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EA 930185

TOPANGA ENVIRONMENTAL CORRIDOR STUDY

ON STATE ROUTE 27 IN THE COUNTY OF LOS ANGELES
From State Route 1 (Pacific Coast Highway) to Top of Topanga

APPROVAL RECOMMENDED:

AZIZ ELATTAR OFFICE CHIEF DIVISION OF ENVIRONMENTAL PLANNING	DATE

CONCURRED:

RON KOSINSKI DEPUTY DISTRICT DIRECTOR DIVISION OF ENVIRONMENTAL PLANNING	DATE

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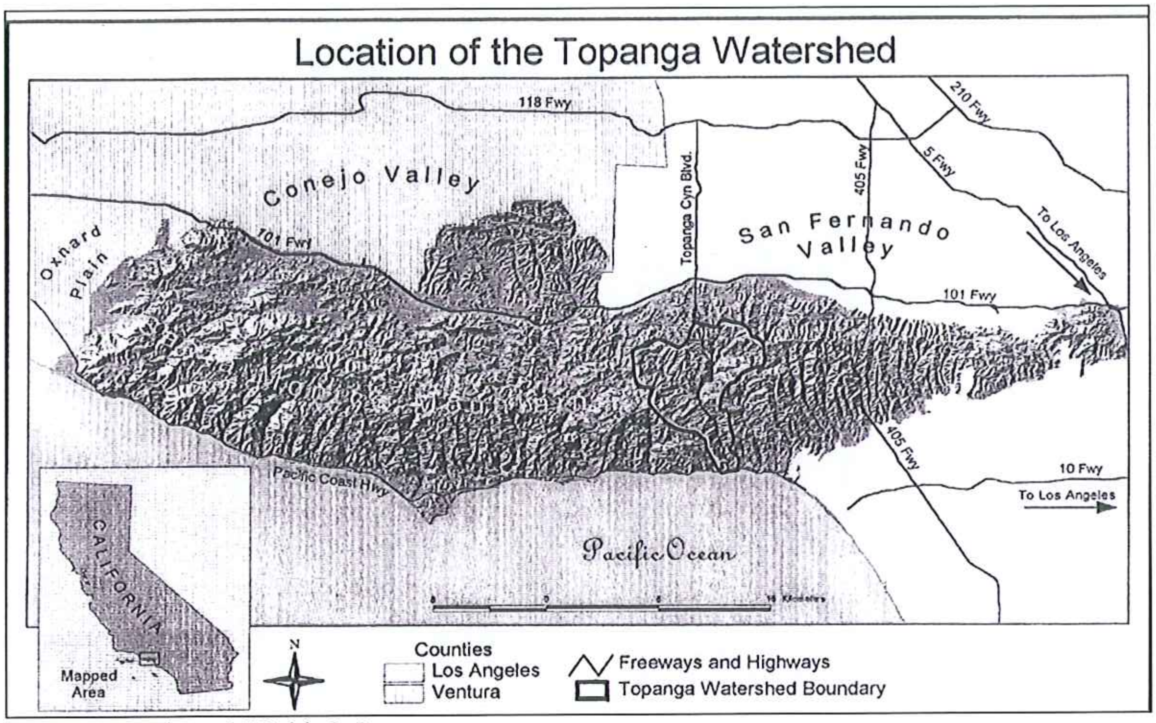
1. Environmental Resources and Conditions in Topanga Canyon

Topanga Canyon is defined by the Topanga Creek watershed. A watershed is a geographic area that collects all the rainfall into a series of drainages and creeks, eventually reaching the sea (Topanga Creek Watershed Committee 2002 vii). The Topanga Creek watershed is 18 square miles in area and is located in Southern California, approximately 13 miles west of the City of Santa Monica and 30 miles west of Hollywood in Los Angeles County (see Figure 3). The watershed ranges in elevation from sea level to approximately 2,200 feet above sea level and is located in the Santa Monica Mountains. The land use in Topanga Canyon is mostly undeveloped in a natural condition. This watershed is the third largest that drains into the Santa Monica Bay (Dagit and Webb 2-1).

The environmental conditions in Topanga Canyon are varied. Each factor plays a role in defining the characteristics that make up the watershed. It is important to discuss the whole setting in order to understand the dynamics at play in the system. These environmental conditions consist of climate, land use, geology, hydrology, water quality, and biological resources.

Figure 1 – Topanga Watershed Location Map



Source: Dagit and Webb 2-2

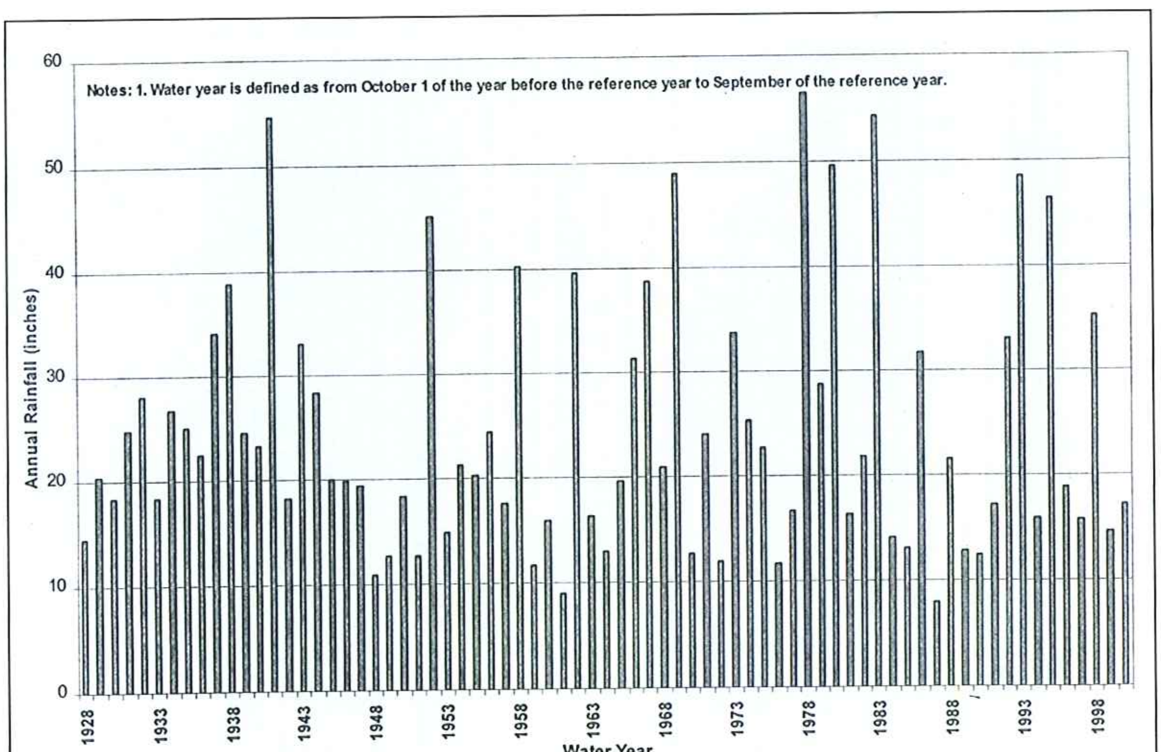
1.1 Climate

The climate in the Topanga Creek watershed is typical of the regional Mediterranean climate, which has warm, dry summers and wet winters. Within the confines of the watershed, there are various micro-climates. Along the tops of the ridges in the upper watershed, the summers are very hot with little to no effects from the coastal marine layer. The coastal marine layer tends to influence climatic conditions in the lower watershed reaching up to the 1,000 foot elevation, where an inversion layer frequently forms (Dagit and Webb 2-1).

On occasion, strong, dry, desert winds from the east, commonly referred to as Santa Ana winds, reach the canyon and can gust up to 60 miles/hour. These winds have a drying effect on local vegetation and strongly influence the distribution of vegetation and species composition within the watershed (Dagit and Webb 2-1). Slopes facing northeast contain northern mixed chaparral communities with little requirements for moisture.

Precipitation amounts vary with greater numbers along the western and northern sides of the watershed, with lower numbers towards the east with the storms' movements. Precipitation amounts have been recorded starting in 1928. The County of Los Angeles maintains a gage to record rainfall in Topanga (gage #6). Rainfall varies year to year with average annual amounts equal to 24.4 inches, although the recorded range is from 7.9 to 56.6 inches/year (L.A. Rainfall B-3). Figure 4 shows the annual recorded rainfall for Topanga since 1928.

Figure 2 – Annual Recorded Rainfall for Topanga



Source: Dagit and Webb 2-5

1.2 Land Use

The Topanga Creek watershed lies within unincorporated Los Angeles County. The development of land in the Topanga Creek watershed is governed by the Los Angeles County General Plan, the Santa Monica Mountains North Area Plan, and the Malibu Local Coastal Plan. Most of the parcels within the watershed are less than 40 acres in area and restricted by the Hillside Management Criteria which limits the amount of square footage of the property according to the slope (Dagit and Webb 2-33).

The Topanga Creek watershed encompasses approximately 12,800 acres, of which 8,000 are dedicated public open space and the remaining 4,800 are in private holdings. 1,718 acres of development consists of two residential sub-divisions and a mobile home park in the northern part of the watershed, three commercial areas (under 20 acres each) along SR-27, a strip of commercial property along Pacific Coast Highway (SR-1), and 3,000 residential properties within the historic small lot sub-divisions or on private lots throughout the Canyon (Dagit and Webb 2-33). Future development will probably consist of the construction of single family residences on undeveloped lots.

Public ownership within the Canyon mostly consists of Topanga State Park, which encompasses 5,628 acres, mostly in the eastern section of the watershed. The Park extends from the upper portion of the watershed all the way to the beach. Other areas of public ownership include Topanga Beach, which is owned and maintained by the Los Angeles County Beaches and Harbors, and various parcels belonging to the Santa Monica Mountains Conservancy (1,311 acres), the National Park Service (224 acres), and the Mountains Restoration Trust (402 acres).

Private development of land started with the Gabrielino Indians who occupied several communities in the upper watershed. In the early 1880s, much of the watershed was divided into several Mexican land grants. When California became a state in 1852, development was minimal until approximately 1960. From then until the year 2000, population increased from 3,000 inhabitants to almost 12,000. Most of the homes are on less than half-acre lots and were built between 1970 and the present with a surge in the mid-1980s (Dagit and Webb 2-33).

Projected growth of the Canyon is not expected to increase dramatically. Most of the development in the watershed has already occurred. More of a concern is the growth in surrounding areas of the Los Angeles metropolitan area and how that may affect Topanga Canyon. In particular, growth in surrounding areas may increase traffic onto SR-27, which may have detrimental impacts to the watershed.

1.3 Geology

Topanga Canyon is located within the Santa Monica Mountains, which are formed of late Cretaceous and Paleocene marine sandstone and conglomerate, overlain by later sandstone, conglomerate, siltstone, and claystone (Dagit and Webb 2-4). Because the Santa Monica Mountains are rising quickly, tendencies for instability and erosion are heightened. In the southern portion of the watershed, the rocks are typically prone to fracturing and faulting. To the north of the watershed, the mountains are relatively young and unconsolidated. Basically, the entire geologic setting in the Topanga Creek watershed is very easily prone to erosion Dagit and Webb 2-4).

Because 99% of the Topanga Creek watershed is hillslopes, the potential for erosion is increased. Most of the watershed (75%) is covered by a mixture of native chaparral and coastal sage scrub vegetation. A smaller proportion (10%) is covered by native oak, walnut, and riparian woodland species. The last 15% has mostly been disturbed due to development in the area. This disturbance has resulted in the introduction of various non-native plant species. This disruption in the natural ecological processes has accelerated the potential for erosion and reduced channel stability (Dagit and Webb 2-6).

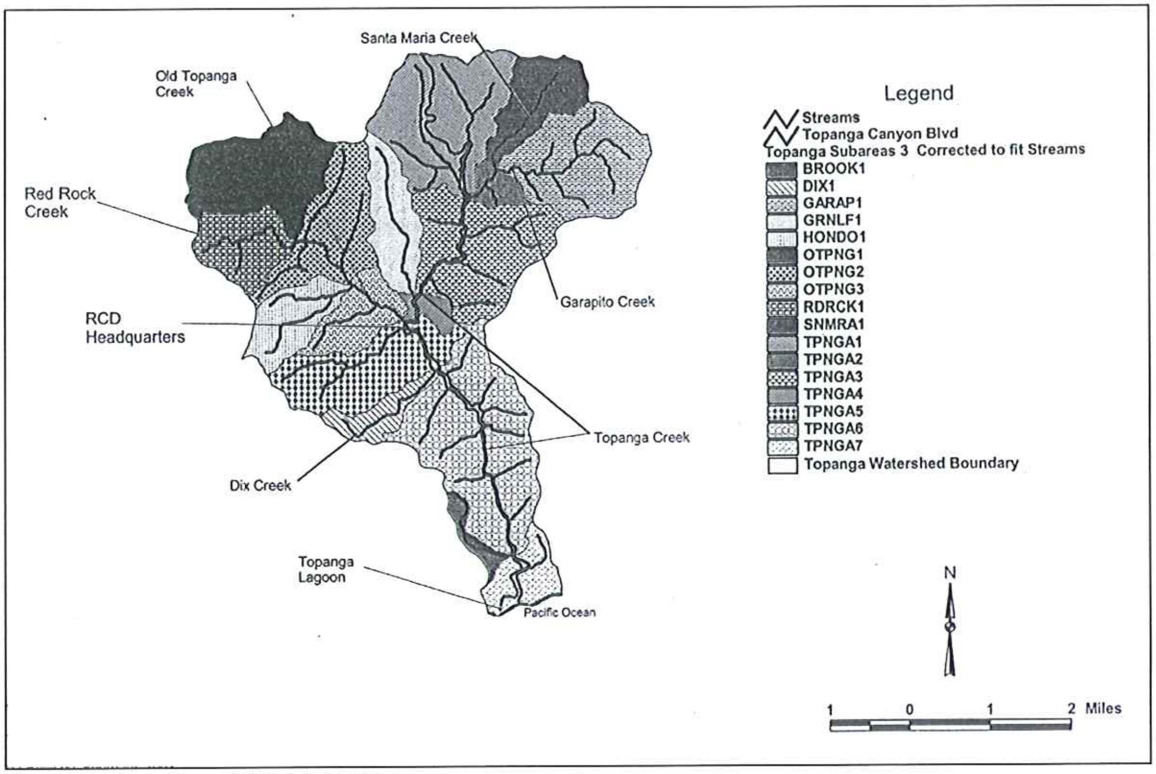
Erosion on hillslopes and sediment transfers usually result from precipitation events in the watershed. This type of erosion can result in debris slides that may occur many days or weeks after the rainfall. Heavy precipitation can quickly lead to landslides filling the creek with sediment. A large amount of sediment yield in the creek can have devastating consequences for property owners nearby (Dagit and Webb 2-6).

