0	0.0	0.0	1.6	0.0	861.5

**2009 Forest Type 5
Trees Per Acre By Diameter and Species**

Diameters	Redwood	Douglas-fir	Grand fir	Western Hemlock	Tanoak	Myrtle	Bay	Madrone	Bishop pine	Nutmeg	Total
0	10.0	20.0	0.0	0.0	120.0	0.0	0.0	0.0	0.0	0.0	150.0
2	15.5	0.0	0.0	0.0	105.0	0.0	0.0	0.5	0.0	0.0	121.0
4	8.5	1.0	0.0	0.0	13.5	0.0	0.0	0.0	0.0	0.5	23.5
6	11.0	0.5	0.0	0.0	23.5	0.0	0.0	0.5	0.0	3.0	38.5
8	5.5	2.5	0.0	0.0	13.5	0.0	0.0	0.5	0.0	0.5	22.5
10	3.5	2.0	0.0	0.0	11.5	0.0	0.0	0.0	0.0	1.0	18.0
12	6.5	0.0	0.5	0.0	8.5	0.0	0.0	1.5	2.5	0.0	19.5
14	3.5	2.5	0.0	0.0	3.5	0.0	0.0	1.0	2.5	0.0	13.0
16	4.0	3.0	0.0	0.0	2.0	0.0	0.0	1.0	4.0	0.0	14.0
18	6.0	1.0	0.0	0.0	1.0	0.0	0.0	0.5	0.5	0.0	9.0
20	2.5	3.0	0.0	0.0	1.0	0.0	0.0	1.5	5.0	0.0	13.0
22	4.5	1.5	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0	7.0
24	2.5	1.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0	4.5
26	0.5	1.5	0.0	0.0	0.0	0.0	0.0	0.0	1.5	0.0	3.5
28	1.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.5	0.0	2.0
30	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0	1.5
32	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.5
34	0.5	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0
36	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5
38	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
40	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5
42	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
44	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
46	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
48	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
50	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total	87.0	40.0	0.5	0.0	303.5	0.0	0.0	7.0	20.0	5.0	463.0

**2009 Forest Type 6
Trees Per Acre By Diameter and Species**

Diameters	Redwood	Douglas-fir	Grand fir	Western Hemlock	Tanoak	Myrtle	Bay	Madrone	Bishop pine	Nutmeg	Total
0	0.0	0.0	0.0	0.0	143.8	0.0	0.0	0.0	0.0	0.0	143.8
2	28.8	0.6	0.0	0.0	162.5	0.0	0.0	0.0	0.0	0.0	191.9
4	20.0	0.0	0.0	0.0	13.1	0.0	0.0	0.0	0.0	0.0	33.1
6	18.8	0.0	0.0	0.0	11.9	0.0	0.0	0.0	0.0	0.0	30.6
8	9.4	0.0	0.0	0.0	5.6	0.0	0.0	0.0	0.0	0.0	15.0
10	8.1	0.6	0.0	0.0	8.8	0.0	0.0	0.0	0.0	0.0	17.5
12	11.3	1.5	0.0	0.0	9.8	0.0	0.0	0.0	0.8	0.0	23.3
14	10.5	0.8	0.0	0.0	3.8	0.0	0.0	0.8	0.0	0.0	15.8
16	18.0	1.5	0.0	0.0	3.8	0.0	0.0	0.8	0.0	0.0	24.0
18	18.0	0.0	0.0	0.0	4.5	0.0	0.0	0.0	1.5	0.0	24.0
20	15.8	2.3	0.0	0.0	0.8	0.0	0.0	0.0	0.0	0.0	18.8
22	7.5	0.8	0.0	0.0	0.8	0.0	0.0	0.0	0.0	0.0	9.0
24	13.5	2.3	0.0	0.0	1.5	0.0	0.0	0.0	0.0	0.0	17.3
26	4.5	0.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.3
28	6.0	1.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	7.5
30	5.3	1.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6.8
32	1.5	1.5	0.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.8
34	3.0	0.0	0.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.8
36	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
38	0.8	0.0	0.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.5
40	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
42	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
44	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
46	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
48	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
50	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total	200.5	15.5	2.3	0.0	370.4	0.0	0.0	1.5	2.3	0.0	592.4

2009 Forest Type 7
Trees Per Acre By Diameter and Species

Diameters	Redwood	Douglas-fir	Grand fir	Western Hemlock	Tanoak	Myrtle	Bay	Madrone	Bishop pine	Nutmeg	Total
0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
8	0.0	10.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	10.0
10	0.0	15.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	15.0
12	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
14	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
16	0.0	10.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	10.0
18	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
20	0.0	10.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	10.0
22	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
24	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
26	0.0	10.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	10.0
28	10.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	10.0
30	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
32	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
34	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
36	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
38	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
40	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
42	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
44	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
46	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
48	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
50	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total	10.0	55.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	65.0

**2009 Forest Type 8
Trees Per Acre By Diameter and Species**

Diameters	Redwood	Douglas-fir	Grand fir	Western Hemlock	Tanoak	Myrtle	Bay	Madrone	Bishop pine	Nutmeg	Total
0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
10	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
12	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
14	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.0	0.0	5.0
16	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	10.0	0.0	10.0
18	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.0	0.0	5.0
20	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
22	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	20.0	0.0	20.0
24	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
26	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
28	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
30	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
32	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
34	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
36	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
38	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
40	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
42	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
44	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
46	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
48	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
50	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	40.0	0.0	40.0

