

## Watershed Characterization

March 2009



### Redwood Creek Watershed

Area	Hydrologic Units	Calwater Subbasins ---	(Planning Watersheds)
5,616 Acres	18050005	2201300003	Fern Creek (5616 Acres)
2,273 Hectares	4th Field HUC		
9 Square Miles			
<hr/>			
<b>Location</b>	2201		
Marin County	4th Field Calwater		

Species Potential	Miles of Streams with Species Present
Central California Coast <b>Steelhead</b> North Coastal Diversity Stratum - Dependent Population	<u>Steelhead</u> 4 NOAA Fisheries, Critical Habitat Redesignation, 2005
Central California Coast <b>Coho</b> Coastal Gualala Diversity Stratum - Dependent Population	<u>Coho</u> 6 CDFG, Coho Distribution, May 2007

Critical Habitat	
Central California Coast Steelhead	4 Miles of Stream
Central California Coast Coho	All accessible river reaches between Punta Gorda & San Lorenzo River including 2 San Francisco Bay streams: Arroyo Corte Madera del Presidio and Corte Madera Creek (64 FR 24049)

Coho Intrinsic Potential	
Km of Historical Coho IP (21.5 C mask)	10
% of IP (21.5 C Mask) with Current Coho Distribution	70%
<small>Spence, B. C., et al., 2008. A framework for assessing the viability of threatened and endangered salmon and steelhead in the North-Central California Coast Recovery Domain. NOAA Tech Memo NMFS-SWFSC-423.</small>	

Miles of Waterway <sup>A</sup>	Miles	Number of Dams <sup>C</sup>
Naturally Occurring Waterways		0
Intermittent Stream	8	
Perennial Stream	12	
<small><sup>C</sup>Passage Assessment Database, Pacific States Marine Fisheries Commission, 2005</small>		

<sup>A</sup>USGS National Hydrography Dataset, High Resolution, 2004. 1:24,000

USGS Gaging Stations <sup>B</sup>	Number of Barriers <sup>C</sup>
11460150	18
Redwood Creek Near Tamalpais	0 Dams 6 Road Crossings 1 Natural Barrier 11 Diversions
<small><sup>C</sup>Passage Assessment Database, Pacific States Marine Fisheries Commission, 2006</small>	

Average Annual Precipitation <sup>E</sup>	Average Annual Precipitation Range <sup>E</sup>
35.2"	27.5 - 45"

<sup>E</sup>California Mean Annual Precipitation Zones, 1900-1960, CA Department of Forestry, 1990



<b>Roads<sup>A</sup></b>	<b>Miles</b>
Roads in Watershed	
Primary Road / Highway	
Secondary and connecting road, state highways	4
Local, neighborhood, and rural road, city street, unseparated	33
Vehicular trail, 4WD	3
Driveway or service road	
Total Miles	

<b>Road Density</b>	
Miles of Roads per SqMi of Watershed	4.5
Miles of Roads per SqMi of 100m Riparian Buffer*	5.2

\*Buffer is 100 meters on either side of the stream centerline

<sup>A</sup>U.S. Census Bureau - Tiger 2000, 2002. 1:24,000

<b>Slope<sup>D</sup></b>	<b>Acres</b>	<b>Percent of watershed</b>
Lands of 0-2 percent slope	42	1%
Lands of 2-4 percent slope	37	1%
Lands of 4-10 percent slope	184	3%
Lands of 10-15 percent slope	242	4%
Lands of 15-30 percent slope	1,406	25%
Lands of 30-60 percent slope	3,284	58%
Lands of 60-100 percent slope	419	7%
Lands of 100-117 percent slope	3	0%

<b>Elevation Range</b>	<b>0 - 2,589 ft.</b>	<b>0 - 789 m</b>
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<sup>D</sup>Slope derived from USGS 10 meter Digital Elevation Models (DEM's)

<b>Vegetation<sup>G</sup></b>	<b>Acres</b>	<b>Percent of watershed</b>
Annual grassland	655	12%
Barren	96	2%
Conifer Forest		
Closed Cone-Pine-Cypress	2	0%
Douglas Fir	766	14%
Montane Hardwood-Conifer	193	3%
Redwood	801	14%
Hardwood Forest		
Montane Hardwood	91	2%
Hardwood Woodland		
Coastal Oak Woodland	776	14%
Eucalytus	25	0%
Valley Foothill Riparian	121	2%
Herbaceous	161	3%
Shrub	1,816	32%
Urban	57	1%
Water	5	0%
Wetland	49	1%

<sup>G</sup>Multi-source Land Cover Data (2002 v2), CA Department of Forestry, 2002. 100 meter Grid

<b>Erodability of Watershed<sup>F</sup></b>	<b>Acres</b>	<b>Percent of watershed</b>
Watershed not Rated		

<sup>F</sup>Department of Conservation, Division of Mines and Geology; minimum mapping unit: approx. 8000 acres  
Watersheds were rated based on slope, precipitation, and lithologic susceptibility to failure. Total erosion potential is based on a combination of the landslide potential, debris slide potential, and the surface erosion potential. Rating 0-10 [ 0 = Low slide potential, 10 = High slide potential ]



<b>Land Ownership<sup>H</sup></b>	<b>Acres</b>	<b>Percent of watershed</b>
Private	267	5%
Local (Water District)	917	16%
State (Parks & Recreation)	2,936	52%
Federal (NPS)	1,453	26%
Federal (Military)	43	1%

<sup>H</sup>Management Landscape, CA Department of Forestry, 2002

<b>Population<sup>I</sup></b>	<b>Housing<sup>I</sup></b>
Total Population within the watershed -- 393 People	Total Housing Units within the watershed -- 146 Houses
	Housing Density
	0 to Less than 1 Housing Unit / 160 Acres 97%
	1 Unit / 160 Acres to 1 Unit / 20 Acres
	1 Unit / 20 Acres to 1 Unit / 5 Acres
	1 Unit / 5 Acres to 2 Units / Acre 3%
	2 Units / Acres to Greater than or Equal to 5 Units / Acre

<sup>I</sup>Census 2000 Block Data (Migrated), CA Department of Forestry, 2003



# Redwood Creek

## Vegetation density and age class in the entire watershed

California Department of Forestry and Fire Protection; fveg02\_2. Vector digital dataset. 100m Grid, 2002.