Roads throughout the Topanga Creek watershed also contribute to erosion and sediment yield in the creek. Soil berms are stockpiled along the side of Topanga Canyon Blvd., which can then erode directly into the adjacent creek during overland rain flows (see Figure 5). However, cut slopes that were created to install the roadway itself, have the most impact in terms of erosion in the canyon. Because the slopes were cut in order to build SR-27, they are unstable and very easily prone to erosion. During and after heavy rains, these slopes yield the most sediment flows, seepage waters, and debris that mostly end up in Topanga Creek. In addition, these cut slopes can also lead to slope failure and landslides (Dagit and Webb 2-6).

Figure 3 – Soil Berms along SR-27 adjacent to Topanga Creek

The Topanga Creek watershed can be divided up into two distinct regions divided at a point 550 yards south of the Dix Canyon confluence with the main stem: the upper watershed and the lower watershed (see Figure 6). The upper watershed's profile is similar to a negative exponential profile whereby the lower watershed is like a strong linear profile because of the steepness of the gradient. The upper watershed has milder slopes compared to the lower part which has steep, narrow canyon walls.

Figure 4 – Different drainage systems in Topanga Creek Watershed

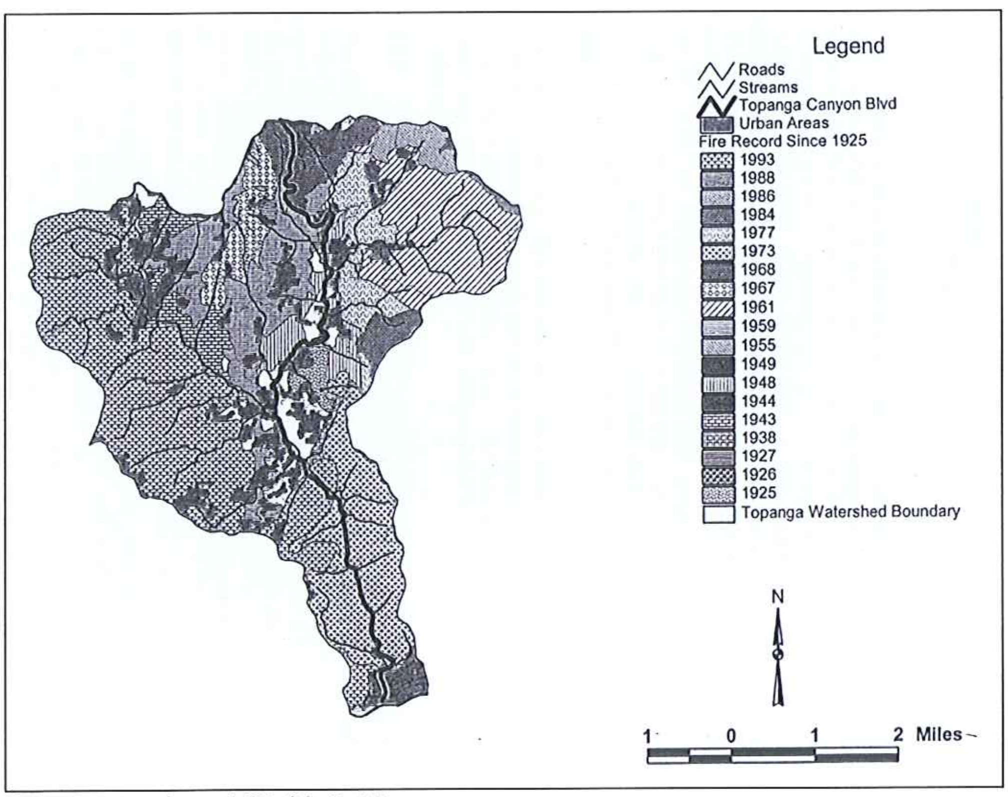


Source: Dagit and Webb 2-12

The differences in the two parts of the watershed reflect the ways in which sediment gets transported in the system. The upper watershed with its gentler slopes transports sediment from the hills to the stream in lower-gradient reaches where it gradually moves downstream to the sea. The lower watershed is strictly dominated by the main canyon walls. Any sediment and debris within the lower canyon gets immediately transported downstream. Very little sediment accumulates in the lower watershed unless it is temporarily blocked by large obstacles or diverted due to meander bends. The sediment and debris finally begin to be deposited approximately 2000 yards before the creek mouth where the gradient decreases again (Dagit and Webb 2-7).

Erosion can also occur as a result of fire events. Chaparral and coastal sage scrub vegetative communities have fire as a natural, reoccurring event. Unfortunately, fire also accelerates erosion activities, especially in areas already prone to sedimentation. When fires destroy plant communities, the soil is then exposed to raindrop impacts and water flows allowing for debris and sediment ravel (Dagit and Webb 2-9). In addition, vegetation recovery in the plant communities in Topanga Canyon is very slow and can take years to be reestablished. Some areas of the Topanga Creek watershed have not been burned for more than 30 years, yet others have recently been burned and are thus more prone to erosion (see Figure 7).

Figure 5 – Burn Areas in Topanga



Source: Dagit and Webb 2-20

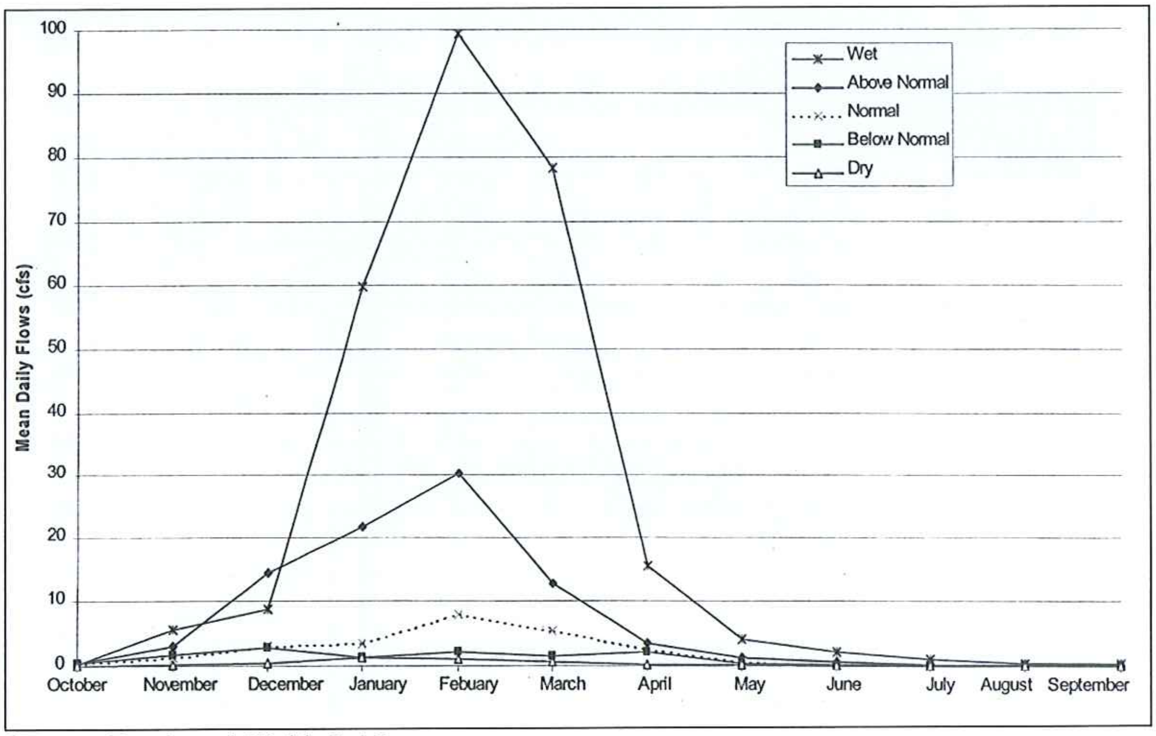
1.4 Hydrology

The Topanga Creek watershed is a relatively small Southern California coastal watershed (18 square miles) but is the third largest watershed draining into the Santa Monica Bay behind Ballona Creek and Malibu Creek. From the Santa Monica Bay in the south it extends northward to the ridge tops of the Santa Monica Mountains. It is irregularly shaped; is narrower at the southern portion and wider towards the north. At its widest point it is 6 miles wide and 7 miles long. It is 98.7% undeveloped with mostly natural vegetated areas covering the land (Dagit and Webb 2-10).

The watershed is composed of many creeks converging into Topanga Creek (see Figure 6). The main stem of the creek is approximately 9 miles long and follows along SR-27. Lower Topanga Creek is the main stem in the southern portion of the watershed for four miles and divides into Old Topanga Creek and Upper Topanga Creek at the town of Topanga. SR-27 mostly follows along Upper Topanga Creek for over four miles upstream into Garapito Creek while Old Topanga Road (County of Los Angeles owned and operated) follows Old Topanga Creek. The smaller creeks and tributaries that merge into Topanga Creek are numerous and exist mostly in the upper watershed. These tributaries include Brookside Creek, Dix Creek, Greenleaf Creek, Hondo Creek, Red Rock Creek, Garapito Creek, and Santa Maria Creek as well as several unnamed drainages.

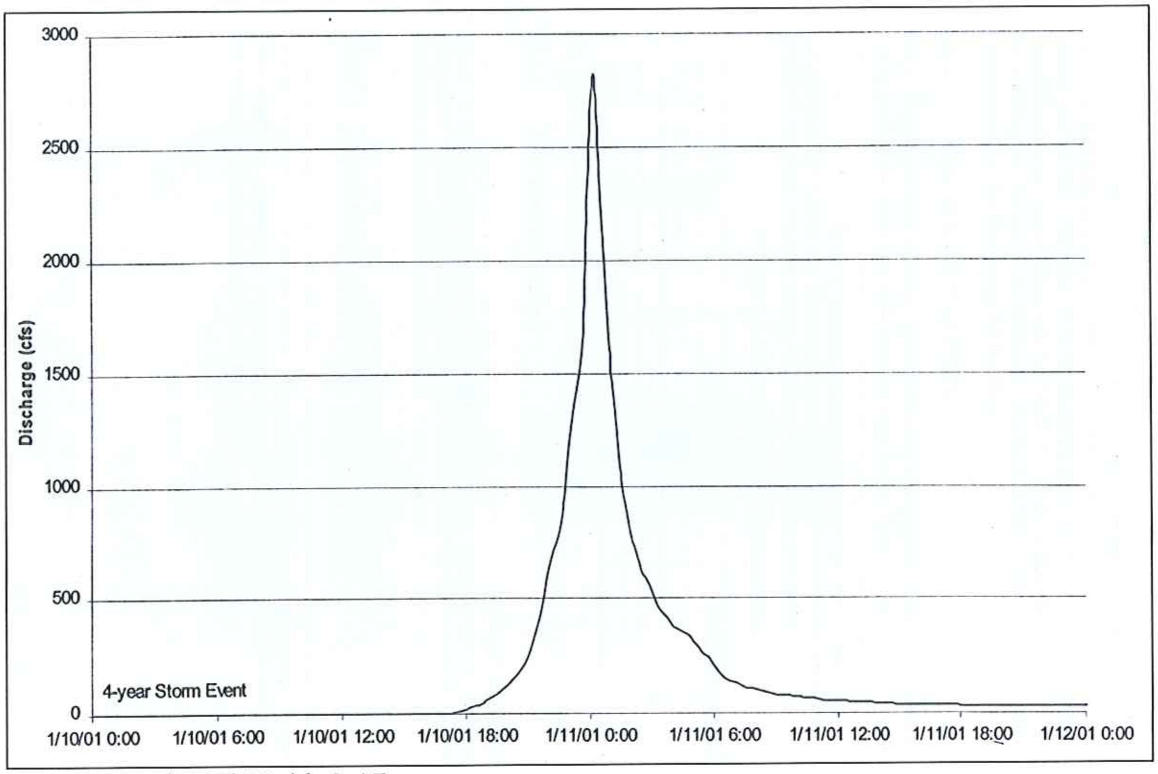
Water velocities in the watershed are usually rapid due to the steep slopes, especially in the lower watershed area. The slope angles vary, but many in the lower watershed are 45 degrees or greater. Because of these steep gradients in the lower canyon, flooding can occur rapidly after heavy rains. The flood intensity can also have high peaks and then quickly dissipate after rains end. Figures 8 and 9 show the mean daily flows by water year type as well as a typical storm hydrograph from a four-year storm in 2001 (Dagit and Webb 2-11).

Figure 6 – Mean Daily Flows by Water Year Type



Source: Dagit and Webb 2-15

Figure 7 – Hydrograph of the January 11, 2001 Storm



Source: Dagit and Webb 2-17

Large flooding events have the potential to create much damage in Topanga Canyon. In recent history, high flows were characterized by five high flow years: 1938, 1969, 1978, 1980 and 1983. Table 5 shows their intensity. The flood in 1980 was the worst ever experienced on record. Portions of SR-27 were destroyed and the highway was closed for many months for repairs. These types of water velocities can reach 20 feet per second (fps) (Dagit and Webb 2-18).

Table 1 – Historic Floods in Topanga Creek

Year	Peak Discharge (cfs)	Return-Interval (Years)
1980	13,800	83
1969	12,200	34
1983	10,200	22
1978	10,127	16
1938	9,300	12

Source: County of Los Angeles Department of Public Works

Low flow conditions are more common and generally are below 1 cubic foot per second (cfs). Most of the year (generally spring, summer and fall), Topanga Creek exhibits extended periods of these low flows. The upper watershed will sometimes go dry during the year, but the lower watershed always contains a few feet of water in the creek (Dagit and Webb 2-18).

Before 1954, there was no imported water; all water was drawn from wells and springs. Today, most of the water used by residents in Topanga Canyon is imported from other areas because of the increase in the amount of residents. This imported amount for the approximately 3,000 households in Topanga is estimated at 5.2 million gallons per day, based on data from the Los Angeles County Waterworks District 29. Yearly amounts of imported water are approximately 5,800 million acre per feet (Dagit and Webb 2-21).

1.5 Water Quality

The chemical levels in Topanga Creek and the Topanga Lagoon are of primary importance to the health of the watershed. A two-year grant-funded study was completed from July 1999 – 2001 in the watershed to assess the health of the water quality. In addition, monthly samples have been taken at the Topanga Lagoon from November 2000

– January 2002. The studies and data gathered show that the chemical composition and pollution levels in the watershed are not a cause for concern. In fact, the water quality in the watershed is actually quite good. It appears that the development in the watershed has not exceeded the ability of the creek to naturally flush pollutants from the system (Dagit and Webb 2-23). The survival and persistence of sensitive aquatic resources is a sign that the watershed is healthy and able to support pollutant-sensitive species.