**Forest Growth Projections
by Vegetation Type & Merchantability**

Type	Acres	Growth/Ac/Year		Growth/Ac/10-yr		Total Growth / 10-yr	
		Sub Merch	Merch	Sub Merch	Merch	Sub Merch	Merch
Type 1	20	254	1,686	2,540	16,860	50,800	337,200
Type 2	37	501	1,888	5,010	18,880	185,370	698,560
Type 3	19	227	1,008	2,270	10,080	43,130	191,520
Type 4	22	155	592	1,550	5,920	34,100	130,240
Type 5	75	112	319	1,120	3,190	84,000	239,250
Type 6	70	217	1,431	2,170	14,310	151,900	1,001,700
Type 7	5	91	312	910	3,120	4,550	15,600
Type 8	10	-	-	-	-	-	-
Total	258	1,557	7,236	15,570	72,360	553,850	2,614,070

**Basal Area Per Acre (Square Feet)
by Type and Species**

Type	Redwood	Douglas-fir	Grand fir	Western hemlock	Bishop pine	Tanoak	Bay	Total	Total Conifer
Type 1	328	0	3	6	0	3	3	344	338
Type 2	309	66	6	0	0	9	0	391	381
Type 3	342	58	8	0	0	25	0	433	408
Type 4	142	58	8	0	8	0	0	217	208
Type 5	73	48	0	0	48	98	0	265	120
Type 6	288	28	9	0	6	109	0	441	325
Type 7	50	125	0	0	0	0	0	175	175
Type 8	0	0	0	0	75	0	0	75	0

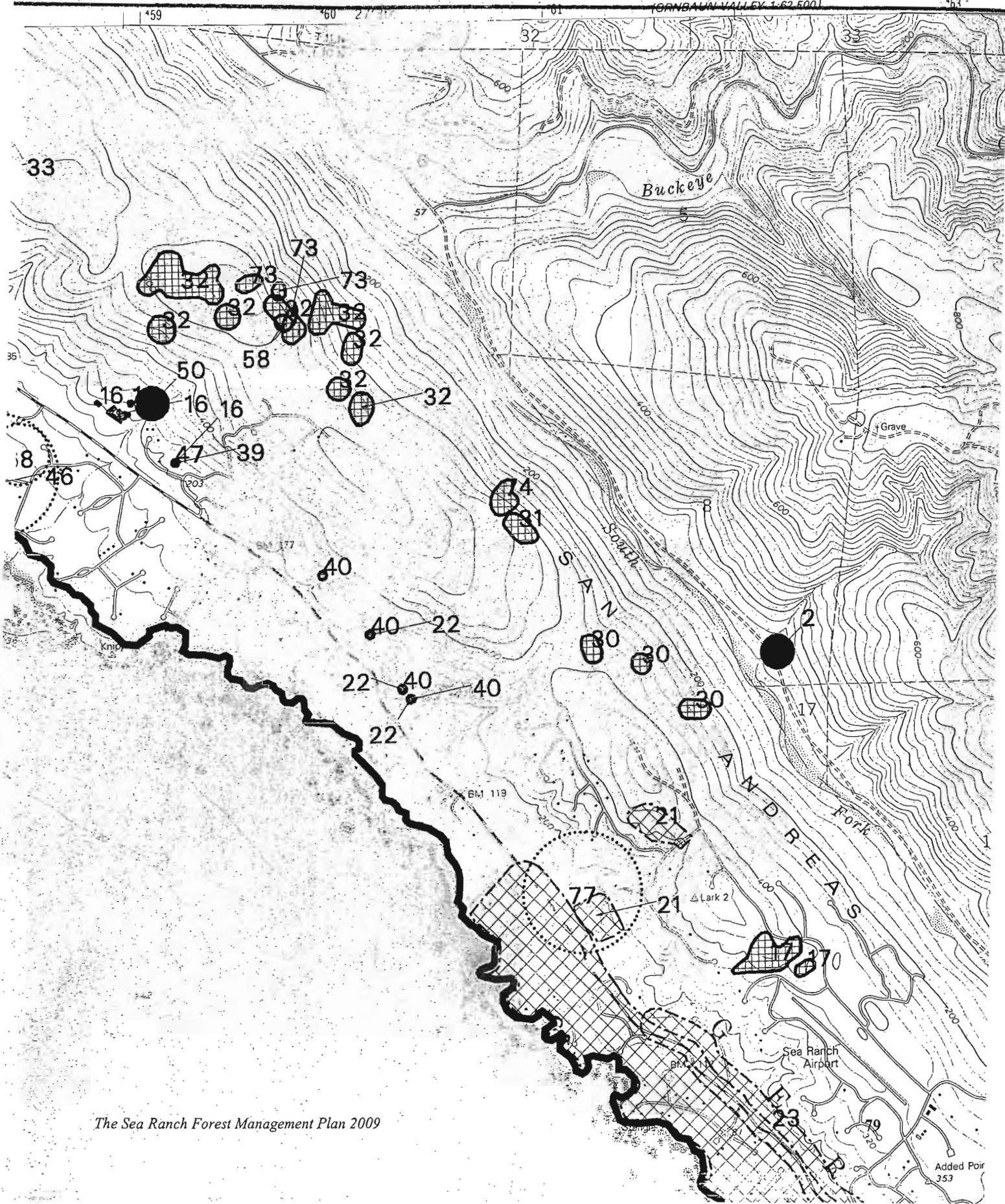
**2009 Snags Per Acre
by Type and Kind**