### Acres

Size	Density	Agriculture	Barren	Conifer Forest	Conifer Woodland	Hardwood Forest	Hardwood Woodland	Herbaceous	Shrub	Urban	Water	Wetland	Grand Total by Size class
Not Determined	Not Determined		91					783	62	5	49		
	S				5		7						
	P				17								
	M				133		69						
	D												
	<b>Total</b>		91	155	0	76	783	0	62	5	49	1221	
Seedling	S												
	P												
	M												
	D												
	<b>Total</b>												0
Sapling	S												
	P												
	M												
	D			10		2							
	<b>Total</b>			10		2							12
Pole	S						2						
	P												
	M				2		5						
	D			124		25	210		42				
	<b>Total</b>			126		25	217		42				410
Small Tree	S						2						
	P						5						
	M			10			5						
	D			62			32		1777				
	<b>Total</b>			1468		74	627		1777				3946
Medium/Large Tree	S												
	P												
	M												
	D			10									
	<b>Total</b>			10									10
Multi Layered	D												
	<b>Total</b>												0
<b>Grand Total by Species Type</b>			91	1769		99	922	783	1819	62	5	49	5599

SIZE	Description	Diameter at Breast Height (DBH)
Not Determined	N/A	
Seedling	Less Than 1 inch	
Sapling	1 to 6 inches	
Pole	6 to 11 inches	
Small Tree	11 to 24 inches	
Medium/Large Tree	Greater Than 24 inches	
Multi Layered	Size 5 Over Size 4 Or 3; Total Tree Crown Closure Greater Than 60%	

### Percent

Size	Density	Agriculture	Barren	Conifer Forest	Conifer Woodland	Hardwood Forest	Hardwood Woodland	Herbaceous	Shrub	Urban	Water	Wetland	Grand Total by Size class
Not Determined	Not Determined		2%					14%	1%	0%	1%		
	S				0%		0%						
	P				0%								
	M				2%		1%						
	D												
	<b>Total</b>	0%	2%	3%		1%	14%		1%	0%	1%	22%	
Seedling	S												
	P												
	M												
	D												
	<b>Total</b>												0%
Sapling	S												
	P												
	M												
	D				0%		0%						
	<b>Total</b>				0%		0%						0%
Pole	S												
	P												
	M				0%		0%						
	D				2%		4%		1%				
	<b>Total</b>				2%		4%		1%				7%
Small Tree	S						0%						
	P						0%						
	M				0%		0%						
	D				1%		1%		32%				
	<b>Total</b>				26%		1%	11%	32%				70%
Medium/Large Tree	S												
	P												
	M												
	D				0%								
	<b>Total</b>				0%								0%
Multi Layered	D												
	<b>Total</b>												0%
<b>Grand Total by Species Type</b>		0%	2%	32%		2%	16%	14%	32%	1%	0%	1%	100%

SIZE (SHRUB)	Desc.	Crown Decadence	DENSITY	Description
Not Determined	N/A			None
Seedling Shrub	Seedlings or sprouts < 3 years		S	10 to 24%
Young Shrub	None		P	25 to 39%
Mature Shrub	1 - 25%		M	40 to 59%
Decadent Shrub	> 25%		D	60 to 100%

# Redwood Creek

Vegetation within Riparian Buffer (100 meter on either side of stream)

California Department of Forestry and Fire Protection; fveg02\_2. Vector digital dataset. 100m Grid, 2002.

Acres												Grand Total by Size class		
Size	Density	Agriculture	Barren	Conifer Forest	Conifer Woodland	Hardwood Forest	Hardwood Woodland	Herbaceous	Shrub	Urban	Water		Wetland	
Not Determined	Not Determined		30.0					178.0		30.0		37.0		
	S													
	P						5.0							
	M			2.0										
Seedling	D		40.0				32.0							
	<b>Total</b>		30.0	42.0			37.0	178.0		30.0	0.0	37.0	354	
	S													
	<b>Total</b>												0	
Sapling	P													
	M													
	D													
	<b>Total</b>												0	
Pole	S						5.0							
	P						114.0		7.0					
	M			40.0		5.0								
	D													
Small Tree	<b>Total</b>		40.0		5.0	119.0		7.0					171	
	S						2.0							
	P						5.0							
	M			7.0			5.0							
Medium/Large Tree	D		452.0			17.0	119.0		356.0					
	<b>Total</b>		481.0		17.0	143.0		356.0					997	
	S													
	<b>Total</b>				5.0								5	
Multi Layered	P													
	M													
	D													
	<b>Total</b>												0	
<b>Grand Total by Species Type</b>			0	30	568	0	22	299	178	363	30	0	37	1527

SIZE	Description	Diameter at Breast Height (DBH)
Seedling	Less Than 1 inch	
Sapling	1 to 6 inches	
Pole	6 to 11 inches	
Small Tree	11 to 24 inches	
Medium/Large Tree	Greater Than 24 inches	
Multi Layered	Size 5 Over Size 4 Or 3; Total Tree Crown Closure Greater Than 60%	