One concern for water quality issues was the presence of algal growth within the watershed. The data collected indicate that the algae is mostly related to normal sun exposure to the organisms rather than attributed to excess nutrient levels. These data are not conclusive, however, but the levels of algal growth in all but three locations were from low to non-detectable supporting this theory (Dagit and Webb 2-24).

The physical parameters of the water in the creek were all found to be in acceptable and healthy ranges. The temperature of the water varied due to canopy cover and seasonal changes, but most of the sites stayed between 8 to 25 degrees Celsius, which is optimal for sensitive aquatic resources. The pH levels of the water consistently ranged between 7 and 8.5, which is also quite desirable for many animal and plant species. Dissolved oxygen varies according to climatic changes, but most locations were found to be within between the acceptable 3 – 15 mg/l range. And, salinity of the water stayed well within the fresh to brackish range depending on distance to the ocean/lagoon (Dagit and Webb 2-24).

Nutrient levels with the Topanga Creek watershed were also found to be significantly less than other nearby watersheds that drain into the Santa Monica Bay, most notably the Malibu Creek watershed. The lower the levels of these nutrients are, the better the quality of water in the watershed. Particular nutrients that were measured were nitrates as nitrogen, orthophosphate, and ammonia as nitrogen. Topanga had mostly lower levels of these nutrients as shown in Table 6 (Dagit and Webb 2-25).

Table 2 – Comparison of Nutrient Levels: Topanga Creek to Malibu Creek

Location*	Avg. pH	Avg. Nitrates as Nitrogen	Avg. Ammonia as Nitrogen	Avg. Phosphates
Topanga Creek Site 6	7.98	0.42	0.0	0.0
Malibu Creek – Cold Creek	8.02	0.30	0.10	0.13
Malibu Creek – Cross Creek	8.19	3.99	0.44	1.87

*Malibu Creek Data Provided by Heal the Bay for 1999-2000

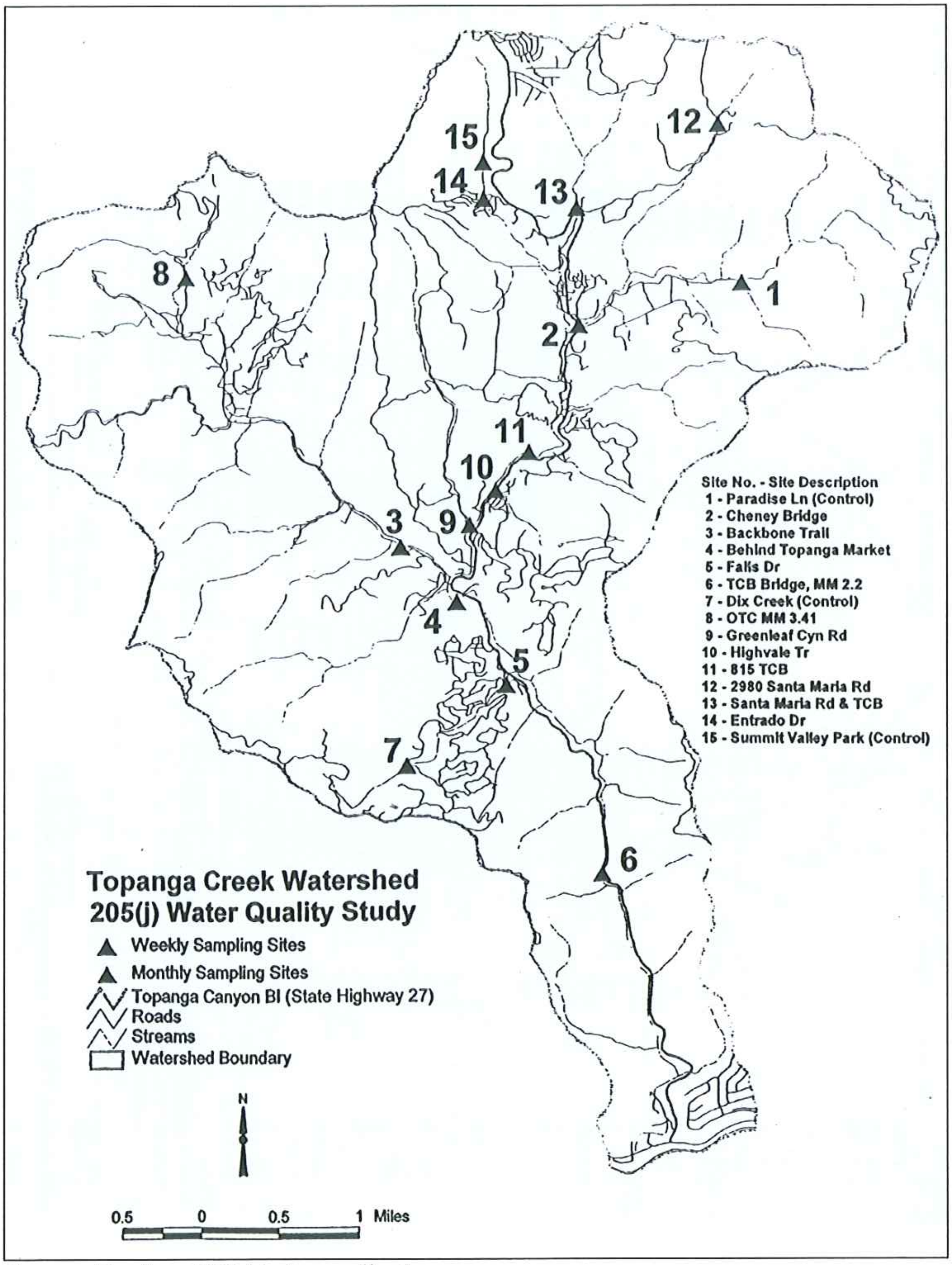
The levels of sedimentation and turbidity in the water are also an important component to the health of the creek. A high amount of suspended solids and turbidity negatively affect benthic aquatic resources. The loads of sedimentation appear to be of heavier particle size with little suspension time (Dagit and Webb 2-26).

An Erosion and Sediment Delivery Study was completed in October 2002 to document the causes of sedimentation in the watershed. It found that the major causes of sedimentation reaching the roadways were from cut slopes in the canyon (viii). Most roadway berms did not actually contribute much sedimentation because they are typically small in size. The larger berms, however, did appear to be problematic in terms of erosion into Topanga Creek (55).

Heavy metals in Topanga Creek were measured as well to help assess water quality in the watershed. Studies were conducted using the most stringent objective criteria (for example, levels for chromium were based on the drinking water standards rather than fresh water standards). The creek had levels that were low to non-detectable for cadmium, copper, nickel, lead and zinc. The chromium levels were well below the objective limits. Figure 10 and Table 7 show the results of the heavy metals data recorded during storm events for Topanga Creek from 1999 – 2000.

Bacteria levels in the form of fecal coliform and *E. coli* levels have been studied and the results indicate that high levels exist at Topanga Beach, and this appears to be related to whether the lagoon remains open or closed. When the lagoon is closed, bacteria levels at the beach are low. When the lagoon is open (for example, during a storm event) the bacteria levels at the beach are high. There are several occurrences in the upper watershed that contain higher levels of bacteria, but it does not appear that this is the source of high bacteria at the beach. After the water flows from the upper watershed to the lower watershed, the bacteria levels are well within primary contact limits at all but three sampling events that were related to storms (Dagit and Webb 2-26). A study is currently underway to determine the sources of the bacteria in the lower watershed. Table 8 shows the summary of bacteria levels at the lowest sampling point in the watershed (Site #6) and at Topanga Beach/Lagoon/Ocean.

Figure 8 – Heavy Metals Sampling Sites



Source: Dagit and Webb Appendix A

Table 3 – Summary of Heavy Metals Data during Storm Events for Topanga Creek

Site	Date	Total Cd	Total Cr	Total Cu	Total Ni	Total Pb	Total Zn	Hardness	Problem?
1*	11/08/99	ND	ND	9.9	15	0.63	14		No
	3/27/00	ND	19	4.3	10	ND	ND		
	10/27/00	ND	17	24	17	7.8	49		
	6/25/01							1192	
3	3/27/00	ND	2.2	4.4	6.6	ND	14		No
	10/27/00	ND	ND	9.4	6.0	7.8	12		
	6/25/01							488	
4	11/08/99	ND	7.7	8.8	21	ND	22		No
	3/27/00	ND	ND	5.6	11	ND	28		
	10/27/00	ND	5.9	10	10	0.80	26		
5	11/08/99	ND	ND	5.1	6.7	ND	18		No
	3/27/00	ND	2.1	3.1	6.3	ND	13		
	10/27/00	ND	30	22	23	1.7	61		
	6/25/01							492	
6	11/08/99	ND	ND	3.3	8.0	ND	6.8		No
	3/27/00	ND	19	4.6	8.2	ND	ND		
	10/27/00	0.79	21	24	39	9.8	54		
	6/25/01							538	
7*	10/27/00	ND	14	11	12	7.4	29		No
8	3/27/00	ND	2.3	5.4	11	ND	14		No
9	11/08/99	ND	ND	24	26	ND	16		No
	3/27/00	ND	2.3	5.4	11	ND	14		
	10/27/00	1.7	28	24	31	4.0	52		
10	11/08/99	1.6	3.3	35	15	6.4	380		No
	3/27/00	ND	26	6.1	12	ND	13		
	10/27/00	ND	2.8	8.6	9.3	4.0	17		
11	3/27/00	ND	28	7.9	18	ND	6.4		No
	10/27/00	ND	2.2	9.8	12	0.82	22		
12	3/27/00	ND	2.1	10	29	ND	37		No
	10/27/00	ND	2.5	9.2	10	1.5	21		
13	11/08/99	ND	ND	6.7	18	ND	14		No
	3/27/00	ND	25	7.6	19	ND	6.3		
	10/27/00	ND	3.3	9.3	12	0.5	17		
14	11/08/99	ND	ND	4.8	34	ND	23		No
	3/27/00	4.5	19	35	70	17	120		
	10/27/00	ND	2.7	8.0	27	1.3	36		
	6/25/01							1484	
15*	3/27/00	ND	3.2	13	23	0.58	28		No
	10/27/00	ND	ND	6.5	7.1	1.3	11		

* = control site
All data are in units of μg/l
Not all sites had water at each storm event
ND = below detectable limit

Table 4 – Summary of Bacteria Levels at Topanga Beach/Lagoon and Site #6 (TC Bridge at PM2.2)

Sampling Date	Bridge PM 2.2			Topanga Beach/Lagoon/Ocean				
	Total coliform	Fecal coliform	E. coli	Dry	Wet	Entrance	Total coliform	Fecal coliform
7/26/99	230	14	14	A+	Ns	Closed	30	6
8/30/99	2200	8	8	A+	Ns	Closed	47	18
9/27/99	120	4	4	A+	Ns	Closed	8	11
10/26/99	220	23	23	A	Ns	Closed	120	80
11/8/99	5000	1100	1200	A	C	Open	4	4
11/22/99	800	50	50	A	A	Closed	86	61
12/16/99	170	4	4	F	Ns	Open	30	11
1/24/00	80	<2	<2	B	A+	Open	8	2
2/28/00	No data	No data	No data	F	F	Open	460	58
3/27/00	130	4	2	B	F	Open	39	21
5/1/00	2200	30	30	F	F	Open	71	28
5/22/00	300	7	7	C	Ns	Open	1500	970
6/26/00	500	13	13	A+	Ns	Closed	20	1
7/24/00	170	14	14	A+	Ns	Closed	5	1
8/28/00	500	13	13	A+	Ns	Closed	30	7
9/25/00	2400	7	7	A+	Ns	Closed	40	9
10/27/00	8	<2	<2	A+	F	Open	80000	6000
11/27/00	500	13	13	A+	ns	Closed	30	7
12/18/00	500	8	8	F	Ns	Open	30	24
1/22/01	900	23	23	A+	F	Open	110	20
2/26/01	3300	3000	3000	B	F	Open	7800	6100
3/26/01	800	300	220	C	F	Open	300	72
4/16/01	300	30	50	C	F	Open	20	2
5/21/01	1700	17	13	A+	NS	Open	160	54
6/25/01	1700	900	900	C	NS	Closed	8	3
7/30/01	170	4	2	A	NS	Closed	10	7
8/27/01	3000	23	Na	A+	NS	Closed	4	3
9/24/01	7	110	Na	A+	NS	Closed	20	24
10/22/01	1400	240	Na	A	NS	Closed		
11/26/01	9000	140000	Na	A	F	Open		
12/17/01			Na	A+	F	Open		

Notes:
Data provided by Heal the Bay, Beach Report Card.
Bacteria expressed in units of MPN/100mls
Primary contact freshwater = <200, <1000
AB411 standards for beach closure:
Total coliform limit 10,000
Fecal coliform limit 400
E.coli limit 400
Enterococcus limit 104

1.6 Biological Resources

An inventory of biological resources within the Topanga Creek watershed has been in effect for several years, primarily collected by the Resource Conservation District of the Santa Monica Mountains. For being in such proximity to the Los Angeles metropolitan area, Topanga Canyon retains much biological diversity, good water quality, native vegetative cover, and intact wildlife linkages. This discussion of biological resources is summarized from the following studies (Dagit and Webb 2-27):

- Sensitive Species Inventory of Infrastructure, Los Angeles County Dept. of Public Works Contract 1997.
- Sensitive Species Inventory of the Santa Monica Mountains National Recreation Area.
- Topanga Creek Watershed Amphibian and Reptile Surveys, 2000, 2001.
- Status of Herpetological Fauna in the Santa Monica Mountains, Southwest Herpetological Society, 1986.
- Topanga Creek Watershed Macro-Invertebrate Surveys, 2000, 2001.
- Southern Steelhead Survey of Topanga Creek, 2001-2003.
- Topanga State Park Bird Monthly Surveys, Gerry Haigh, 1972-present.
- Mammal sightings records for the Topanga Creek Watershed, RCDSMM files.