Type	Snags				Green Snag			Total
	Large Conifer	Small Conifer	Large Hardwood	Small Hardwood	12" - 24"	24" - 34"	36+	
Type 1	1.9	0.0	0.0	0.0	1.3	0.0	0.0	3.1
Type 2	6.3	0.6	0.0	0.6	0.6	0.0	0.0	8.1
Type 3	5.0	3.3	1.7	1.7	5.0	0.0	0.0	16.7
Type 4	3.3	3.3	0.0	0.0	0.0	0.0	0.0	6.7
Type 5	4.5	2.5	0.0	1.0	1.0	0.0	0.0	9.0
Type 6	1.3	0.0	0.0	0.0	0.0	0.0	0.0	1.3
Type 7	20.0	10.0	0.0	0.0	0.0	0.0	0.0	30.0
Type 8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

STATE OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES

SONC
BOARD
DEPARTMENT

1361 IV
GRNBAUN VALLEY 1-62 5001



The Sea Ranch Forest Management Plan 2009

Added Point
353

Campanula californica

swamp harebell

Element Code: PDCAM02060

Status	NDDB Element Ranks	Other Lists
Federal: None	Global: G3	CNPS List: 1B.2
State: None	State: S3.2	

Habitat Associations
 General: BOGS AND FENS, CLOSED-CONE CONIFEROUS FOREST, COASTAL PRAIRIE, MEADOWS, FRESHWATER MARSH, N COAST CONIFEROUS FOREST.
 Micro: BOGS AND MARSHES IN A VARIETY OF HABITATS; UNCOMMON WHERE IT OCCURS. 1-405M.

Occurrence No. 62	Map Index: 44635	EO Index: 44635	Dates Last Seen
Occ Rank: Unknown			Element: 1991-07-23
Origin: Natural/Native occurrence			Site: 1991-07-23
Presence: Presumed Extant			
Trend: Unknown			Record Last Updated: 2000-12-29

Quad Summary: Stewarts Point (3812364/520B)
 County Summary: Sonoma

Lat/Long: 38.68948° / -123.41916°	UTM: Zone-10 N4282402 E463546	Area: 2.0 acres	Elevation: 625 ft	Mapping Precision: SPECIFIC	Symbol Type: POLYGON	Township: 10N	Range: 14W	Section: 28	Meridian: M	Qtr: XX
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Location: THE SSEA RANCH, ABOUT 1 MILE NE OF BLACK POINT ALONG TIMBER RIDGE ROAD AT INDIAN CLOSE, NORTH OF STEWARTS POINT.
 Location Detail: SINGLE COLONY MAPPED JUST WEST OF TIMBER RIDGE RD AND JUST NORTH OF INDIAN CLOSE.
 Ecological: SHALLOW SAG POND/SWALE IN REDWOOD FOREST. GROWING WITH CAREX AND BOTRICHUM MULTIFIDUM SPP SILAIFOLIUM.
 Threat: DEVELOPMENT AND UNDERSTORY THINNING FOR FUEL REDUCTION.
 General: NOT COUNTED IN 1991.
 Owner/Manager: PVT

Occurrence No. 63	Map Index: 44636	EO Index: 44636	Dates Last Seen
Occ Rank: Good			Element: 1998-06-19
Origin: Natural/Native occurrence			Site: 1998-06-19
Presence: Presumed Extant			
Trend: Unknown			Record Last Updated: 2000-12-29

Quad Summary: Stewarts Point (3812364/520B)
 County Summary: Sonoma

Lat/Long: 38.72080° / -123.44506°	UTM: Zone-10 N4285888 E461310	Area: 7.7 acres	Elevation: 400 ft	Mapping Precision: SPECIFIC	Symbol Type: POLYGON	Township: 10N	Range: 14W	Section: 08	Meridian: M	Qtr: XX
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Location: RIDGE ABOVE THE SEA RANCH, ABOUT 0.9-1.3 MILES NNW OF SEA RANCH AIRPORT, SE OF GUALALA.
 Location Detail: SEVERAL COLONIES MAPPED WITHIN 3 POLYGONS.
 Ecological: MESIC TO WET OPENINGS WITH SANDY AND CLAY SOILS. IN REDWOOD FOREST WITH BISHOP PINE FOREST, COASTAL SCRUB, AND POND INCLUSIONS. ASSOCIATED WITH WHIPPLEA MODESTA, STACHYS AJUGOIDES, STELLARIA CRISPA, HYPERICUM ANAGALLOIDES, ET AL.
 Threat: WETLAND ALTERATION, TIMBER HARVEST, AND ROAD MAINTENANCE.
 General: LOCALLY COMMON IN 1998.
 Owner/Manager: PVT

Occurrence No. 64	Map Index: 44637	EO Index: 44637	Dates Last Seen
Occ Rank: Good			Element: 1998-06-19
Origin: Natural/Native occurrence			Site: 1998-06-19
Presence: Presumed Extant			
Trend: Unknown			Record Last Updated: 2000-12-29