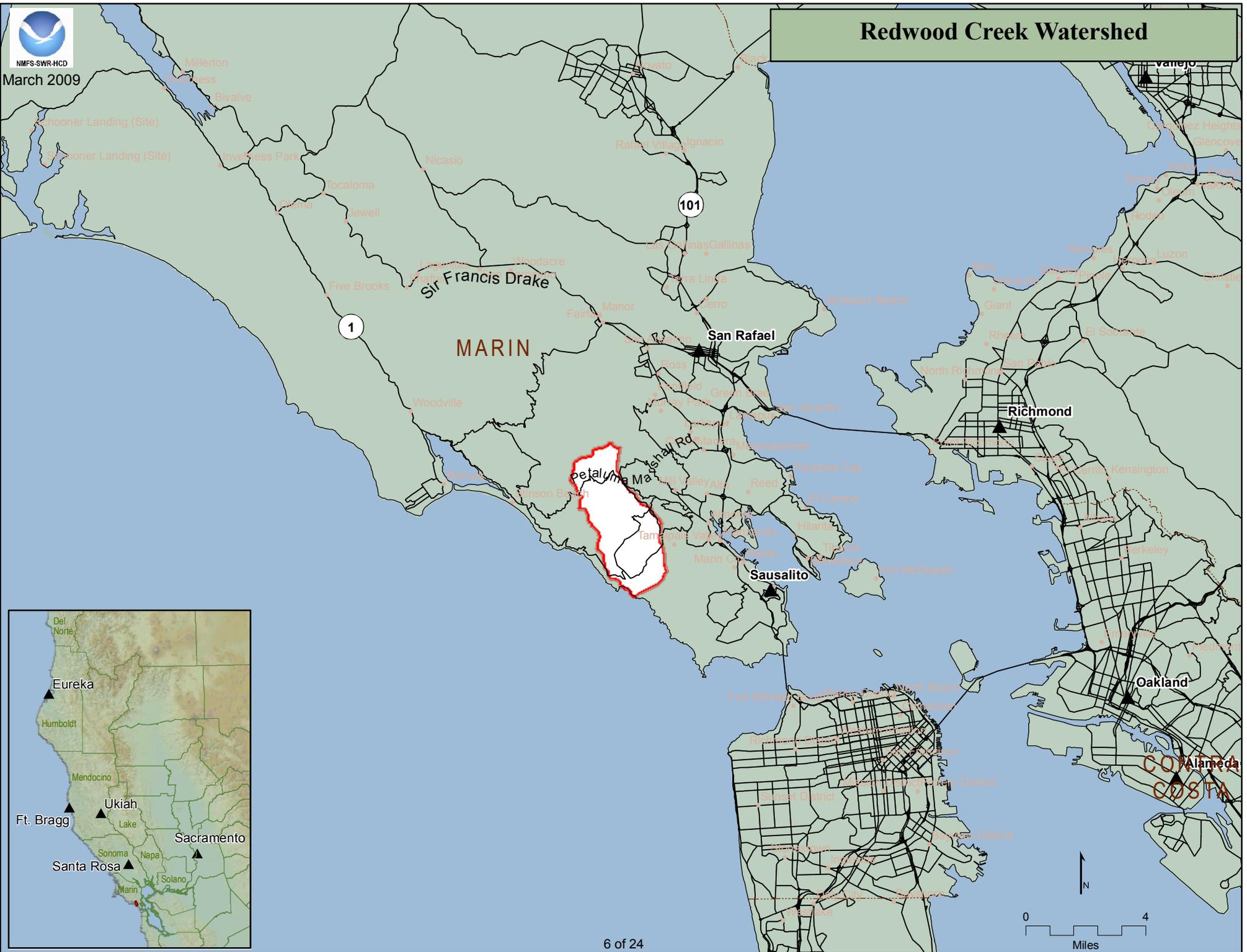
Percent												Grand Total by Size class		
Size	Density	Agriculture	Barren	Conifer Forest	Conifer Woodland	Hardwood Forest	Hardwood Woodland	Herbaceous	Shrub	Urban	Water		Wetland	
Not Determined	Not Determined		2%					12%		2%		2%		
	S													
	P						0%							
	M						3%							
Seedling	D						2%							
	<b>Total</b>		2%	3%			2%	12%		2%	0%	2%	23%	
	S													
	<b>Total</b>												0%	
Sapling	P													
	M													
	D													
	<b>Total</b>												0%	
Pole	S													
	P													
	M													
	D													
Small Tree	<b>Total</b>			3%		0%	0%	7%		0%			11%	
	S													
	P													
	M													
Medium/Large Tree	D													
	<b>Total</b>			30%		1%	8%	23%					65%	
	S													
	<b>Total</b>			0%									0%	
Multi Layered	P													
	M													
	D													
	<b>Total</b>												0%	
<b>Grand Total by Species Type</b>			0%	2%	37%	0%	1%	20%	12%	24%	2%	0%	2%	100%

SIZE (SHRUB)	Desc.	Crown Decadence	DENSITY	Description
Not Determined		N/A	S	10 to 24%
Seedling Shrub		Seedlings or sprouts < 3 years	P	25 to 39%
Young Shrub		None	M	40 to 59%
Mature Shrub		1 - 25%	D	60 to 100%
Decadent Shrub		> 25%		



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# Redwood Creek Watershed

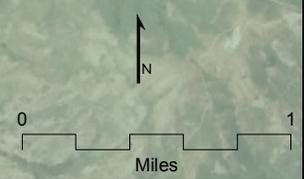
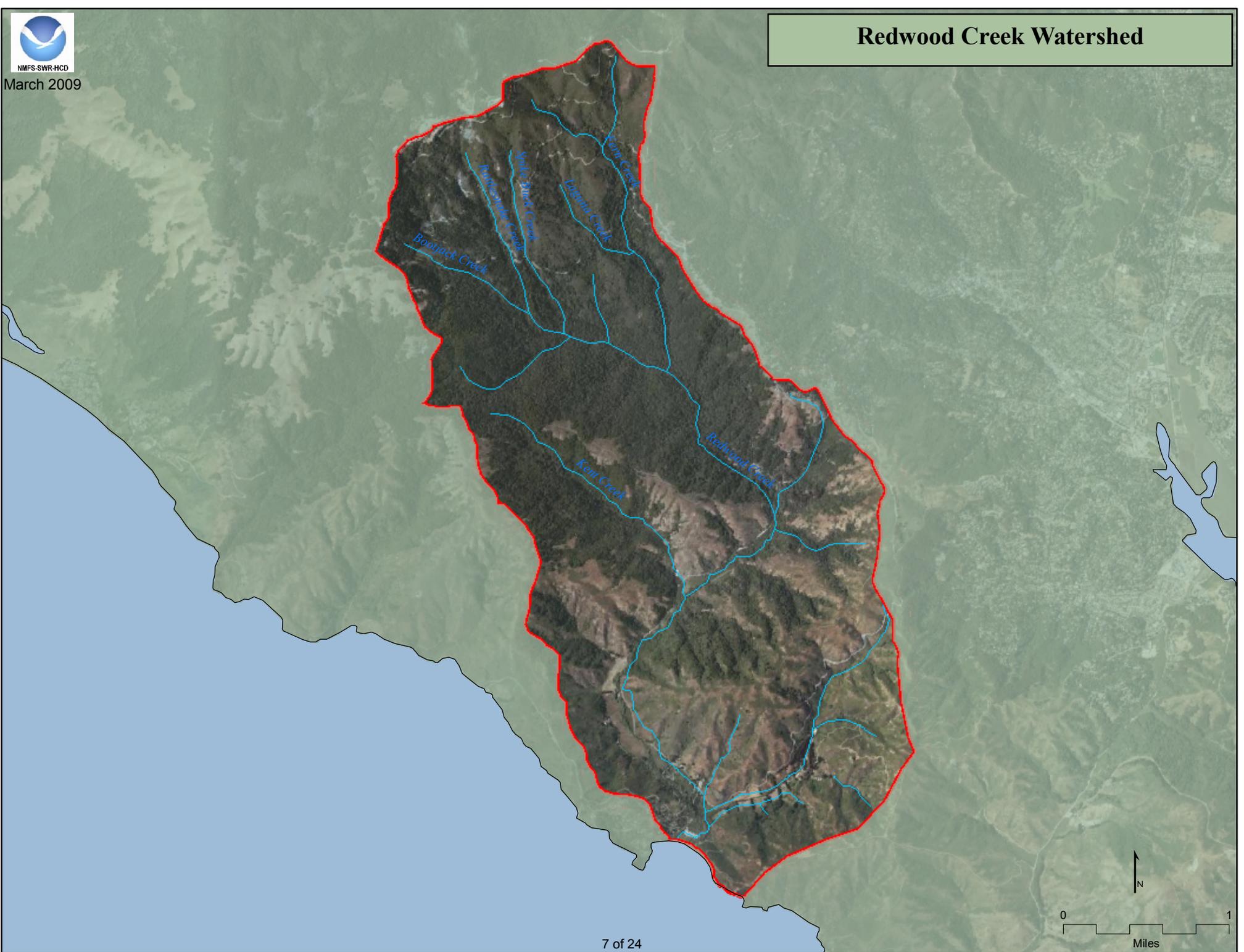