1.6.1 Flora

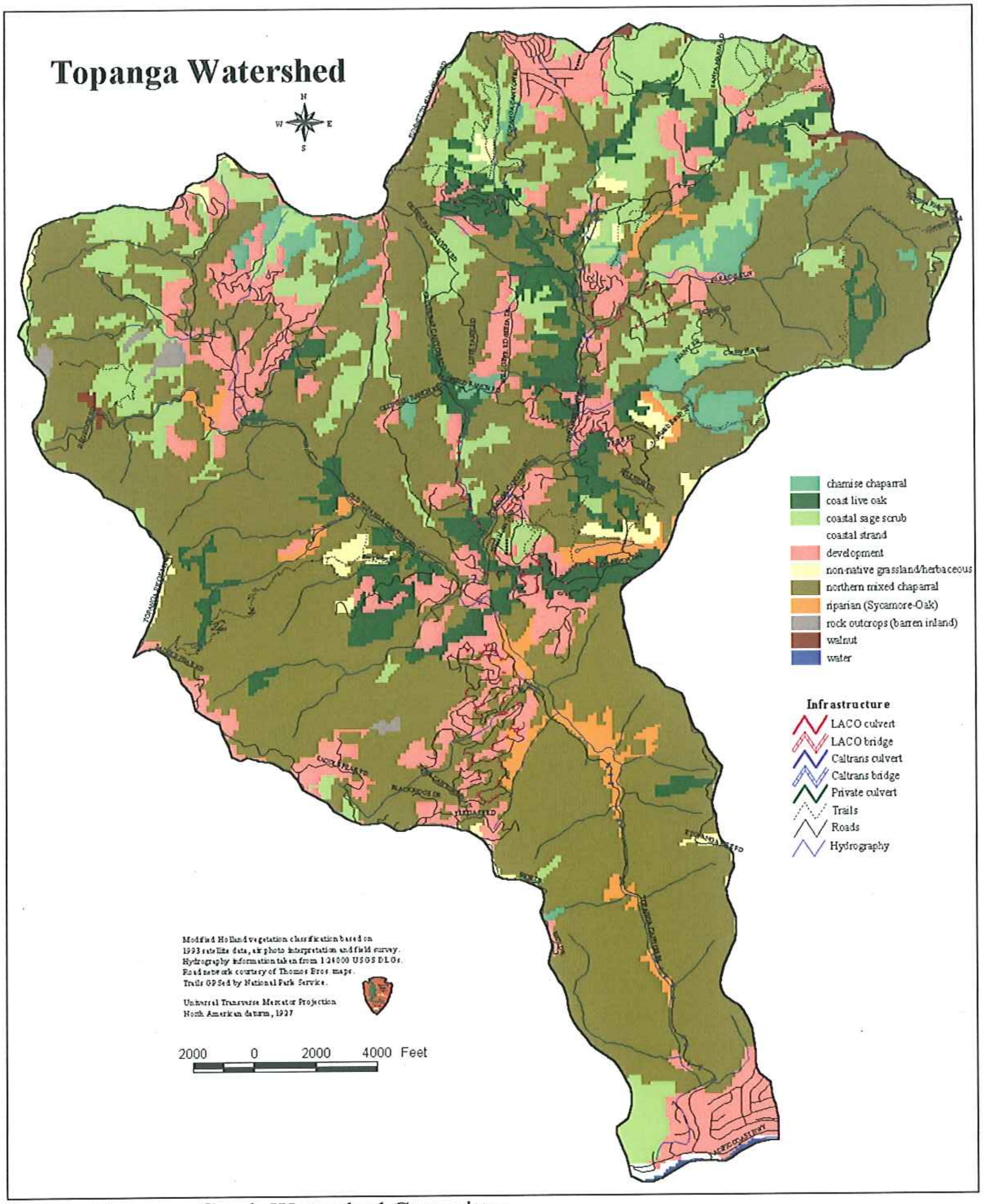
Vegetative communities in Topanga Canyon are varied, but the dominant type is Northern mixed chaparral (see Figure 11). This type of community covers 7,600 of the 12, 800 acres in the watershed. Some sensitive state listed plant communities are also found in the watershed like Southern Walnut Woodland and Riparian Woodlands. Table

9 lists the abundance of plant communities in the watershed. In addition, several sensitive state and/or federally listed species are found in the watershed like Santa Monica Dudleya (*Dudleya cymosa ssp. Ovatifolia*) and Santa Susana Tarweed (*Hemizonia minthornii*) (Dagit and Webb 2-27).

The health of the riparian communities is very important to the overall status of the watershed. Riparian communities are one of the most threatened in the state. The vegetation in these communities provide shelter for water temperature control, habitat preferences for numerous species, erosion control for bank stabilization, as well as canopy cover to soften the effects of raindrop impacts to soil surfaces (Dagit and Webb 2-27). The importance of the preservation of riparian communities is of utmost importance to the watershed.

The vegetation in Topanga Canyon is not entirely native, however. The presence of exotic plant species is well documented and plans to control the spread of invasive species are underway by the Topanga Creek Watershed Committee. Types of invasive species found in the watershed are *Arundo donax*, Cape Ivy, Castor Bean and Yellow Star Thistle. Fragmentation of native vegetative communities is also threatened by disturbance caused by development and routine roadway activities (Dagit and Webb 2-27).

Figure 9 – Major Vegetative Communities in Topanga Creek Watershed



Source: Topanga Creek Watershed Committee

Table 5 – Major Floristic Communities in the Topanga Creek Watershed

Floristic Community*	Number of Acres

Northern Mixed Chaparral	7600
Coastal Sage Scrub	1700
Coast Live Oak Woodland	900
Riparian Woodland	318
Chamise Chaparral	300
Non-native Grassland	169
Walnut Woodland	10

* Modified Holland Classification, based on 1996 data from Native Plant Society

1.6.2 Fauna

The abundance of insects and macro-invertebrates in the watershed is a good indicator of the good health of the watershed. Many species have low tolerances for pollution and low water quality resulting from increased temperatures, reduced levels of dissolved oxygen, and sedimentation. The most limiting factor in the Topanga Creek watershed appears to be sedimentation in the creek. In Topanga, over 600 species of insects have been reported in the watershed. This amount of diversity is sufficient to support a wide-range of predators. Table 10 illustrates the diversity of macro-invertebrates and their tolerance levels in the watershed (Dagit and Webb 2-28).

Amphibian and reptile populations in the watershed are excellent, with Topanga Creek watershed containing the most diversity of any watershed that drains into the Santa Monica Bay. A survey was conducted by the Southwest Herpetological Society in 1986 and revealed that Topanga has 7 of 9 possible amphibian species and 16 of 23 possible reptiles. Sensitive species are included in this diversity. Examples include four California Species of Concern: California Newts (*Taricha torosa torosa*), Western Pond Turtle (*Clemmys marmorata*), San Diego Mountain Kingsnake (*Lampropeltis zonata pulchra*), and the Two-Striped Garter Snake (*Thamnophis hammondii*). The abundance of these sensitive species is a good indicator of the overall health of the watershed (Dagit and Webb 2-29).

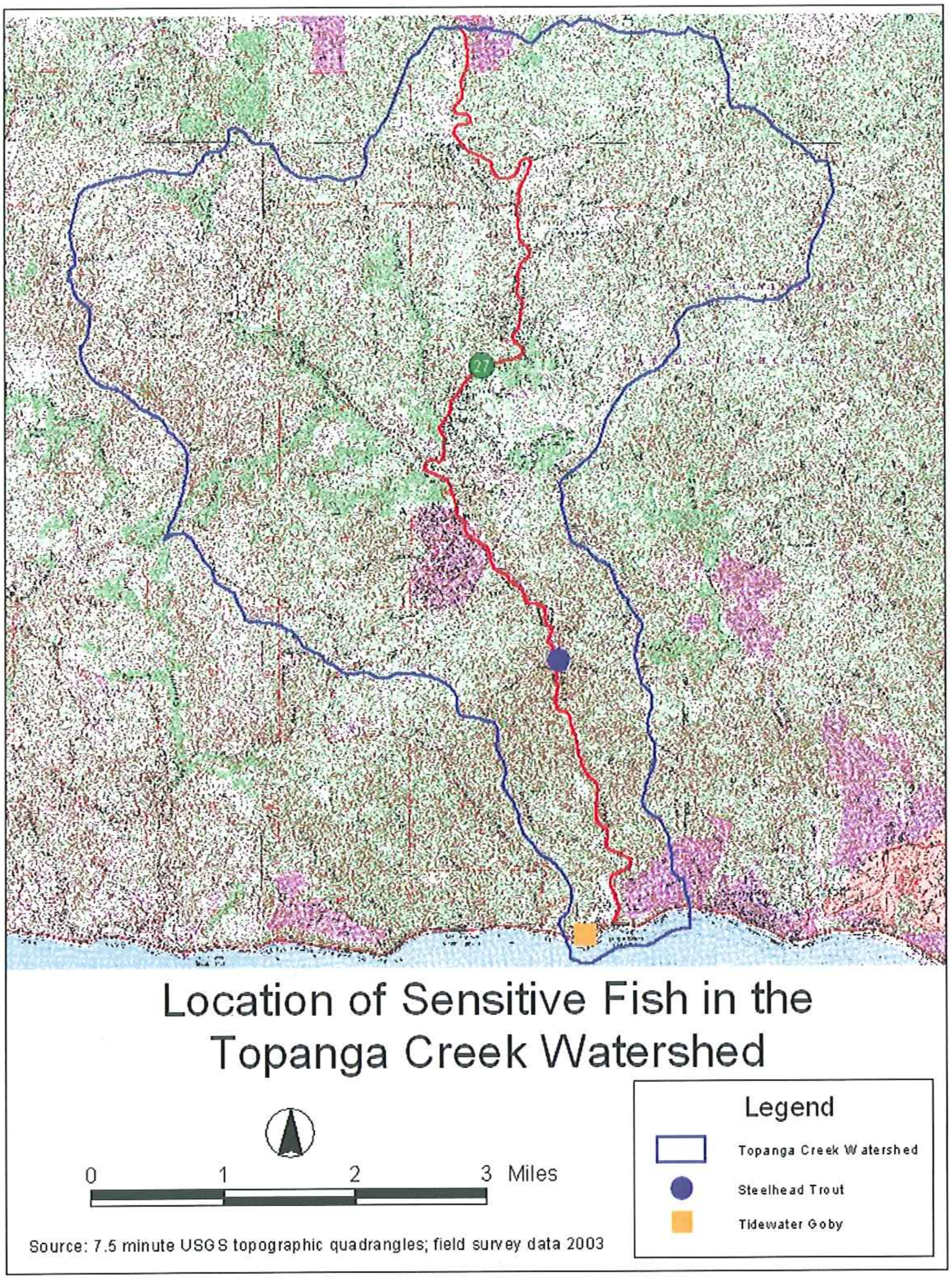
Table 6 – Major Groups of Aquatic Macro-invertebrates Found in Topanga Creek

Common Name	Order	Family	Functional Feeding Group	Tolerance Level*
True Flies	Diptera	Simulidae	Filterer collector	6
		Chironomidae	Collector gatherer	6
Mayflies	Ephemeroptera	Baetidae	Collector gatherer	4
Caddisflies	Trichoptera	Hydropsychidae	Filterer collector	4
		Philipotamidae	Filterer collector	3
		Psychomyiidae	Collector gatherer	2
		Sericosotomatidae	Shredder	3
		Hydroptilidae	Piercer (rare)	4
Stoneflies	Plecoptera	Perolodidae	Shredder	0
		Capniidae	Shredder	1
Aquatic moths	Lepitoptera	Pyralidae	Scraper	5
True Bugs	Hemiptera	Belostomatidae	Predator	8

*Tolerance Scale: 0 = extremely sensitive to pollution; 10 = tolerant of pollution

Many populations of native and sensitive fish have been found in the Topanga Creek watershed. Native fish, like the Arroyo Chub (*Gila orcutti*), are commonly found in the watershed. Two of the species present are federally endangered species. These species are Steelhead Trout (*Onchorhynchus mykiss*) and Tidewater gobies (*Eucyclogobius newberryi*). Both adult and juvenile Steelhead Trout have been found in the lower watershed and the Tidewater Gobies are present in the Topanga Lagoon (see Figure 12). Interestingly enough, no non-native fishes have been found in the watershed. The only exotic invasive animal that was found is crayfish which seem to be confined to a disturbed part of the upper watershed (Dagit and Webb 2-30). Efforts are underway to eradicate this species which proposes a threat to native fish populations.

Figure 10 – Location of Sensitive Fish in Topanga Creek Watershed



Volunteer birders have documented the presence of over 200 species of birds in the Topanga Creek watershed. Some rare species are included in this list, such as Cooper's hawk and Red-shouldered Hawk, which are actually quite common in Topanga versus being rare elsewhere. Many passerines include the upper watershed as a migratory stopover. Other uncommon bird species found in lower Topanga Canyon include Belted Kingfishers, Snowy Egrets, and Great Blue Herons (Dagit and Webb 2-31).

Mammal species in the watershed are varied and include top-level predators as well as small size mammals. There have been over 59 species documented to occur in Topanga Canyon. The top-level predators include mountain lion, bobcats, ringtail cats, and badgers. Several bat species are also found, including the California Species of Concern Western Mastiff Bat, which is found in the upper watershed. Wildlife linkages connecting habitat for wildlife species has been compromised by development. It is thought that if development continues, top-level predators would not be able to survive due to the fragmented landscape (Dagit and Webb 2-32).

2. Roadway Activities along Topanga Canyon Boulevard

2.1 Routine Maintenance Practices

Maintenance activities in Topanga Canyon are varied and occur throughout the year. Most activities involve debris clearing and fire prevention, although other less common practices are regularly conducted such as erosion control, culvert clearing, and surface repair work. These maintenance activities are important in keeping SR-27 safe for traveling motorists, but should also be done in an environmentally sound manner. It is important to minimize environmental impacts as much as possible while performing these types of activities.

2.1.1 Debris Clearing

Most of the routine maintenance practices in the Topanga Creek watershed involve clearing debris sloughed off from the canyon walls and hillsides. The entire stretch of Topanga Canyon Blvd., with the exception of the town of Topanga (located near post mile [PM] 5.0) contains areas of concern regarding excess material reaching the roadway (see Figure 13). Cleaning the highway of such debris is typically done once a month, and especially after storm events (per. comm. with Dennis Cutting). This activity is very important to perform in order to ensure the safety of motorists. The curves along SR-27 are sharp and numerous, therefore if debris, such as large rocks, has fallen onto the road, it may be blinded by a curve and cause an accident. This task is completed by closing a lane and flagging off the bulldozer, while the debris is pushed to the side. Equipment called a "loader" (see Figure 14) then drives along and removes the sloughed material and hauls it to a dumpsite (Cutting). Oftentimes, however, excess material is stored as berms on the shoulders because hauling excess material to a far away dump site is difficult and costly to do on a regular basis (see Figure 15). In addition, excess material is useful for repairing shoulders that constantly get eroded; therefore, removing excess material outside of the canyon to a far dump site is not often implemented.