Quad Summary: Stewarts Point (3812364/520B)
 County Summary: Sonoma

Lat/Long: 38.72669° / -123.45217°	UTM: Zone-10 N4286544 E460695	Area: 4.0 acres	Elevation: 490 ft	Mapping Precision: SPECIFIC	Symbol Type: POLYGON	Township: 10N	Range: 14W	Section: 07	Meridian: M	Qtr: XX
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Location: RIDGE ABOVE THE SEA RANCH, ABOUT 1.7 MILES NNW OF SEA RANCH AIRPORT, SE OF GUALALA.
 Location Detail: SEVERAL COLONIES MAPPED IN SINGLE POLYGON.
 Ecological: MESIC TO WET OPENINGS WITH SANDY AND CLAY SOILS. IN REDWOOD FOREST WITH BISHOP PINE FOREST, COASTAL SCRUB, AND POND INCLUSIONS. ASSOCIATED WITH WHIPPLEA MODESTA, STACHYS AJUGOIDES, STELLARIA CRISPA, HYPERICUM ANAGALLOIDES, ET AL.
 Threat: WETLAND ALTERATION, TIMBER HARVEST, AND ROAD MAINTENANCE.
 General: LOCALLY COMMON IN 1998.
 Owner/Manager: PVT

Erigeron supplex

supple daisy

Element Code: PDAST3M3Z0

Status	NDDB Element Ranks	Other Lists
Federal: None	Global: G1	CNPS List: 1B.2
State: None	State: S1.1	

Habitat Associations
 General: COASTAL BLUFF SCRUB, COASTAL PRAIRIE.
 Micro: USUALLY IN GRASSY SITES. 5-50M.

Occurrence No. 2	Map Index: 07377	EO Index: 17005	Dates Last Seen
Occ Rank: Unknown			Element: 1937-06-18
Origin: Natural/Native occurrence			Site: 1937-06-18
Presence: Presumed Extant			
Trend: Unknown			Record Last Updated: 2003-11-13

Quad Summary: Stewarts Point (3812364/520B)
 County Summary: Sonoma

Lat/Long: 38.67093° / -123.41491°	Township: 10N
UTM: Zone-10 N4280343 E463905	Range: 14W
Area:	Section: 33
Elevation: 130 ft	Meridian: M
	Qtr: XX

Location: 1.7 MI N OF STEWARTS POINT POST OFFICE.
 Location Detail: MAPPED ALONG HIGHWAY ONE APPROXIMATELY 1.7 MILES NORTH OF STEWARTS POINT TOWN.
 Ecological: IN MARITIME GRASSLAND.
 General: NO PLANTS FOUND SINCE 1967.
 Owner/Manager: PVT

Occurrence No. 3	Map Index: 07312	EO Index: 29065	Dates Last Seen
Occ Rank: Fair			Element: 2005-06-23
Origin: Natural/Native occurrence			Site: 2005-06-23
Presence: Presumed Extant			
Trend: Fluctuating			Record Last Updated: 2008-06-24

Quad Summary: Stewarts Point (3812364/520B)
 County Summary: Sonoma

Lat/Long: 38.73141° / -123.47537°	Township: 10N
UTM: Zone-10 N4287079 E458681	Range: 15W
Area: 1.0 acres	Section: 12
Elevation: 160 ft	Meridian: M
	Qtr: XX

Location: EAST SIDE OF HIGHWAY 1, NEAR MILEPOST 55.44, THE SEA RANCH NEAR NORTH FIRE STATION, AND S OF JCT WHALE BONE REACH.
 Location Detail: 3 NORTHERN COLONIES ARE IN FIREBREAK, AND SOME IN SHORT GRASS AREAS. SOUTHERN COLONY IS GROWING ALONG AN UNPAVED ROAD EAST OF AND PARALLEL TO HWY 1.
 Ecological: ON FIREBREAK AND IN ADJACENT GRASSY AREA; IN SHORTGRASS & DISTURBED AREAS. RARE PLANTS S OF WHALE BONE REACH: CAMPANULA CALIFORNICA, VERATRUM FIMBRIATRUM, LOTUS FORMOSISSIMUS, CEANOTHUS GLORIOSUS GLORIOSUS, CALYSTEGIA PURPURATA SAXICOLA.
 Threat: POSSIBLE THREATS FROM BUILDING OR REFORMING FIREBREAK. SOUTHERN COLONY: PROPOSED WATERLINE INSTALLATION.
 General: 34 SMALL COLONIES OF LESS THAN 50 PLANTS TOTAL IN 1984. ONLY A FEW DEPAUPERATE PLANTS IN 1985, < 100 IN 1986, 17 IN 1987, 52 IN 1988, SAME IN 1988-90, UNKNOWN # IN 1992-94, 36 IN 1995, 21 IN 1996, & NONE IN 1997, UNKNOWN # IN 2005.
 Owner/Manager: PVT, UNKNOWN

Occurrence No. 4	Map Index: 07339	EO Index: 17003	Dates Last Seen
Occ Rank: Good			Element: 2003-XX-XX
Origin: Natural/Native occurrence			Site: 2003-XX-XX
Presence: Presumed Extant			
Trend: Fluctuating			Record Last Updated: 2008-06-19

Quad Summary: Stewarts Point (3812364/520B)
 County Summary: Sonoma

Lat/Long: 38.70792° / -123.43722°	Township: 10N
UTM: Zone-10 N4284456 E461984	Range: 14W
Area: 11.3 acres	Section: 17
Elevation: 420 ft	Meridian: M
	Qtr: SE

Location: NEAR WEST END OF THE SEA RANCH AIR STRIP, SEA RANCH, ABOUT 4 KILOMETERS SOUTH OF THE NORTH FIRE STATION.
 Location Detail: 1985 COLLECTION BY WELLS FROM "4 KM SOUTH OF NORTH FIRESTATION" ATTRIBUTED TO THIS SITE. APPROACH VIA HIGHWAY 1, ANNAPOLIS ROAD, TURN NW ON TIMBER RIDGE ROAD AND WEST ON SPRING MEADOW ROAD.
 Ecological: GROWING IN MOSTLY SHORT GRASS PRAIRIE WITH SOME IRIS DOUGLASII, PINUS MURICATA, AND BRODIAEA TERESTRIS. SOIL IS SANDY LOAM.