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# Redwood Creek Watershed

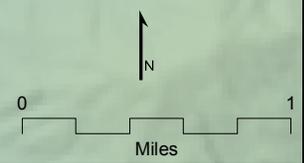




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# Redwood Creek Watershed CalWater Planning Watersheds





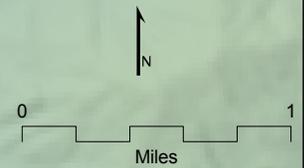
NMFS-SWR-HCD

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# Redwood Creek Watershed Fish Distribution and Critical Habitat



-  CCC Steelhead Distribution and Critical Habitat  
National Marine Fisheries Service, August 2005. 1:100,000.
-  Coho Distribution  
CDFG - NCNCR-ISB, 2007. 1:100,000.
-  1:24,000 Streams  
USGS National Hydrography Dataset, 2004. 1:24,000
-  Walker Creek Watershed





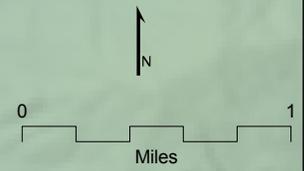
NMFS-SWR-HCD

March 2009

# Redwood Creek Watershed Steelhead Current vs. Historical



- Current CCC Steelhead Distribution  
National Marine Fisheries Service,  
August 2005. 1:100,000.
- Steelhead Intrinsic Potential  
NMFS SWR Fisheries Science Center, 2005.  
Potential historical suitable habitat
- 1:24,000 Streams  
USGS National Hydrography Dataset, 2004. 1:24,000
- Walker Creek Watershed





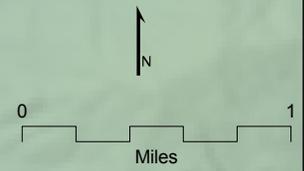
NMFS-SWR-HCD

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# Redwood Creek Watershed Coho Current vs. Historical



-  Current Coho Distribution  
CDFG - NCNCR-ISB, 2007. 1:100,000.
-  Steelhead Intrinsic Potential  
NMFS SWR Fisheries Science Center, 2005.  
Potential historical suitable habitat
-  1:24,000 Streams  
USGS National Hydrography Dataset, 2004.  
1:24,000
-  Walker Creek Watershed





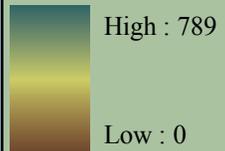
NMFS-SWR-HCD

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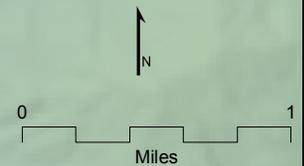
# Redwood Creek Watershed Elevation



## Redwood Creek Elevation (Meters)



SWR-SCFSC  
10 Meter Digital  
Elevation Model  
(DEM)