Figure 11 – Areas along SR-27 with Sloughing Concerns

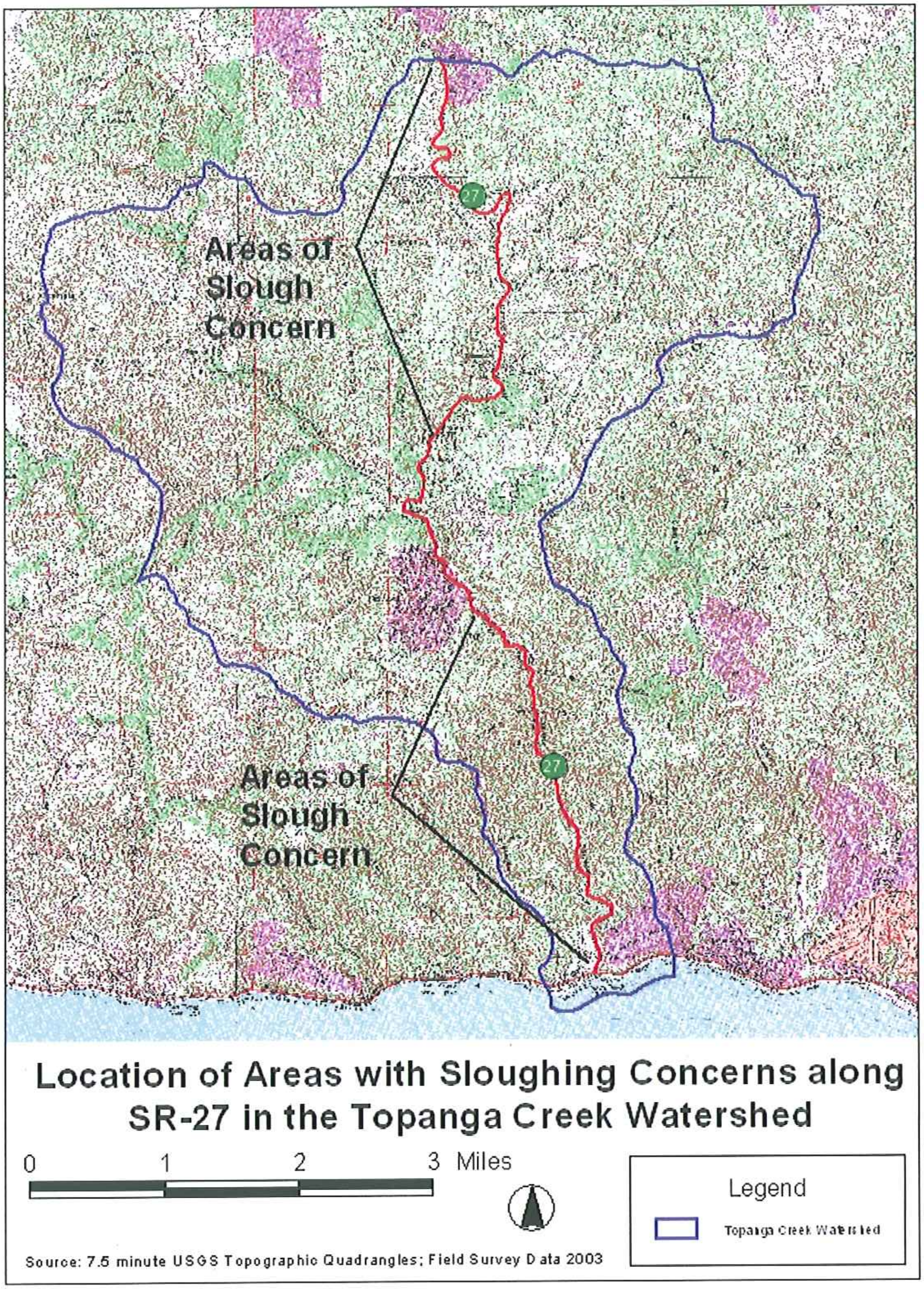


Figure 12 – Typical Loader

Figure 13 – Soil Berms along SR-27

2.1.2 Vegetation Mowing

Another very important maintenance activity that occurs in the canyon is vegetation mowing for fire prevention and improved sight distance. For fire prevention, the Los Angeles County Fire Department normally requires 10 feet horizontally from the edge of traveled way clear of flammable material such as dry vegetation. This clearance protects motorists from fires started by ignitable material thrown or otherwise emitted from vehicles along the roadway. Also, mowing is performed in order to improve the sight distance of traveling motorists along SR-27. Lush vegetation along slopes at roadway curves may decrease the amount of roadway a motorist can see ahead while driving. This amount of vision is called "sight distance" and is very important along curvy roads. Because of the sensitivity and erosion control function of much of the vegetation in Topanga Canyon, Caltrans Maintenance staff generally clears only 6 feet horizontally from SR-27. Some of this mowing occurs along the highway shoulder, while other mowing occurs on the hillsides next to the roadway (called "slope mowing"). Behind the guardrails, Caltrans Maintenance staff uses hand tools to cut vegetation because heavy equipment cannot maneuver behind them. Shoulder and slope mowing generally occurs in the spring and late summer when fire season is in progress. Because of the amount of vegetation present in the canyon and the difficulty in using equipment in the canyon, this process usually takes approximately 3-4 weeks to complete at a time. No herbicidal sprays are used in Topanga Canyon in order to protect the nearby creek and sensitive natural resources, therefore vegetative mowing is essential in order to reduce fire risks and improve the safety of traveling motorists (Cutting).

2.1.3 Shoulder Repair

Another type of routine maintenance practice in the Topanga Creek watershed is the repair of unpaved shoulders. The compacted dirt that makes up the shoulders along the highway gets eroded over time and needs to be repaired. Maintenance staff usually imports this type of material from coastal areas on an as needed basis. Unpaved shoulders exist all along SR-27 within the Topanga Creek watershed. Currently there is a project in the design stages to pave some of the shoulders within this region to eliminate some of this routine maintenance activity (Cutting).

2.1.4 Erosion Control

Erosion control is another type of maintenance activity that isn't performed on a regular basis, but is handled by Caltrans Maintenance staff when needed. There are various types of erosion control used throughout the Canyon. Generally, the most common is riprap bank protection to stabilize the roadway next to Topanga Creek. During large storm events, the creek impacts its banks with such velocity and force that erosion occurs. SR-27 travels adjacent to the creek throughout much of the Canyon and therefore it is affected by these currents. Certain locations are affected more than others. In particular, at PM 2.2 the creek has washed out the banks so much that SR-27 has sustained severe damage from various storm events over the years. Rock riprap has been placed at this location as well as other areas to protect the road. Some of the stabilization includes grouted riprap (boulders placed in a cement mixture) while in other locations ungrouted riprap (boulders without cement) is sufficient (see Figure 16). From time to time the repair of some boulders may be required after large storm events (Cutting).

Another type of erosion control involves stabilizing hillsides that have become prone to landslides. At PM 5.45 a concrete barrier wall was installed in 1998 to prevent the continued erosion of the slope onto SR-27 (see Figure 17). In addition, other landslides have occurred near PM 5.25, 2.0, 1.8 and 1.4. These slides are an on-going problem in the Santa Monica Mountains and Southern California as a whole. Various techniques employed by maintenance staff typically involve hard-armoring of unstable slopes and are performed on an as-needed basis (Cutting).

2.1.5 Drainage Cleaning/Repair

Another type of routine maintenance practice that occurs along Topanga Canyon Blvd. is drainage channel cleaning/repair. Most of the drainage systems along SR-27 are overside drains, which direct storm water runoff directly off the side of the road into pipes that empty the water into adjacent stream channels. There are also approximately six (6) drop inlets in the canyon. Both of these types of drainages are easily cleaned by flushing or simply cleaning the grates. Two large culverts also are present underneath Topanga Canyon Blvd. One of the culverts is located at PM 3.7 behind the present gas company and is approximately five feet in diameter. The other is located at approximately PM 7.2 and is approximately six feet in diameter (see Figures 18 and 19).

Figure 14 – Views of Grouted and Ungrouted Riprap along SR-27


Grouted Riprap


Ungrouted Riprap

Figure 15 – View of Concrete Barrier Wall

Figure 16 – Culvert Located at PM 3.7

Figure 17 – Culvert Located at PM 7.2

The culvert at PM 3.7 does not get clogged regularly. The culvert at PM 7.2 is actually in need of cleaning; however, the responsibility of the culvert belongs to the Los Angeles County Flood Control because the inlet is located outside of Caltrans' right-of-way. For these reasons, culvert cleaning is not a regularly occurring Caltrans maintenance practice in Topanga Canyon (Cutting).

2.1.6 Surface Work

Surface work is also another type of maintenance activity that occurs a couple of times per year. This involves the repair of roadway pavement that includes asphalt and concrete mixes. This type of routine activity only repairs potholes and other irregularities in the roadway surface. Larger projects that completely rehabilitate the entire pavement for long stretches of roadway are performed by a contractor, not maintenance crews, and involve more complicated review processes (Cutting).

2.1.7 Bridge Maintenance

Special maintenance crews also inspect the bridges along Topanga Canyon Blvd. approximately once every two (2) years. Bridges are located at PM 2.0, 4.2, and 6.6 along SR-27 in Topanga Canyon. This inspection is required in order to ensure the integrity of the structure. The work generally involves drift removal, and the maintenance and replacement of structures such as washing, painting, scraping and patching of curbs, rails, and deck joints (Oregon Department of Transportation 12).

2.2 Planned Construction Projects

Caltrans has proposed various construction projects to occur along Topanga Canyon Blvd. within the watershed. Most of them are minor projects, while two are more complex. These projects have not yet been constructed and are at various stages in the planning/design process.

2.2.1 Minor Projects

The first project is a proposed traffic signal installation at PM 4.22 near Old Topanga Canyon Rd. at Pinetree Plaza (see Figure 20). Final design plans are expected to be completed in the fall of 2003 and construction is scheduled to begin in the summer of 2004. The purpose of the project is to improve traffic safety in this commercial area and improve safety for pedestrians attempting to cross Topanga Canyon Blvd. (Liu 2003).

Another project that is in the design stage is a proposal to make highway safety improvements from State Route 1 (Pacific Coast Highway) to Mulholland Drive in (PM 0.0 to 11.1) (see Figure 21). Because SR-27 is a windy 2-lane highway abutting steep cliffs with very few shoulders and turn-outs, this project proposes to make improvements to increase safety. Included in the project is to install metal beam guardrails (MBGR) along high embankment locations, upgrade current non-standard rails to current standards, widen the shoulders at certain curved locations to provide a median buffer zone, and install thermoplastic striping for increased visibility during the night and adverse driving conditions. The project will not only improve motorists' safety and

Figure 18 – Location Map of Traffic Signalization Project

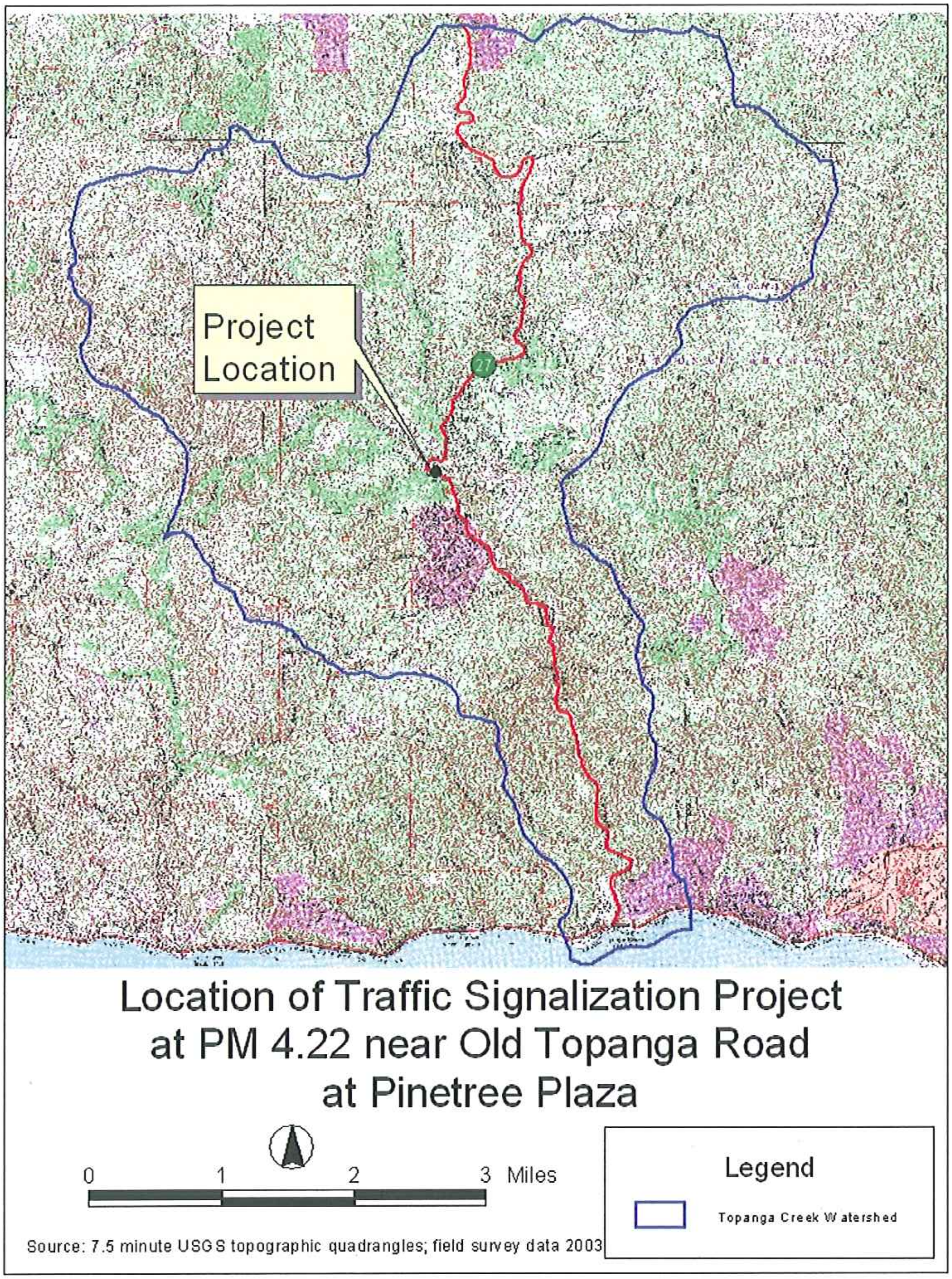
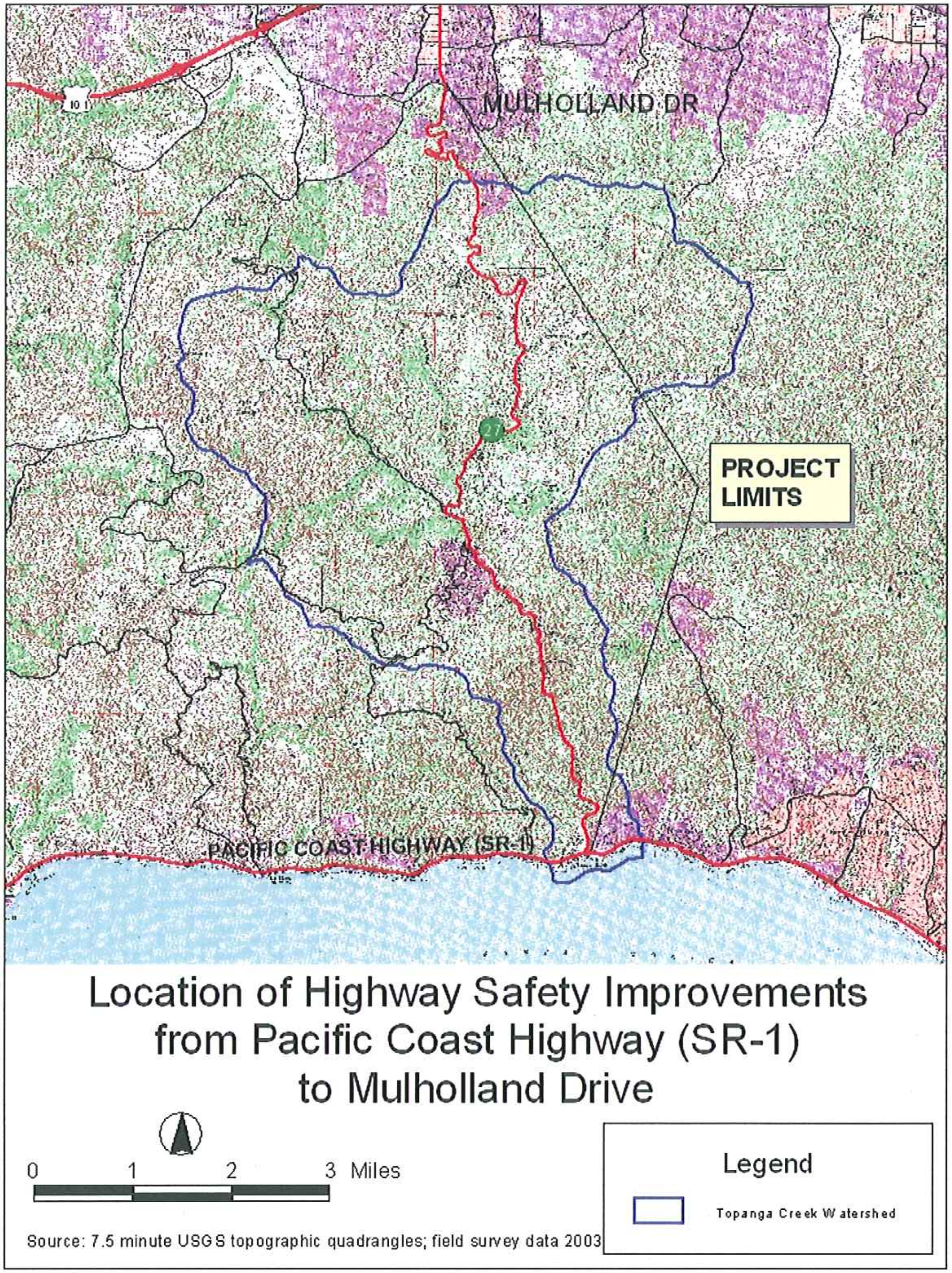