Erigeron supplex

supple daisy

Element Code: PDAST3M3Z0

Status _____ NDBB Element Ranks _____ Other Lists _____
 Federal: None Global: G1 CNPS List: 1B.2
 State: None State: S1.1

Habitat Associations _____
 General: COASTAL BLUFF SCRUB, COASTAL PRAIRIE.
 Micro: USUALLY IN GRASSY SITES. 5-50M.

General: 4 PLANTS IN 1985, 700 NW OF AIRPORT IN 1989, SAME # IN 1990, UNK # IN 1992-1994, 178 IN 1994, 203 IN 1996, 152 IN 1997. CNPS PLANT WATCH REPORT FOR (SEA RANCH) "SPRING MEADOW (AIRPORT)": 262 IN 1999, 491 IN 2000, 35 IN 2002, 580 IN 2003.

Owner/Manager: PVT

Occurrence No. 5 Map Index: 07270 EO Index: 17000 Dates Last Seen _____
 Occ Rank: Unknown Element: 2003-XX-XX
 Origin: Natural/Native occurrence Site: 2003-XX-XX
 Presence: Presumed Extant Record Last Updated: 2008-06-19
 Trend: Fluctuating

Quad Summary: Stewarts Point (3812364/520B)
 County Summary: Sonoma

Lat/Long: 38.74573° / -123.51418° Township: 10N
 UTM: Zone-10 N4288686 E455316 Range: 15W
 Radius: 1/5 mile Mapping Precision: NON-SPECIFIC Section: 3 Qtr: XX
 Elevation: 25 ft Symbol Type: POINT Meridian: M

Location: SEA RANCH, WEST OF HWY 1, 4000 FT S OF GUALALA RIVER.
 Location Detail: "COMMONS SITE". SOUTHEAST OF THE INTERSECTION OF HALCYON AND LEEWARD, WEST OF SEA STACK. ALSO INCLUDES "GOLF COURSE" SITES. NEED BETTER MAP DETAIL FOR THESE POPULATIONS.
 Ecological: SCATTERED IN FIELDS OF DRY GRASS ON SANDY LOAM WITH HOLCUS LANATUS AND CALAMAGROSTIS NUTKAENSIS IN MOIST AREAS NORTH OF ERIGERON.
 Threat: HOME CONSTRUCTION.
 General: ~15 PLANTS IN 1985. <50 IN 1986-88, 70 AT NEW POP. IN 1989, SAME # IN 1990, <1000 IN 1992, UNKNOWN # IN '93 & '94, 36 IN '95, 105 IN '96, 87 IN '97. AT "GOLF COURSE, 9TH HOLE": 35 IN '99, 106 IN '00, 105 IN '01, 116 IN '02, 135 IN '03.

Owner/Manager: PVT

Occurrence No. 20 Map Index: 53346 EO Index: 53346 Dates Last Seen _____
 Occ Rank: Good Element: 2003-XX-XX
 Origin: Natural/Native occurrence Site: 2003-XX-XX
 Presence: Presumed Extant Record Last Updated: 2008-06-19
 Trend: Fluctuating

Quad Summary: Stewarts Point (3812364/520B)
 County Summary: Sonoma

Lat/Long: 38.70970° / -123.44734° Township: 10N
 UTM: Zone-10 N4284658 E461106 Range: 14W
 Area: Mapping Precision: NON-SPECIFIC Section: 17 Qtr: W
 Elevation: 375 ft Symbol Type: POLYGON Meridian: M

Location: LONGMEADOW ROAD, JUST EAST OF HIGHWAY ONE AND EXTENDING EAST OF SCHOONER DRIVE, SEA RANCH AREA.
 Location Detail: 2 COLONIES: PLANTS SEEN ON E SIDE OF HWY 1 NEAR MILEAGE MARKER 53.24 ON N & S SIDES OF LONGMEADOW RD, & N & E OF SCHOONER DR & LONGMEADOW RD (TIMBER PRESERVE). SEA RANCH PLANNING DEPT IS AWARE OF THE PLANTS.
 Ecological: ON MEADOW EDGE OF SEQUOIA SEMPERVIRENS AND PSEUDOTSUGA MENZIESII FOREST, AND IN MEADOWS OF COASTAL PRAIRIE. ASSOCIATES: ZIGADENUS FREMONTII AND BRODIAEA TERRESTIS. SOUTH ASPECT.
 Threat: AREA IS GOING TO BE LOGGED, BUT PLANTS SHOULD BE PROTECTED. SEA RANCH OWNERS ARE TRYING TO BUY THIS SITE AS A PRESERVE.
 General: <50 PLANTS IN 1987 N & S OF LONGMEADOW DR & E OF HWY 1. 452 IN 1990 AT TIMBER PRES. 200 IN 1995, 116 IN 1996, 117 IN 1997. 1297 IN NE ("SCHOONER"), 43 IN SW ("BASE OF LONGMEADOW") IN 1999; 1035 NE 2000; 1408 NE, 18 SW IN 2002; 3411 NE 2003.