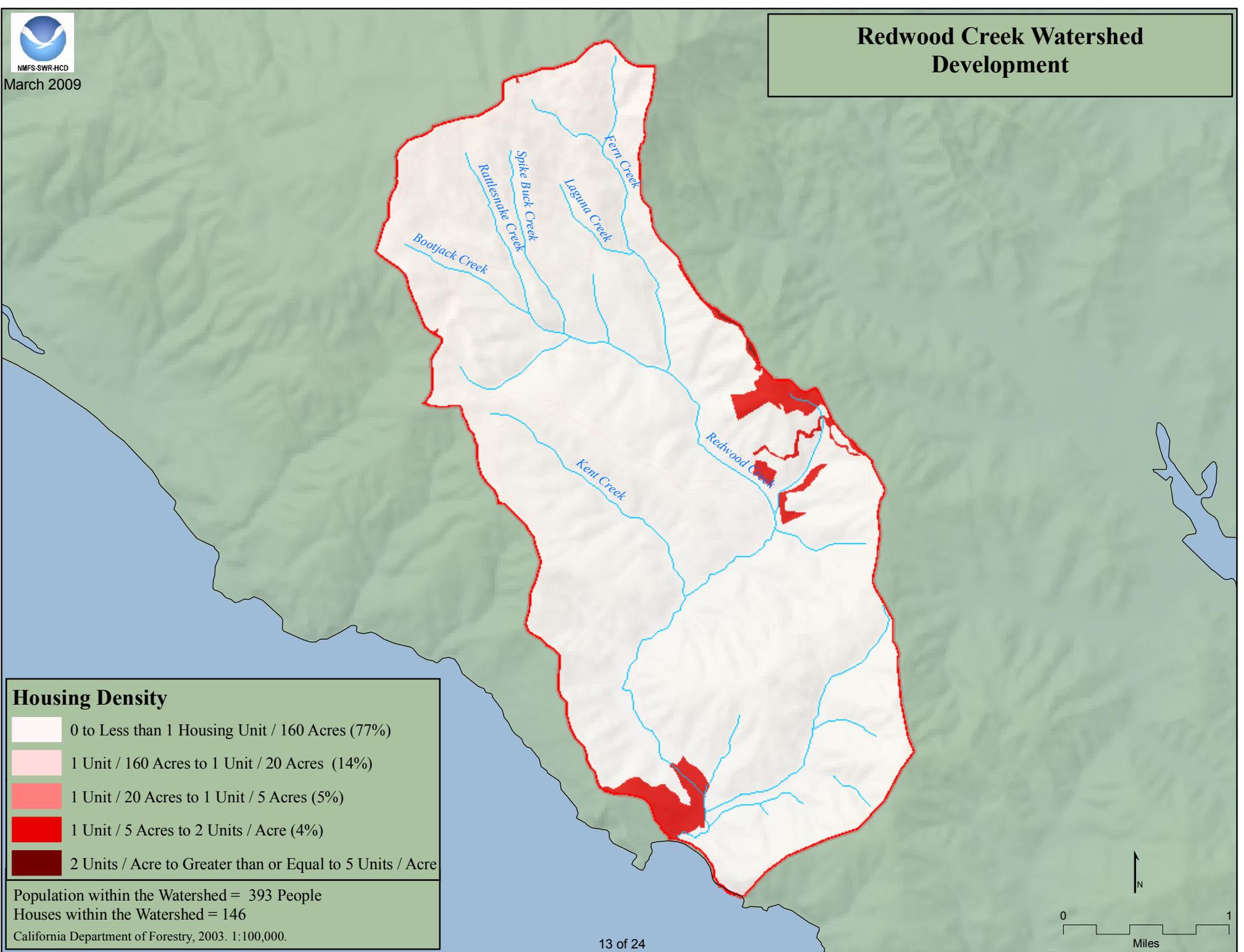




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# Redwood Creek Watershed Development

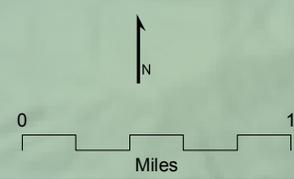


## Housing Density

- 0 to Less than 1 Housing Unit / 160 Acres (77%)
- 1 Unit / 160 Acres to 1 Unit / 20 Acres (14%)
- 1 Unit / 20 Acres to 1 Unit / 5 Acres (5%)
- 1 Unit / 5 Acres to 2 Units / Acre (4%)
- 2 Units / Acre to Greater than or Equal to 5 Units / Acre

Population within the Watershed = 393 People  
 Houses within the Watershed = 146

California Department of Forestry, 2003. 1:100,000.

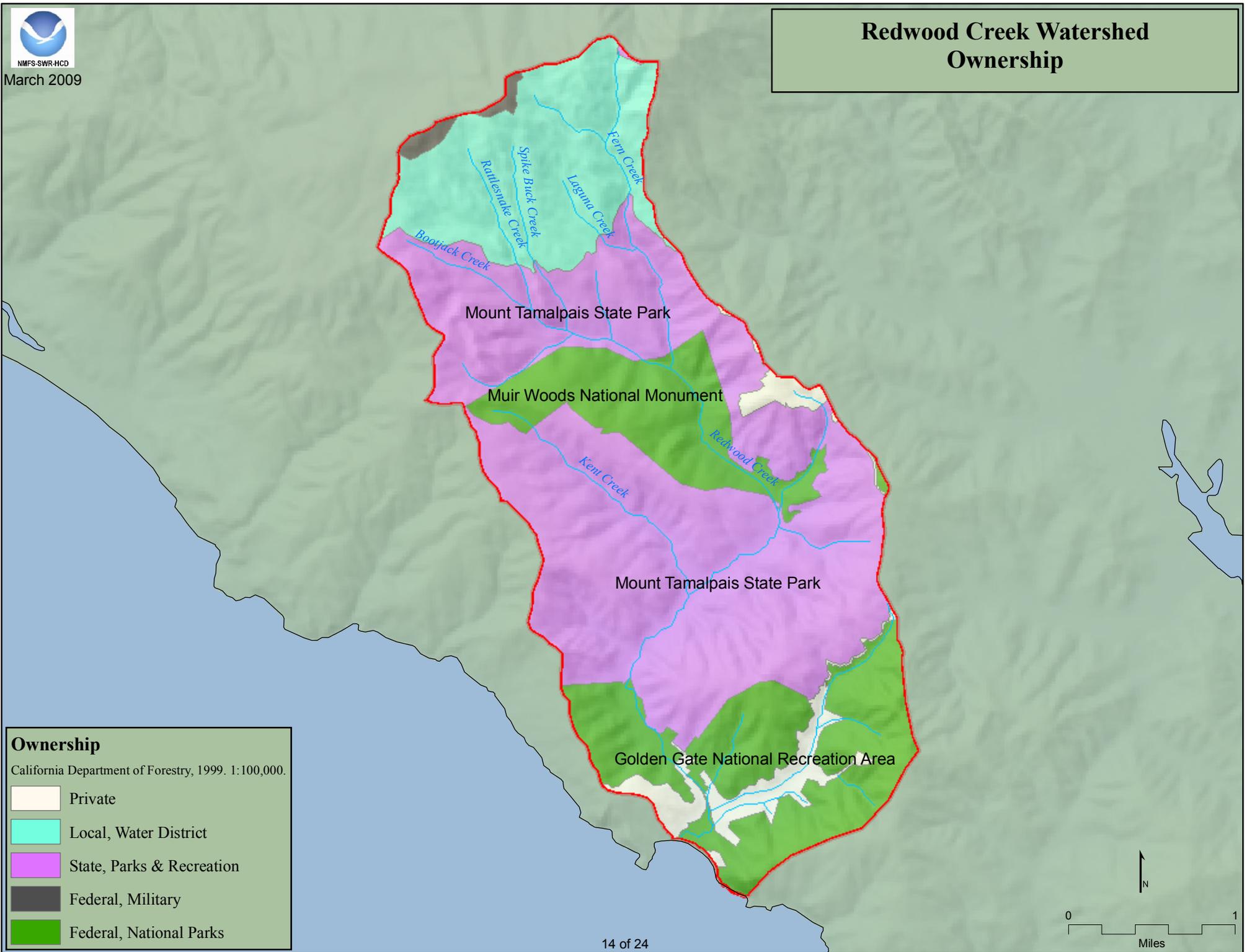




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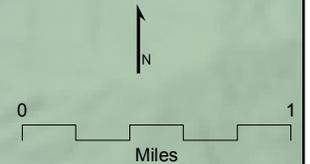
# Redwood Creek Watershed Ownership



## Ownership

California Department of Forestry, 1999. 1:100,000.