Figure 19 – Location Map for Safety Improvement Project



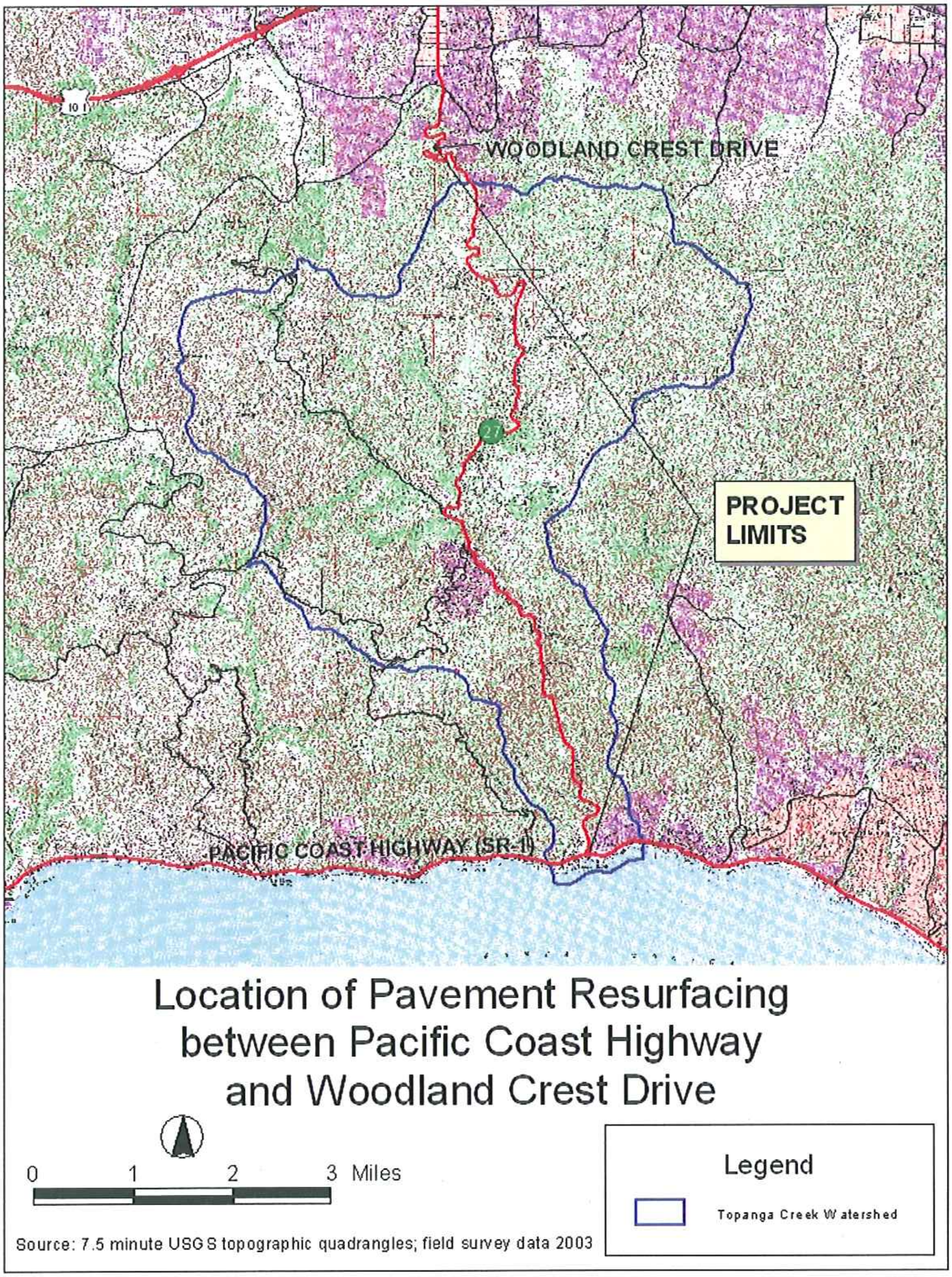
decrease the amount of accidents, but will also improve operations and reduce maintenance costs. Construction is scheduled to begin in the fall of 2004 and end by the spring of 2005 (Caltrans Fact Sheet for EA 20700).

A third minor project is also in the final design plans and scheduled for construction in the fall of 2004 and end by the spring of 2005. This project involves resurfacing the pavement of Topanga Canyon Blvd. between Pacific Coast Highway and Woodland Crest Drive (PM 00.0 – 10.8) (see Figure 22). A Pavement Condition Survey Inventory was completed in 1999 and it identified this route in need of rehabilitation. This project proposes to cold plane the existing pavement, place rubberized asphalt concrete, type G, and replace pavement delineation (Caltrans Fact Sheet for EA 20740).

2.2.2 Major Projects

Two projects are now in the early planning stages and are larger in scope than the previously described projects. The first one involves the total roadway reconstruction for a section of Topanga Canyon Blvd. between PM 2.0 to 2.2. The project proposes to reconstruct the roadway at this location in order to improve public safety, restore habitat for endangered steelhead trout, and restore a portion of the creek's streambed that has been lost from in-fill at this narrowest cross-section within the watershed (Dagit, Narrows 5). Major concerns are still being addressed for this project, specifically in terms of constructability. Full highway closure in both directions may be necessary to construct the project, although this is not feasible due to emergency service and traffic concerns (Liu 2003). The initial planning document, called a Project Study Report (PSR) is

Figure 20 – Location Map for Pavement Resurfacing Project



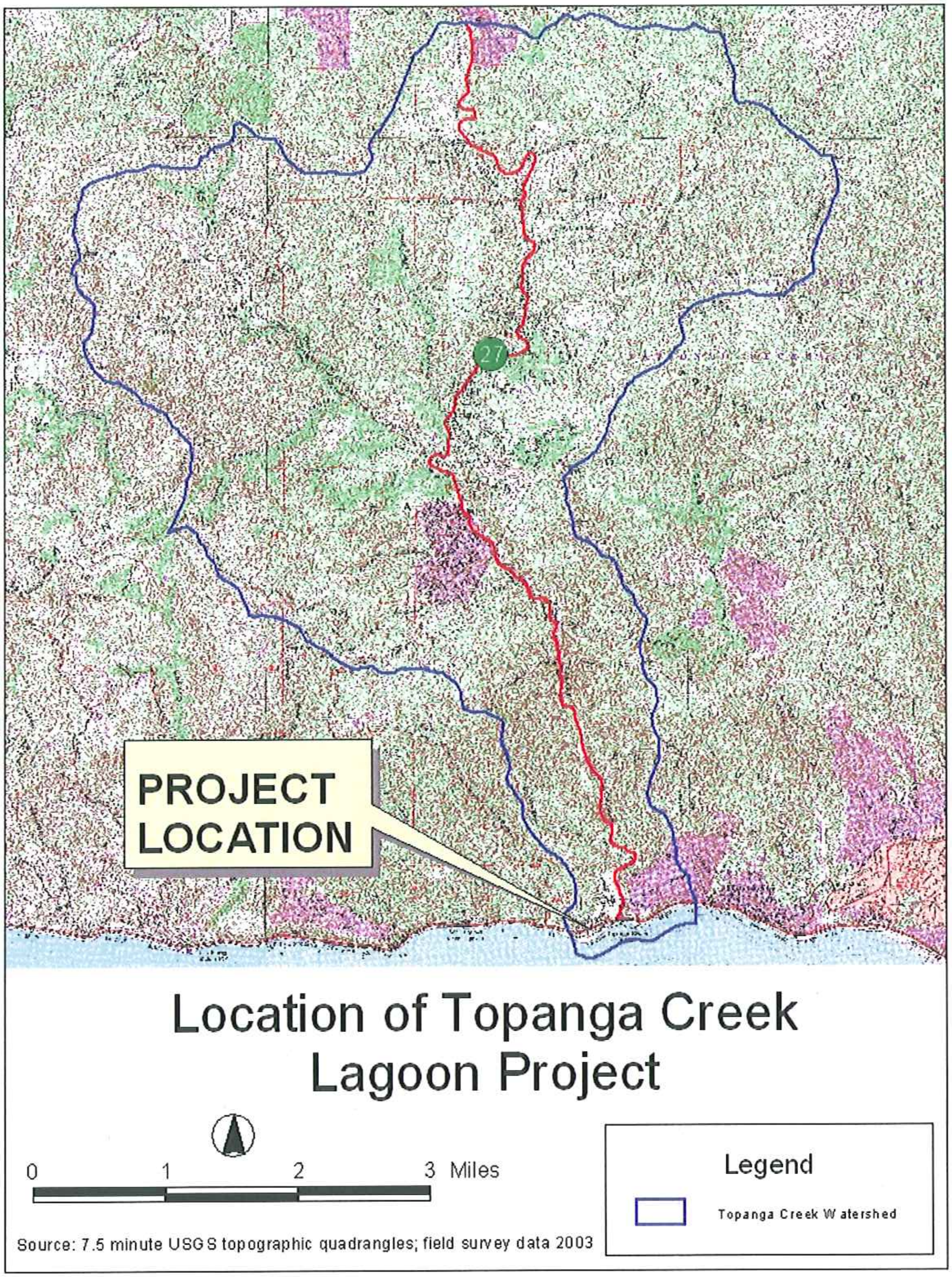
currently being prepared and is scheduled for completion late in 2003. This document, once approved, will be used to seek funding for the Engineering and Environmental Support for the Project Approval and Environmental Document component. The remaining support and capital components will be sought at a later date. There is no current schedule for these remaining steps as it depends upon funding approval.

The other major project similar in schedule to the above project is the widening of the Topanga Creek Lagoon where Topanga Creek empties into the Pacific Ocean. This project is not located adjacent to Topanga Canyon Blvd., (see Figure 23) but it is the southernmost portion of the watershed. In 1934 Caltrans constructed a bridge over Topanga Creek at Pacific Coast Highway that narrowed the cross-section of the lagoon and filled in all but 2 acres of the original lagoon (Dagit and Webb 4-1). The proposed project would construct a new bridge at the same location but with a longer configuration in order to restore the lagoon similar to its original condition. The purpose of this project would be to alleviate velocity, erosion, and sedimentation problems in the upper watershed, restore fish habitat, and restore tidal wetlands.

3. Conflicts between SR-27 and Environmental Resources

The existence of SR-27 in Topanga Canyon results in a number of conflicts between the roadway and the environmental resources in the Canyon. These conflicts result from the existence of the road itself as well as from maintenance and construction activities.

Figure 21 – Location Map of Lagoon Project



3.1 Existing Roadway Conflicts

Once a highway is constructed, there are several impacts that this facility has on the environment just as a matter of existing in a natural area. For example, the existence of Topanga Canyon Blvd. creates problems such as the disruption of wildlife linkages, increased wildlife mortality, increased erosion, and pollution deposition. These conflicts are a result of the construction of the roadway within the Canyon, and some of these impacts may not ever disappear even if the road were removed and allowed to be revegetated. Other impacts will continue to exist as long as the roadway is fully operational.

3.1.1 Wildlife Mortality/Separation

The first conflict is increased wildlife mortality and separation of wildlife linkages. Most of the mortalities are the result of vehicular collisions and are located throughout the watershed, although many of the wildlife crossings seem to occur between PM 0.5 to 3.75. The separation of wildlife linkages is also connected to increased mortality. As more wildlife individuals are killed along the road, it is apparent that their ability to travel to their destination on the other side of the road is compromised. It should be noted that the mortalities and linkage separation are not as significant along Topanga Canyon Blvd. as they are on higher volume, multi-lane freeways. Topanga Canyon Blvd. is a two-lane highway with low traffic volumes at night when animals are more likely to migrate across the road (Dagit Re: Topanga).

3.1.2 Increased Erosion

Another type of impact that is the result of the existence of Topanga Canyon Blvd. is the erosion generated by culverts underneath the road as well as erosion on slopes cut and filled for the creation of the highway. This erosion is born out of the creation of the road and efforts to keep it stabilized. Canyon walls had to be cut and gullies filled to make room for SR-27 through Topanga Canyon (see Figure 24). When streams ran perpendicular to the roadway, they had to be diverted underneath in culverts so the road would not be washed out or act like a dam causing slope failure. These actions do make the roadway stable for a while, but eventually erosion does occur.