Owner/Manager: PVT

Lilium maritimum

coast lily

Element Code: PMLIL1A0C0

Status _____ NDDB Element Ranks _____ Other Lists _____
 Federal: None Global: G2 CNPS List: 1B.1
 State: None State: S2.1

Habitat Associations _____
 General: CLOSED-CONE CONIFEROUS FOREST, COASTAL PRAIRIE, COASTAL SCRUB, BROADLEAVED UPLAND FOREST, NORTH COAST CONIFEROUS FOREST.
 Micro: HISTORICALLY IN SANDY SOIL, OFTEN ON RAISED HUMMOCKS OR BOGS; TODAY MOSTLY IN ROADSIDE DITCHES. 10-335M.

Threat: BRUSH ENROACHMENT, ROAD & POWERLINE MAINTENANCE, TIMBER HARVESTING, & DEER BROWSING.
 General: APPROXIMATELY 107 INDIVIDUALS BETWEEN THIS AND OCCURRENCE #58.

Owner/Manager: PVT-GUALALA REDWOODS

Occurrence No. 58	Map Index: 47052	EO Index: 47052	Dates Last Seen
Occ Rank: Unknown			Element: 1998-06-19
Origin: Natural/Native occurrence			Site: 1998-06-19
Presence: Presumed Extant			Record Last Updated: 2002-01-23
Trend: Unknown			

Quad Summary: Stewarts Point (3812364/520B)
 County Summary: Sonoma

Lat/Long: 38.72810° / -123.45326°	UTM: Zone-10 N4286701 E460601	Area: 4.1 acres	Elevation: 520 ft	Mapping Precision: SPECIFIC	Symbol Type: POLYGON	Township: 10N	Range: 14W	Section: 07	Meridian: M	Qtr: NE
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Location: SAN ANDREAS RIFT ZONE. APPROXIMATELY 0.8 AIR MILE SSE OF BUCKEYE CREEK CONFLUENCE WITH SOUTH FORK GUALALA RIVER.

Location Detail: 5 COLONIES MAPPED AS ONE POLYGON BY CNDDDB.

Ecological: BISHOP PINE FOREST & TRANSITIONAL AREAS BETWEEN PINUS MURICATA & SEQUOIA SEMPERVIRENS FORESTS ON SANDY SUBSTRATES ALONG A MARITIME RIDGE. ASSOCIATES: ARCTOSTAPHYLOS CANESCENS SSP. CANESCENS, ARCTOSTAPHYLOS NUMMULARIA, CEANOTHUS SP, ET AL.

Threat: BRUSH ENROACHMENT, ROAD & POWERLINE MAINTENANCE, TIMBER HARVESTING, & DEER BROWSING.

General: APPROXIMATELY 107 INDIVIDUALS BETWEEN THIS AND OCCURRENCE #57.

Owner/Manager: PVT-GUALALA REDWOODS

Rana boylei

foothill yellow-legged frog

Element Code: AAABH01050

Status _____ NDDB Element Ranks _____ Other Lists _____
 Federal: None Global: G3 CDFG Status: SC
 State: None State: S2S3

Habitat Associations _____

General: PARTLY-SHADED, SHALLOW STREAMS & RIFFLES WITH A ROCKY SUBSTRATE IN A VARIETY OF HABITATS.
 Micro: NEED AT LEAST SOME COBBLE-SIZED SUBSTRATE FOR EGG-LAYING. NEED AT LEAST 15 WEEKS TO ATTAIN METAMORPHOSIS.

Occurrence No. 367 Map Index: 51686 EO Index: 51686 Dates Last Seen _____
 Occ Rank: Excellent Element: 1993-10-19
 Origin: Natural/Native occurrence Site: 1993-10-19
 Presence: Presumed Extant
 Trend: Unknown Record Last Updated: 2003-07-02

Quad Summary: Stewarts Point (3812364/520B)
 County Summary: Sonoma

Lat/Long: 38.70523° / -123.40785° Township: 10N
 UTM: Zone-10 N4284146 E464537 Range: 14W
 Radius: 80 meters Mapping Precision: SPECIFIC Section: 22 Qtr: NW
 Elevation: 140 ft Symbol Type: POINT Meridian: M