- Private
- Local, Water District
- State, Parks & Recreation
- Federal, Military
- Federal, National Parks





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# Redwood Creek Watershed Road Density

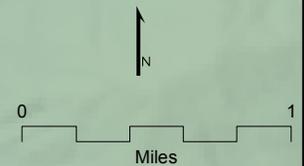


 Road

U.S. Census Bureau - Tiger 2000, 2002. 1:24,000

**Road Density (Miles of Road per Square Mile of Watershed)**

 4.5





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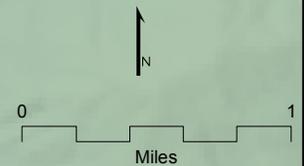
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# Redwood Creek Watershed Road Density in the Riparian Corridor



-  1:24,000 Streams  
USGS National Hydrography Dataset, 2004. 1:24,000
-  Road Segments within the 200 meter Riparian Corridor  
U.S. Census Bureau - Tiger 2000, 2002. 1:24,000
-  200 Meter Riparian Buffer (100 m on either side of stream centerline)

Overall Riparian Corridor Density = 5.2 Miles / SqMi of Corridor

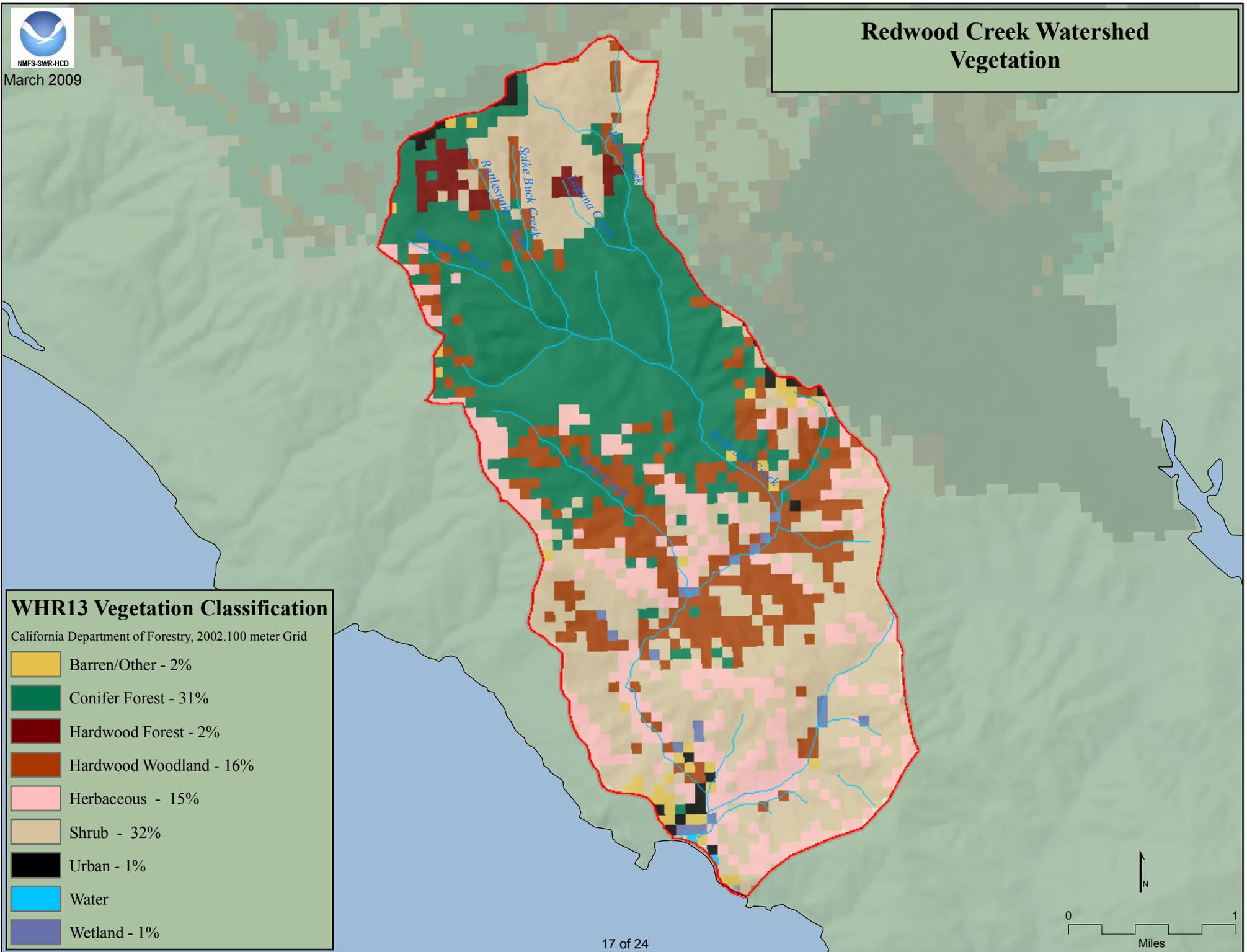




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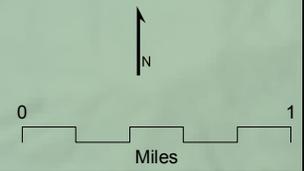
# Redwood Creek Watershed Vegetation