Figure 22 – Historical Photo of Building Topanga Canyon Blvd. (circa 1900-1920)

Source: http://digital-library.csun.edu/copyright.html

Culverts act to divert water underneath the roadway into main streams. Since the water is funneled through these narrow passages, water velocity can be high. Oftentimes the culverts are emptied into the sides of streams where the water flows directly onto the streambanks. This creates erosion on the slope, affects local vegetation, and also can undermine the roadway (see Figure 25).

Figure 23 – View of Culvert Causing Erosion

Cut and fill slopes in the canyon facilitate erosion of the affected soils. These slopes are not very stable because they are disturbed and part of their soil structure was destroyed. For these reasons erosion of the topsoil occurs over time. Eventually, this erosion causes the soil to fall into the creek causing increased sedimentation (see Figure 26).

Figure 24 – Erosion Caused by a Fill Slope on SR-27

3.1.3 Pollution Deposition

The existence of Topanga Canyon Blvd. also results in the deposition of various chemicals onto vegetation and the ground. Lead is found in the ground adjacent to the roadway because of the previous use of leaded gasoline. Soot also covers much of the vegetation near SR-27 resulting from the emissions of vehicles. Other traces of pollutants may be traced to the roadway uses, but these amounts are low as seen in Section 1.1.5.

3.1.4 Increased Light

Lastly, the creation of Topanga Canyon Blvd. increased the amount of light into the Canyon as well as the creek. This increased light creates suitable habitat for exotic weeds that can out-compete their native counterparts along the sides of the roadway. The light onto the creek can result in an increase in water temperature that can be detrimental to aquatic organisms. Fortunately, water temperatures tested in the creek are relatively good despite the increase of light as seen in Section 1.1.5.

3.2 Conflicts from Planned Construction Projects

Planned construction activities will generally not result in significant negative effects on natural resources. All of the minor projects planned for construction will have few biological impacts. The major proposed projects, however, may have some significant impacts during the construction phase, but the overall end result will be extremely beneficial for the natural resources in the Canyon.

3.2.1 Minor Projects

The minor projects are either too small in scope or involve work within the existing prism of the roadway so that they will not result in any major biological impact. The traffic installation project is in an urbanized area and is too small in scope to create any such effect. The safety improvement project is larger in scope, but all work will take place within the existing roadway area and no new lanes will be added. The effects of the project will mainly be to increase safety of motorists, therefore no new impacts are expected to biological resources. The third minor project to repave SR-27 will also not create impacts since all work will be on the existing pavement and no changes will be made to the road. For all these projects, Best Management Practices would need to be employed during construction to prevent impacts to the natural resources in the canyon.

3.2.2 Major Projects

The major construction projects that are in the early planning stages may have detrimental impacts to biological resources, but only during the construction phase. After the projects are complete, they are expected to result in positive impacts to natural resources. In fact, the primary reason for their implementation is to protect and enhance existing natural resources in the Canyon. The lagoon project will increase tidal wetlands and fish habitat while alleviating velocity, erosion, and sedimentation in the watershed. During construction, however, it is possible that disruption to the existing fish habitat and sedimentation may occur. In addition, the project to reconstruct the roadway between PM 2.0 to 2.2 will likely negatively impact Topanga Creek during construction. The endangered steelhead trout may also be negatively impacted at this time. The resulting project, however, will increase the creek's streambed width to a more natural condition and will restore streamside and fish habitat. Mitigation options are being explored for the two projects for any impacts and coordination with resource agencies will ensure that the biological resources are protected as best as possible.

3.3 Conflicts from Routine Maintenance Activities

Routine maintenance activities in Topanga Canyon Blvd. also result in a number of conflicts with biological resources. Generally the three areas in which maintenance conflicts with the natural resources in Topanga Canyon include slough removal, vegetation mowing, and hardscaping. These three categories contribute significantly to the difficulty in protecting environmental resources.

3.3.1 Slough Removal

The environmental impacts associated with slough removal generally involve the use of the material after removal occurs. Because of the lack of a proper disposal site within Topanga Canyon, slough is generally bermed on the side of SR-27 until it can be reused. This berming of material impacts various resources within the canyon.

One of the resources that are impacted is the root system of mature native trees. Coast live oak trees (*Quercus agrifolia*) in particular are sensitive to soil berms covering their roots (see Figure 27). The soil berms smother the shallow extensive horizontal root system, which is vitally important to the overall health of the tree. This root system supplies the exchange of gases and water to the tree. If excessive berming occurs over these roots, this exchange is halted and moisture can be trapped, thus leading to root or crown rot (Johnson and Gustafson 2).

Figure 25 – Soil Berms Impacting Oak Roots

Another problem associated with soil berming on the side of the highway is the spillage of excessive material into the adjacent creek. This sedimentation occurs when the berms are placed at the top of the slope supporting SR-27, which is located next to Topanga Creek or one of its tributaries (see Figure 28). Gradually, soil becomes displaced from the berm and slides down into the creek. Sedimentation into the creek can contribute to decreased water quality and degraded aquatic habitat.

Figure 26 – Soil Berms Sloughing into Creek

Lastly, soil berms on the side of highways negatively contribute to the natural environment by their mere appearance. In other words, these berms are not aesthetically pleasing. One of the benefits of having a roadway in a natural area is the ability to appreciate nature's beauty. Berming slough on the side of the road depreciates the value of the surrounding landscape and does not contribute positively to the motorists' appreciation of the Canyon's splendor.

3.3.2 Vegetation Mowing

Other routine maintenance activities that conflict with environmental resources in Topanga Canyon are vegetation mowing activities, especially along the canyon slopes and roadway shoulders near the highway. These mowing practices contribute to increased erosion, slope destabilization, benefit exotic species, and degrade aquatic habitat.

Mowing the canyon slopes adjacent to the roadway is necessary in order to remove flammable vegetation next to the road that may be ignited by motorist actions. This particular activity is called "slope mowing" and regularly occurs in the Canyon (see Figure 29). The problem with slope mowing is that the removal of vegetation along slopes adjacent to the road results in an increase in slope erosion. Vegetation acts to secure the slope with established root systems. Slope mowing generally involves grading the entire slope thereby disrupting even the roots of the vegetation, thus destabilizing the slope. As more erosion occurs, more debris falls onto the roadway increasing problems in the canyon.

Slope mowing also prevents the existence of sensitive native plants that are ecologically adapted to rocky slopes, such as the Santa Monica dudleya (*Dudleya cymosa ssp. Ovatifolia*) and Santa Susana tarweed (*Hemizonia minthornii*), which are found in Topanga Canyon. The continued disturbance of the slopes decreases the overall habitat for these and many other native species to thrive. Therefore, the presence of sensitive species within the zone of slope mowing is extremely rare.

Figure 27 – Slope Mowing along SR-27

Vegetation mowing performed by maintenance crews also involves the mowing of shoulders next to the highway, called "shoulder mowing". Shoulder mowing on a regular basis increases the presence of invasive exotic species that can out-compete natives (see Figure 30). Shoulder mowing also degrades aquatic habitat that exists adjacent to the side of the highway in certain locations (see Figure 31). These locations have become established due to natural ground springs emitted from the canyon faces. Amphibians routinely use these seeps to spawn, and numerous tadpoles are found at these locations every year. When shoulder mowing occurs here, the aquatic organisms and their habitat are destroyed due to heavy equipment traffic and vegetation removal (see Figure 32).

Figure 28 – Presence of Wild Fennel (Foeniculum vulgare) on Shoulder of SR-27

Figure 29 – Wetlands Adjacent to SR-27 at PM 2.2

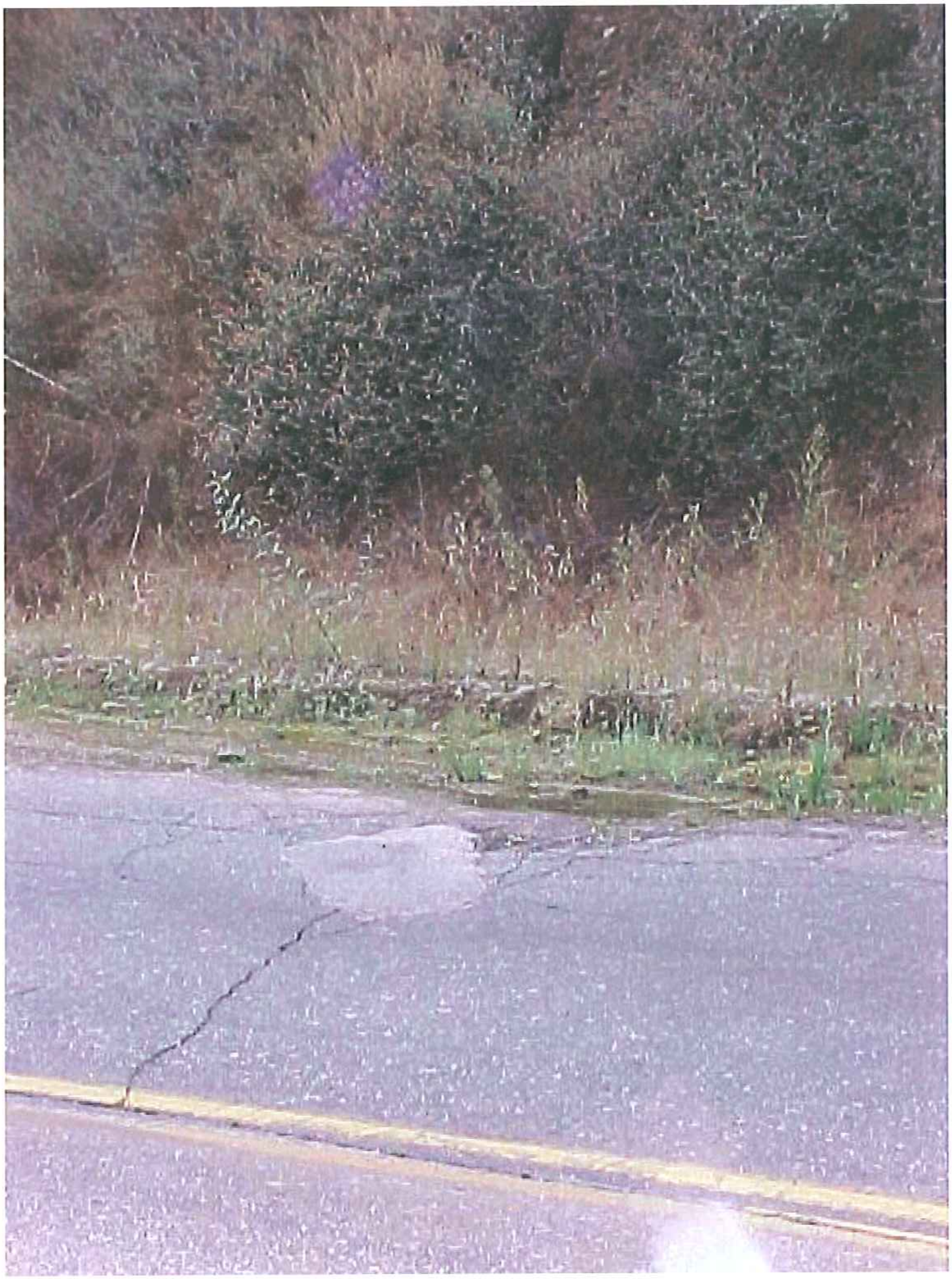


Figure 30 – Same Wetlands at PM 2.2 after Shoulder Mowing

3.3.3 Hardscaping

The third way in which maintenance activities conflict with natural resources is in the introduction and maintenance of hardscapes. Hardscapes are the inanimate elements in a landscape, often involving some type of masonry or woodworking. The specific hardscapes used by maintenance crews in Topanga Canyon are rock riprap (both ungrouted and grouted) and retaining walls. The existence of these elements conflicts with the natural processes in the watershed and results in detrimental impacts to the resources in the canyon.

The introduction of retaining walls in the canyon is typically implemented to support slopes from failing. It is generally considered a safe engineering solution to protect structures and roads. Usually retaining walls are designed and constructed as part of planned construction activities in an area, although maintenance crews can also be involved in their construction. One particular retaining wall in Topanga Canyon was constructed as part of maintenance efforts to protect the roadway from a potential landslide. The slope was becoming destabilized and therefore a retaining wall was constructed to prevent the failure (see Figure 33). The problem with this retaining wall is that it is not aesthetically appealing. The white façade does not blend with the natural coastal sage scrub hillside it is protecting. Also, this wall is constructed on a curve and therefore is visible from a distance away. Again, the natural beauty of the canyon suffers from the construction of a hardscape element.

Another hardscaping element that has many disastrous effects on natural resources in Topanga Canyon is the introduction of both ungrouted and grouted rock riprap, also called rock slope protection (RSP), along the banks of Topanga Creek and its tributaries. RSP has been placed in various locations throughout Topanga Canyon mainly to stabilize the slope supporting SR-27 adjacent to Topanga Creek. The storm water events in the canyon have the velocity to wash out the roadway and therefore reinforcement of the slope is essential in protecting the roadway as well as motorists' safety. Unfortunately, RSP also has negative consequences in the natural environment.

Figure 31 – Concrete Retaining Wall at PM 5.45

Specifically, this hardscaping contributes to the destruction of aquatic organisms and their habitat, destruction of streambank habitat, the disturbance of oak tree root systems, increased velocity of streamflow, increased vulnerability to slope failure, increased debris in the stream channel, and increased stormwater runoff due to an increase in impervious soil.

A type of native vegetation that is impacted with the installation of RSP is the coast live oak. If RSP, especially grouted, is placed around an existing oak, the root system can become compromised, much like soil berming (see Figure 34). The survival of coast live oaks surrounded by grouted RSP is not likely.

The installation of RSP on the banks of the stream channel destroys the natural vegetation growing on the slope. This vegetation provides habitat for various organisms and also shelters the stream and cools the water. Various species found in or near Topanga Creek are sensitive including the steelhead trout (*Onchorhynchus mykiss*), California newts (*Taricha torosa torosa*), western pond turtle (*Clemmys marmorata*), San Diego mountain kingsnake (*Lampropeltis zonata pulchra*), and the two-striped garter snake (*Thamnophis hammondii*). The installation of this element would therefore eliminate all of these natural resources that may exist in the affected location, including any sensitive ones. In fact, RSP was placed along the bank of Topanga Creek following a massive flood event exactly where steelhead trout now inhabit (see Figure 35). Fortunately, the fish were not present when the RSP was placed, but future flooding events and continued maintenance of this particular slope may result in harm to the species.

At this same location, the placed RSP decreased the channel width in order to support the roadbed. This decrease in the channel capacity also served to increase water velocities through the canyon at this location. The increased water velocities thereby increase downstream erosion.