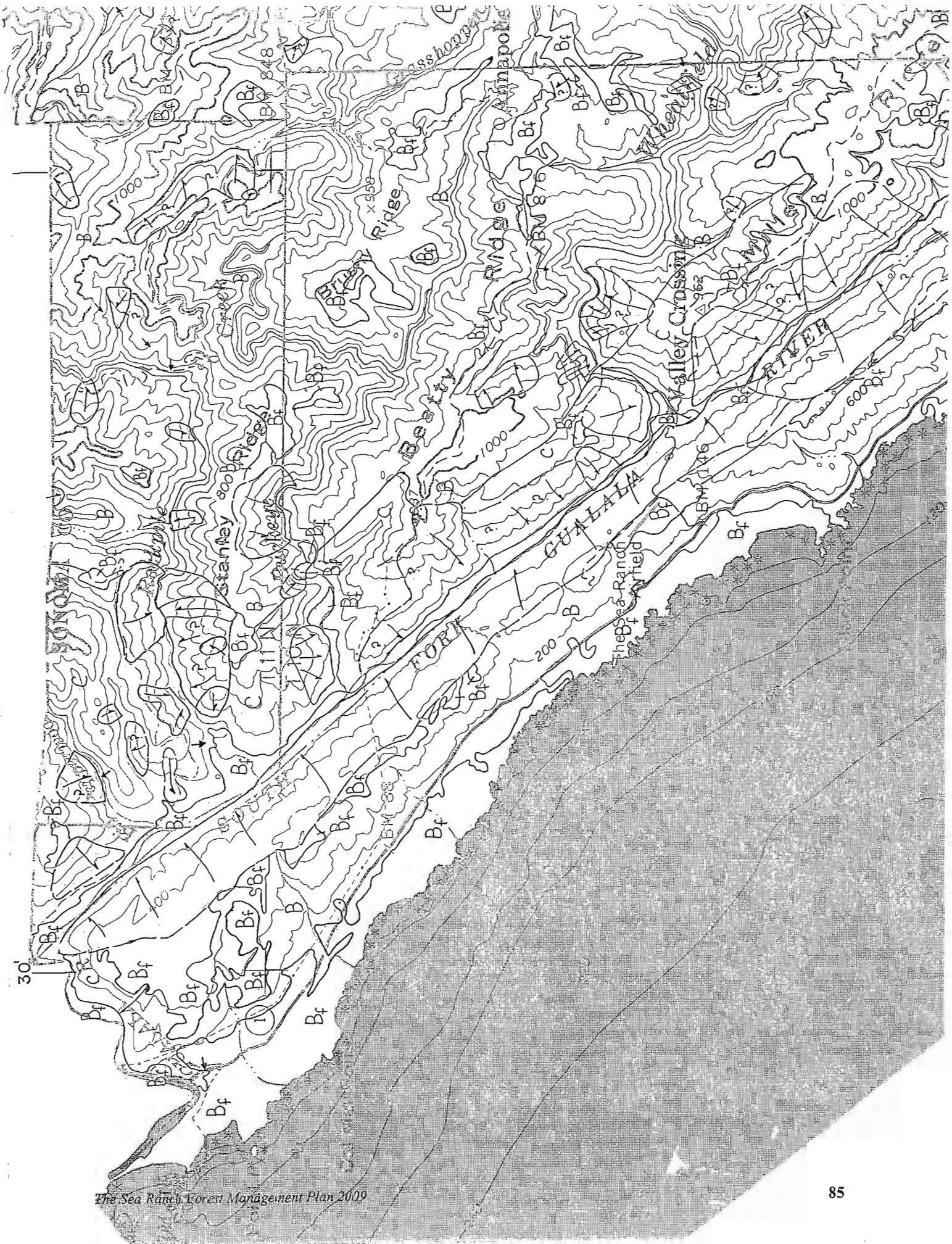
Location: WHEATFIELD FORK OF THE GUALALA RIVER, 0.6 MILE UPSTREAM FROM THE GUALALA RIVER CONFLUENCE, EAST OF SEA RANCH
 Ecological: HABITAT CONSISTS OF REDWOOD FOREST SURROUNDING THE GUALALA AND ITS TRIBUTARIES.
 General: 1 JUVENILE OBSERVED ON 19 OCT 1993.
 Owner/Manager: UNKNOWN

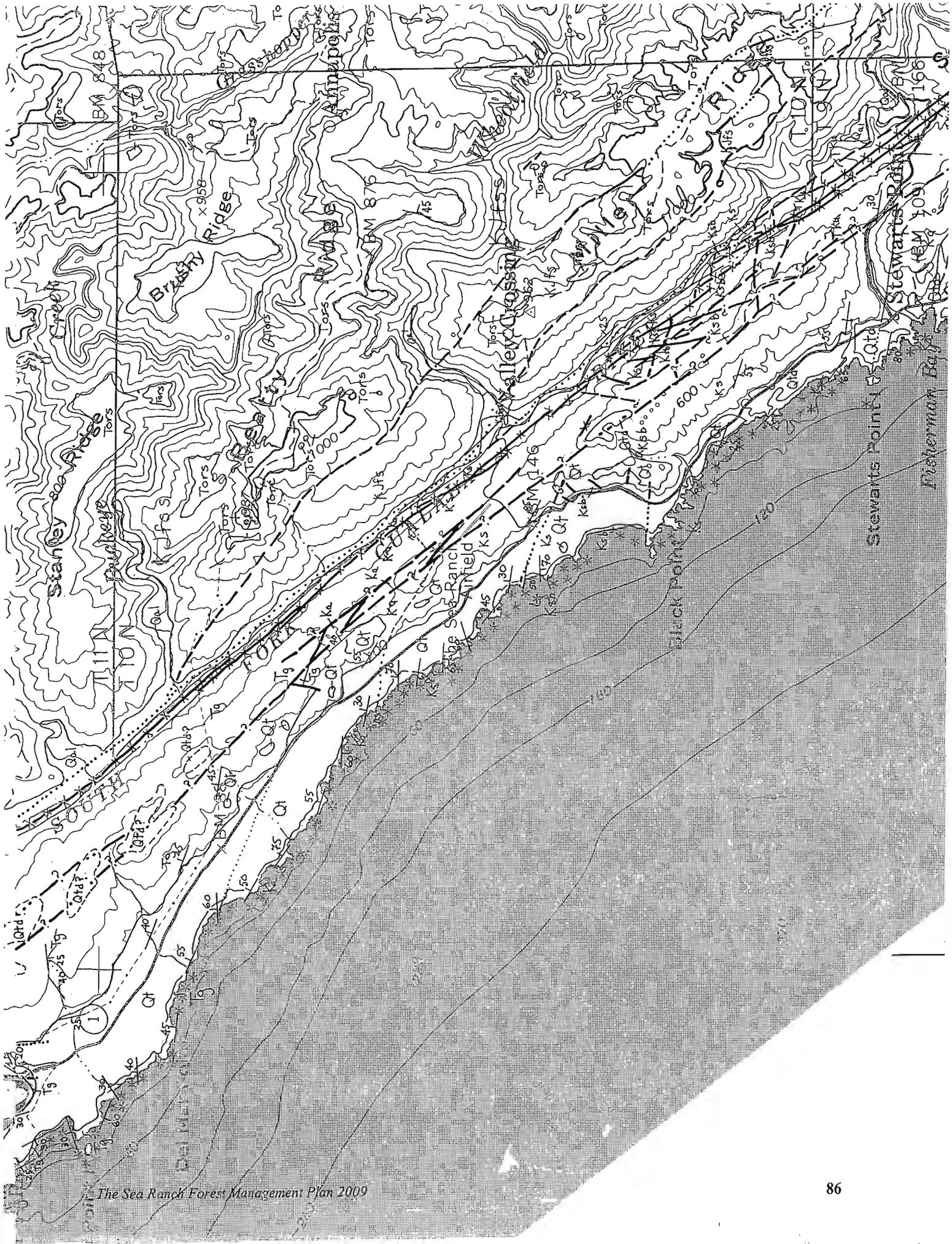
Occurrence No. 368 Map Index: 51687 EO Index: 51687 Dates Last Seen _____
 Occ Rank: Excellent Element: 1993-10-19
 Origin: Natural/Native occurrence Site: 1993-10-19
 Presence: Presumed Extant
 Trend: Unknown Record Last Updated: 2003-07-02