## WHR13 Vegetation Classification

California Department of Forestry, 2002.100 meter Grid

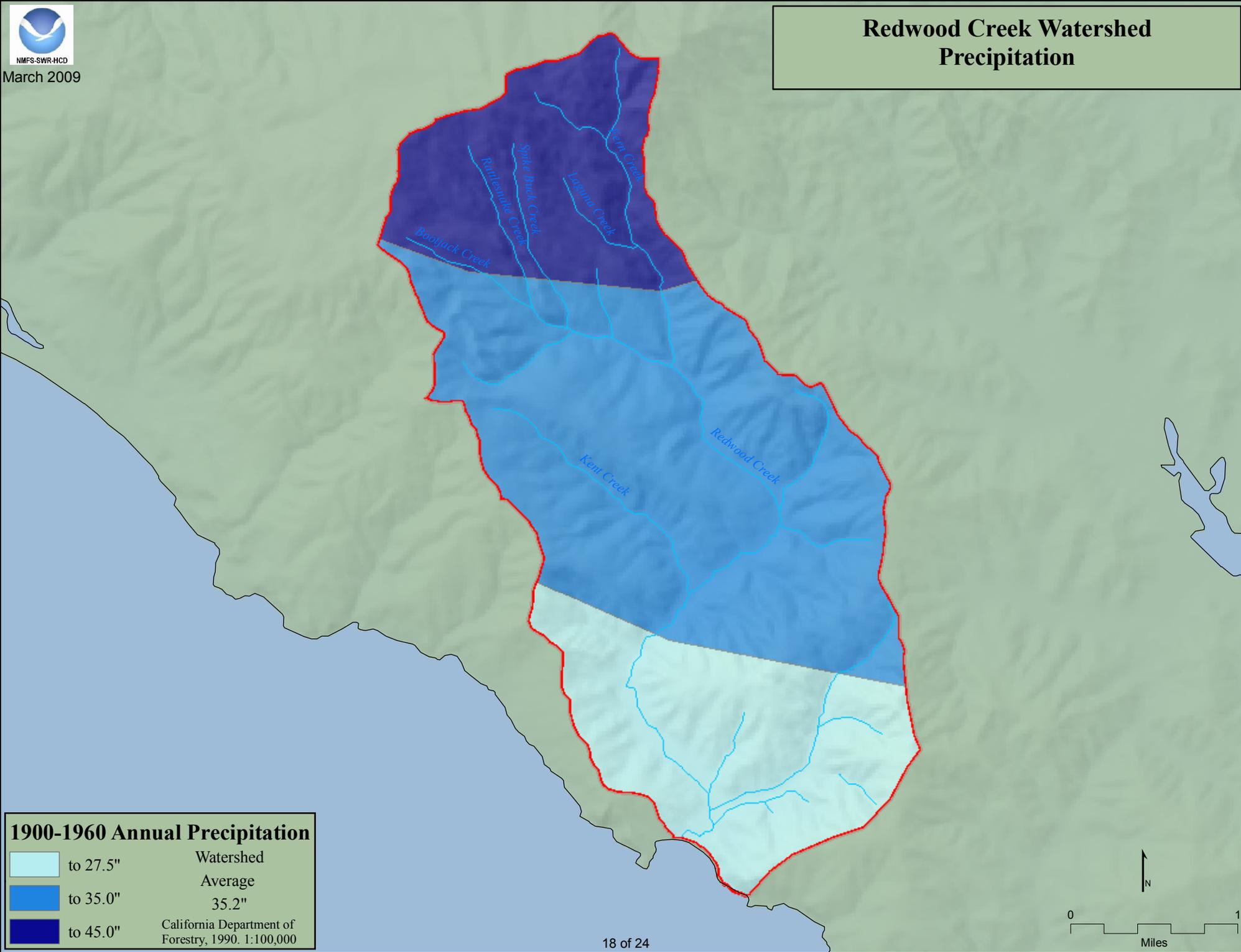
-  Barren/Other - 2%
-  Conifer Forest - 31%
-  Hardwood Forest - 2%
-  Hardwood Woodland - 16%
-  Herbaceous - 15%
-  Shrub - 32%
-  Urban - 1%
-  Water
-  Wetland - 1%





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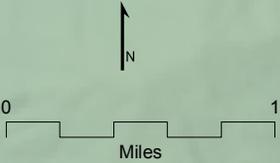
# Redwood Creek Watershed Precipitation



**1900-1960 Annual Precipitation**

Light Blue	to 27.5"	Watershed
Medium Blue	to 35.0"	Average
Dark Blue	to 45.0"	35.2"

California Department of Forestry, 1990. 1:100,000





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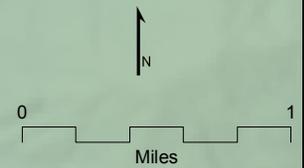
# Redwood Creek Watershed Flood Zones



## FEMA Flood Zones

FEMA, 1996. 1:24,000

-  100 Year Flood Zone
-  500 Year Flood Zone





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# Redwood Creek Watershed Barriers \ Discharge \ Gages



hazardous & Solid Waste Sites

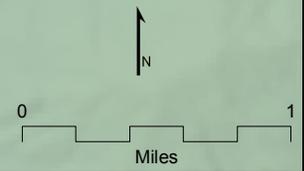
Gage Station

BASINS, USEPA. 2001.

**Barrier Type, Barrier Status**

CA Fish Passage Assessment, PSMFC, 2008

- Diversion, Unknown
- Non-structural, Unknown
- Road crossing, Partial
- Road crossing, Unknown





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# Redwood Creek Watershed In-stream Temperature

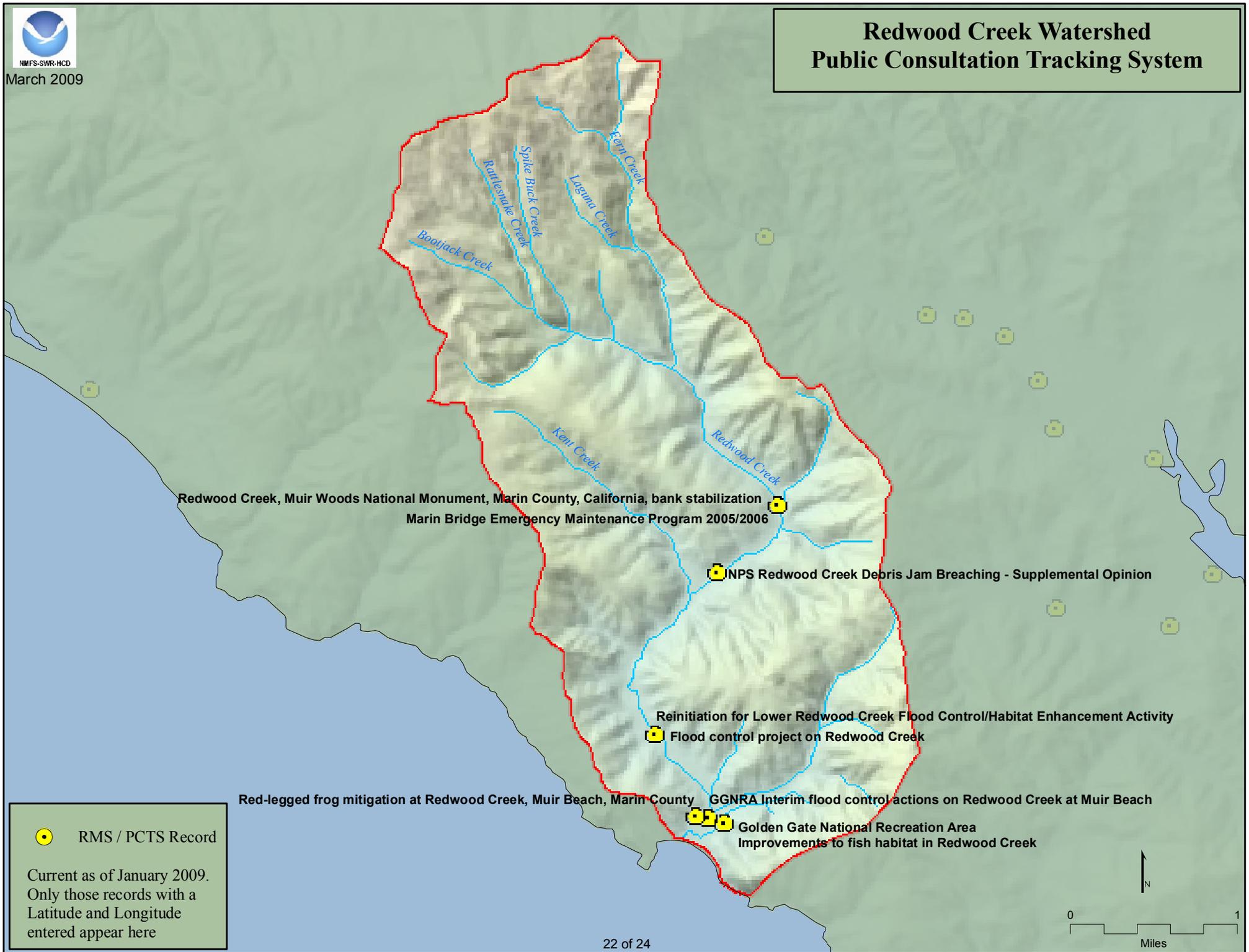




NMFS-SWR-HCD

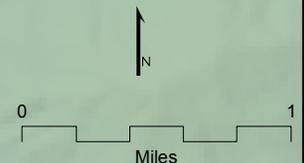
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# Redwood Creek Watershed Public Consultation Tracking System



● RMS / PCTS Record

Current as of January 2009.  
Only those records with a  
Latitude and Longitude  
entered appear here



## References

### **Watersheds**

calwater\_ver2\_2  
vector digital data  
California Watersheds (CALWATER 2.2)  
California Department of Forestry and Fire  
Protection  
1:24,000  
1999  
<http://www.ca.nrcs.usda.gov/features/calwater/>

### **Distribution**

CCC\_Steelhead\_Distribution\_06\_2005  
vector digital data  
National Marine Fisheries Service (NOAA  
Fisheries)  
1:100,000  
August 2005  
<http://swr.nmfs.noaa.gov/salmon/layers/finalgis.htm>

Coho\_Distribution  
vector digital data  
Eric Haney - CDFG - NCNCR-ISB  
1:100,000  
2006  
Draft  
<http://www.calfish.org/>

### **Critical Habitat**

CCC\_Steelhead\_ch\_06\_2005  
vector digital data  
National Marine Fisheries Service (NOAA  
Fisheries)  
1:100,000  
August 2005  
<http://swr.nmfs.noaa.gov/salmon/layers/finalgis.htm>

### **Hydrology**

1805 NHD Flowline  
vector digital data  
National Hydrography Dataset High Resolution  
United States Geological Survey  
1:24,000  
2004

### **Dams**

Dams\_2005  
vector digital data  
Goslin, M.,  
Santa Cruz Fishery Science Center

National Marine Fisheries Service  
2005  
<http://swfsc.noaa.gov/>

### **Barriers and Diversions**

pad\_september2008  
vector digital data  
California Fish Passage Assessment Database

Pacific States Marine Fisheries Commission  
September 2006  
<http://www.calfish.org/>

### **Gaging Stations**

gages  
vector digital data  
Better Assessment Science Integrating point and  
Nonpoint Sources (BASINS)  
United States Environmental Protection Agency  
2001  
<http://www.epa.gov/waterscience/basins/>

### **Precipitation**

California Mean Annual Precipitation Zones, 1900-  
1960  
Vector digital data  
California Department of Forestry and Fire  
Protection 1990  
1:100,000  
<http://frap.cdf.ca.gov/data/frapgisdata/select.asp>

### **Roads**

TGRR00  
vector digital data  
Roads  
United States Census Bureau  
1:100000  
2000  
<http://www.census.gov/geo/www/tiger/>

### **Elevation**

Spln\_mos\_02  
10 Meter Digital Elevation Model (DEM)  
NOAA Fisheries, Santa Cruz Laboratory  
2003

### **Vegetation**

fveg02\_2

raster digital data

Multi-source Land Cover Data

California Department of Forestry and Fire  
Protection

100 meter Grid

2002

<http://frap.cdf.ca.gov/data/frapgisdata/select.asp>

### **Land Ownership**

GOVTOWNA

vector digital data

California Department of Forestry Forest and  
Rangeland Resources Assessment Program  
Bureau of Land Management Surface Management

1:100,000

September 1999

<http://old.casil.ucdavis.edu/casil/gis.ca.gov/teale/govtowna/>

### **Developed Area and Population**

Census 2000 Block Data (Migrated)

vector digital data

California and the Department of Forestry and Fire  
Protection, FRAP

2003

1:100,000

<http://frap.cdf.ca.gov/data/frapgisdata/select.asp>

### **Imagery**

Google Maps

remote-sensing image

raster digital data

2008

### **Historic Suitable Habitat (Steelhead, Coho)**

Intrinsic Potential Model

vector digital data

NOAA Fisheries

Santa Cruz Laboratory, Santa Cruz, CA

2005

<http://swfsc.noaa.gov/>

### **Toxins**

Hazardous\_&\_solid\_waste\_sites

Better Assessment Science Integrating point and  
Nonpoint Sources (BASINS)

vector digital data

United States Environmental Protection Agency

2001

<http://www.epa.gov/waterscience/basins/>

### **Records Management System (RMS)**

### **Public Consultation Tracking System**

National Marine Fisheries Service

Oracle Databases

2008

### **Flood Zones**

FEMA Flood Insurance Maps 1996

Vector digital data

Federal Emergency Management Agency

Q3 Flood Data Program

1996

<http://www.fema.gov/>

### **Temperature**

All\_Valid\_MWMT\_Stats\_20080311

Vector digital data

Sonoma Ecology Center

March 2008