Quad Summary: Stewarts Point (3812364/520B)
 County Summary: Sonoma

Lat/Long: 38.72138° / -123.43728° Township: 10N
 UTM: Zone-10 N4285950 E461986 Range: 14W
 Radius: 80 meters Mapping Precision: SPECIFIC Section: 08 Qtr: SE
 Elevation: 140 ft Symbol Type: POINT Meridian: M

Location: UNNAMED TRIBUTARY TO THE GUALALA RIVER, JUST UPSTREAM FROM THE GUALALA RIVER CONFLUENCE, EAST OF SEA RANCH
 Ecological: HABITAT CONSISTS OF REDWOOD FOREST SURROUNDING THE GUALALA AND ITS TRIBUTARIES.
 General: 1 JUVENILE OBSERVED ON 19 OCT 1993.
 Owner/Manager: PVT





Additional Sources Of Information

General Resources

- 2009 Forest Practice Rules
- The California Natural Diversity Database, Nov 2008
- Technical Rule Addendum #1 and #2, Board of Forestry
- California Forestry Handbook, T. F. Arvola, 1978
- Maps of past recorded timber sales
- Assessors Parcel Maps of Sonoma County

Geologic

- Soil Survey, Sonoma County, California, USDA, SCS, 1961
- USGS maps; Stewarts Point 1977
- Keaton, J.R. and DeGraff, J.V. (1996) Surface Observations and Geologic Mapping, In Turner, A.K. and Schuster, R.L., editors Landslides, Investigation and Mitigation Transportation Research Board, National Research Council Special Report 247.
- Air photos
- CGS Special Report 120

Wildlife

- California Natural Diversity Data Base Maps (11/08).
- California Department of Fish and Game Natural Diversity Database Special Plants List, January 2009.
- California Native Plant Society's Inventory of Rare and Endangered Vascular Plants of California, February 1994.
- California Native Plant Society's Inventory of Rare and Endangered Vascular Plants of California, August 2001.
- Owls of North America, Biology and Natural History, Johnsgard, Paul. 2nd edition 2002.
- Hawks, Eagles, & Falcons of North America, Johnsgard, Paul. 1990.
- Amphibians of Oregon, Washington, and British Columbia, Corkan and Thoms, 1996.
- Plants of the Cost Redwood Region, Lyons and Cooney-Lazaneo, 1988.
- National Audubon Society, The Sibley Guide to Birds, 2000.
- "Plants of the Coast Redwood Region", Lyons and Cooney Lazaneo, 1988
- California Salmonid Stream Habitat Restoration Manual Flosi et al 1998
- NCWAP Report for the Gualala River 2002.

Archaeology

- CLFA-CDF Archaeological Training Program For RPF Vol. 1-2. June 1999.
- CLFA-CDF Archaeological Training Program For RPF Vol. 1-2. September 2005.
- Various Primary Site Records in Sonoma County

- Pomo Buildings, S.A. Barrett
- The Ethno-Geography of the Pomo And Neighboring Indians, S.A. Barrett
- Material Aspects of Pomo Culture Vol 1, S.A. Barrett
- Material Aspects of Pomo Culture Vol 2, S.A. Barrett

Other Sources of Information

- The Sea Ranch, A Declaration of Restrictions, Covenants, and Conditions
- The Sea Ranch Association Fuels Management Plan, Nov. 2002
- Identification of Areas of High Windthrow Potential at The Sea Ranch, 1999.
- Re-evaluation of the Wind Throw Problem at The Sea Ranch, 2003.
- Guidelines for Vegetation Management, Pilot's Reach and Fly Cloud Windthrow Areas, 2005.
- The Sea Ranch Web Pages.

Personal Contacts

- Bill Weimeyer
- Mike Howell
- Bob Hartstock

The Sea Ranch
Central TPZ
Sonoma County, California

Property Map

German Rancho
Scale 1" = 660' CI = 40'
Stewarts Point Quad

660 Feet

- Legend
- Property Boundary
 - Seasonal Roads
 - Hiking Trails
 - Class II Watercourse
 - Class III Watercourse
 - Sag Pond
 - Water Tank

Edward A. Tunheim
March 2009