Figure 32 – Riprap Placed at Base of Oak Tree

Figure 33 – Riprap on Slope adjacent to Steelhead Trout Location

Rock slope protection's purpose is to secure the roadway from further erosion. Unfortunately, with high stormwater events common in Topanga Canyon the RSP is no match for Mother Nature. The RSP is clearly being undercut by the creek's strength and is therefore susceptible to failure once again (see Figure 36). In fact, various boulders have already pried themselves loose of the bank and have landed squarely in the creek, which increases the amount of unnatural debris in an already constricted stream (see Figure 37). And, if failure of the slope happens to occur during a high velocity storm event, the result would be disastrous for the aquatic organisms in the stream at that time as the boulders would become dislodged and fall directly into the creek.

Figure 34 – Undercutting of Riprap near Steelhead Location

Figure 35 – Loose Boulders in Topanga Creek from Riprap

The last negative consequence of the installation of RSP along the streambank is the increase in impervious soil. Natural streambanks absorb much of the storm water through the roots of riparian vegetation. When RSP is placed on the streambank without any vegetative cuttings, all of the stormwater runs off the boulders and concrete and flows directly into the stream. This water increase in the stream may result in increased downstream erosion.

4. Solutions to Alleviate Impacts

With a clear understanding of the environmental resources existing in the Topanga Creek watershed, the roadway activities involved with Topanga Canyon Blvd., as well as the conflicts that exist between the two, it is possible to examine the potential solutions to alleviate these impacts on the environmental resources. The solutions are individually associated with each roadway activity from the inherent elements of the facility, to planned construction projects, to routine maintenance activities. One completed activity to minimize impacts will hardly have an effect, but cumulatively they should improve the overall quality of the environment.

4.1 Solutions to Existing Roadway Impacts

The existence of Topanga Canyon Blvd. impacts numerous natural resources, but there are a number of solutions that can be employed to mitigate for these impacts. One of the impacts is the increase in wildlife mortality and habitat separation that results from animal/vehicle collisions. Another is the erosion resulting from the use of culverts and cut/fill slopes created for the roadbed. A third impact is the chemical deposition onto vegetation and the ground near the road from vehicle emissions. The last impact in Topanga Canyon from the existence of the road is the increased amount of light filtering onto the ground and the stream. Appropriate solutions have been developed to alleviate these impacts and minimize intrusion into the natural environment in the Topanga Canyon watershed.

4.1.1 Wildlife Mortality/Separation

Increased wildlife mortality and habitat separation in the Topanga Canyon watershed does not seem to have a very serious individual impact on wildlife populations in the Santa Monica Mountains. Still, there are several steps that can be taken to improve the linkages between habitats on either side of the highway. First, a study should be conducted to determine in a systematic fashion where the impacts to wildlife linkages exist along the highway and to what extent does SR-27 impact the viability of the linkages.

Based on the results of this study, one can determine what mitigation would be necessary, if any, to alleviate the impacts. If impacts are present but not very severe, there are some lower cost solutions that can improve the linkages for wildlife. Some of these solutions include modifying existing culverts to make them more usable for wildlife movement, installing signs to alert motorists to the potential of wildlife crossing, and installing fencing to prevent animals from reaching the roadway by diverting them to culverts that safely travel underneath the roadway.

If significant impacts to wildlife movement are discovered as a result of Topanga Canyon Blvd., then more intensive mitigation would be required to alleviate these impacts. Possible solutions include the construction of overpasses and/or underpasses where wildlife movement is severely restricted. These mitigation measures are more costly and require more time to design and construct than the other solutions, but they have the potential to significantly improve wildlife movement.

4.1.2 Increased Erosion

Another type of impact that is the result of the existence of Topanga Canyon Blvd. is the erosion generated by culverts underneath the road as well as erosion on slopes cut and filled for the creation of the highway. The solution to this increased erosion is not easy but possible. Efforts to stabilize the slopes should incorporate bioengineering methods as much as possible. A combination of traditional methods along with bioengineering may prove to be a successful solution if bioengineering cannot hold the slope by itself. Potential solutions may consist of vegetated buffers or strawbale barriers. A cost-benefit analysis should also be conducted to determine the best way to stabilize the slopes.

4.1.3 Pollution Deposition

The deposition of chemicals into the air, onto the vegetation, ground, and water is a common occurrence with a fully operational highway. The effects of these chemicals are well-noted but solutions are more difficult to find. In Topanga Canyon, the amount of chemicals in the watershed does not seem to be a cause for concern. Nevertheless, precautions should be made to limit the amount absorbed by the environment. For example, in Topanga Canyon, Caltrans maintenance crews have already eliminated the use of herbicides to control for weeds. Unfortunately, there are other sources of chemicals that have not been eliminated like vehicle emissions, brake and tire wear, and old leaded gasoline that have remained in the ground for decades.

One way to filter pollutants before they reach the waterways is to encourage the water to drain directly into the ground next to the roadway rather than funnel the water directly into the stream via a storm drain. This allows the ground to filter the pollutants naturally. Also, the use of retention ponds and swales to gather storm water and allow the pollutants to filter into the ground before reaching the stream is a possibility. Unfortunately though, in Topanga Canyon space is very limited and therefore these types of systems may not be easily implemented.

4.1.4 Increased Light

The existence of a roadway also creates a wide area that receives more light than it would have if it was vegetated. This increase of light into the natural area allows for weedy plants to flourish. Solutions to alleviate the spread of invasive exotic plants next to the roadway include the planting of native vegetation. To combat the spread of potential fires next the roadway, native plants could be planted in the clear recovery zone that are more fire resistant. Table 11 lists some native plants and their suitability for fire safety. Also, vegetation within the fire prevention zone should be cleared after the growing season and only done in areas that need to be cleared for fire safety.

Table 7 – Native Plants for Fire Safety in the Santa Monica Mountains

GROUNDCOVERS

Common Name	Scientific Name	Flammability	Habitat	Exposure
CA fuchsia	*Epilobium californica*	low	Oak wood, chap	sun, part shade
CA poppy	*Eschscholzia californica*	med	chap	sun
Catalina perfume*	*Ribes viburnifolium*	med	chap	sun, part sun
Cinquefoil	*Potentilla glandulosa*	med	chap	sun
Coreopsis	*Coreopsis gigantea*	low-med	chap, coast	sun, part sun
Coyote brush	*Baccharis pilularis*	low	chap	sun
Evening primrose	*Oenethera elata*	low-med	chap	sun, part sun
Fleabane	*Erigeron foliosus*	low	chap	sun
Live forever	*Dudleya sp.*	low	rock faces	sun
Mahonia	*Mahonia repens*	low	riparian	shade
Manzanita*	*Artcostaphylos sp.*	low-med	chap	sun, part sun
Rockrose*	*Cistus sp.*	low	open	sun
Sagebrush*(prostate)	*Artemesia californica*	low-med	oak wood, chap	sun
Shrubby butterweed	*Senecio douglasii*	low	oak, wood, chap	sun
Yarrow	*Achillea millifolium*	low	rock faces	sun, part shade

css=coastal sage scrub

PERENNIAL HERBS

Common Name	Scientific Name	Flammability	Habitat	Exposure
Beach suncups	*Cammisonia cheiranthifolia*	low	coastal dunes	sun
Bladderpod	*Isomeris arborea*	low-med	css	sun
Blue eyed grass	*Sisyrinchium bellum*	low	open	sun
Butterfly bush	*Buddleia davidii*	low-med	css, oak wood	sun, part sun
CA blackberry	*Rubus ursinus*	med	chap, riparian	shade, part sun
CA rose	*Rosa californica*	low	chap, riparian	part sun, sun
Chaparral curranat	*Ribes malvaceum*	med	chap	sun
Chaparral honeysuckle	*Lonicera subspicata*	low-med	chap, oak wood	shade
Coast sunflower	*Encelia californica*	med	css, chap	sun
Fuchia flowering gooseberry	*Ribes speciosum*	med	chap, riparian	part sun, shade
Giant Wild rye	*Leymus condensatus*	med	chap, riparian	sun, part sun
Golden currant	*Ribes aureum*	med	chap, oak wood	part sun
Golden eyed grass	*Sisyrinchium californicum*	low	open	sun
Gum plant	*Grindelia robusta*	low	chap, css	sun
Heart-leaved penstamon	*Keckellia cordifolia*	low-med	css, chap	sun, part sun
Hummingbird sage	*Salvia spathacea*	low	oak wood, chap	shade
Iris	*Iris douglasiana*	low	riparian	sun, part sun
Lupines	*Lupinus sp.*	low-med	css, chap	sun, part sun
Mahonia	*Mahonia pinnata*	med	riparian	shade
Matilija poppy	*Rommneya coulteri*	med	css, chap	sun
Meadow rue	*Thalicatrum fendleri*	low	oak wood, riparian	shade
Monkey flowers	*Mimulus sp.*	low-med	chap, oak wood	sun, part sun
Nightshade	*Solanum sp.*	low	chap, oak wood	sun, part shade
Our Lord's candle	*Yucca whipplei*	med	chap, css	sun

css=coastal sage scrub

PERENNIAL HERBS (cont.)

Common Name	Scientific Name	Flammability	Habitat	Exposure
Rush	*Juncus textilis*	low-med	riparian	shade, part sun
Scarlet larkspur	*Delphinium cardinale*	low	chap, css	sun, part shade
Sea lavander	*Limonium californicum*	low	css	sun,part sun
Snowberry	*Symphoricarpos mollis*	low	chap, oak wood	shade
St. Catherine's Lace	*Eriognum giganteum*	med	css	sun
Wild grape	*Vitus girdiana*	low	riparian	shade, part sun
Wooly blue curls	*Trichostema lanatum*	med	chap, oak wood	sun
Yerba santa	*Eriodictyon crassifolium*	low	chap, css	sun

css=coastal sage scrub

TREES AND SHRUBS

Common Name	Scientific Name	Flammability	Height	Spread
Alder	*Alnus rhombifolia*	low	50-90	40+
Ash	*Fraxinus velutina*	med	20-50	30-50
Big Leaf Maple	*Acer macrophyllum*	med	30-95	30-95
Big-pod Ceanothus	*Ceanothus megacarpus*	high	<15	10-May
Box Elder*	*Acer negundo californicum*	med	<60	<60
Buck-brush	*Ceanothus cuneatus*	high	<51	10-May
Buckeye*	*Aesculus californica*	low-med	20+	30+
CA Bay	*Umbellularia californica*	low-med	30-75	30-75
CA Walnut	*Junglans californica*	low-med	25-35	30-40
Coast Live Oak	*Quercus agrifolia*	low	30-70	70+
Coffeeberry	*Rhamnus californica*	med	<15	<15
Cottonwood	*Populus fremontii*	low	40-60	40-60
Elderberry	*Sambucus mexicana*	low/med	<20	<20
Flannelbush*	*Fremontedendron sp.*	low	<20	<10
Greenbark Ceanothus	*Ceanothus spinosus*	high	<15	<15
Hairy-leaved Ceanothus	*Ceanothus oliganthus*	high	<15	<15
Hoary-leaved Ceanothus	*Ceanothus crassifolius*	high	<15	<15
Holly leaf Cherry	*Prunus ilicifolia*	low-med	<20	<15
Laurel Sumac	*Malosma laurina*	high	<20	<20
Lemonade Berry	*Rhus integrifolia*	med high	<15	<15
Manzanita	*Arctostaphylos glauca*	med high	<15	<15
Mountain mahagany	*Cercocarpus betuloides*	med -high	<15	<15
Prickly pear cactus	*Opuntia littoralis*	low	<15	<15
Quailbush	*Atriplex lentiformis*	low	<15	<15
Redbud*	*Cercis occidentalis*	low	<20	<20
Scrub Oak	*Quercus berberidifolia*	low-med	<20	<20
Sugarbush	*Rhus ovata*	med high	<20	<20
Sycamore	*Platanus racemosa*	low	50-100	50-100
Toyon	*Heteromeles arbutifolia*	low-med	15-30	15-30
Tree Mallow	*Lavatera assurgentiflora*	low	<15	<15
Valley Oak	*Quercus lobata*	low	70+	70+
Willows	*Salix sp.*	low	20-40	20-30

Source: Dagit and Webb C-2

An increase in light onto surfaces next to the road also results in an increase in temperature to those areas as well because of the lack of shade. In Topanga Canyon, this temperature increase is largely felt in Topanga Creek, especially because the road surface took the place of riparian trees that used to shade the water. Since an increase in water temperature can be detrimental to aquatic species in the water, solutions to alleviate this impact involve replanting riparian trees next to the water. Removing existing rock slope protection and using bioengineering techniques to restore habitat and shade trees is ideal. Of course, a combination of traditional methods with bioengineering may be necessary to stabilize some steep banks. One thing to always keep in mind when planting native vegetation, however, is to make sure that the soil type is correct for the type of species to be planted.

4.2 Solutions to Planned Construction Activity Impacts

Construction activities have a number of impacts on environmental resources depending on the activity and planned project. The planned construction projects in Topanga are varied and therefore so are the impacts. For example, the minor projects that involve surface work have fewer impacts on the natural environment and therefore would require a lower level of mitigation. Larger projects, on the other hand, have more potential for inflicting damage on resources in the canyon and therefore more mitigation would be required.

4.2.1 Minor Projects

The minor construction projects that are planned in the near future have the potential to affect the natural environment unless Best Management Practices (BMPs) are employed. These BMPs are varied but are important to include in construction practices to ensure no needless harm is created to resources in the project area.

Some of the BMPs that should be employed when doing even minor surface repair work involve the prevention of soil loss into waterways. In order to prevent this impact, crews can compact soils near streams and wetlands to prevent sloughing of soil into those sensitive areas. Silt fencing and other sediment traps can also be utilized to prevent soil from reaching those areas. In addition, construction vehicles and equipment should be routinely washed after working in exposed soils to prevent the transfer of these soils to other areas.

The Oregon Department of Transportation (1999) recommends other BMPs during surface work to prevent hazardous and otherwise detrimental materials from entering sensitive waterways. First, construction crews should have on hand different types of prevention supplies (e.g. diapers, kitty litter, shovels) to ensure unwanted materials do not enter sensitive areas. Excess materials should be disposed in appropriate disposal sites. When asphalt is produced, crews should have an adequate spill plan in case of accidental spills. Asphalt mixing plants should be located outside of riparian corridors in order to prevent the impacts on these sensitive communities. This type of work should only be done in dry weather unless it is not possible. If asphalt production is required in inclement weather, storm drain inlets and catchments should be protected so as to minimize hazardous materials entering into these waterways (5).

4.2.2 Major Projects

For the major projects that are planned for up-coming construction (Narrows and Lagoon projects) there is more potential for significant impacts to natural resources than the minor projects. Although these major projects are focused on improving the quality of the natural resources in Topanga Canyon, during construction there is always the possibility that needless impacts will occur if proper planning, design, construction, and post-construction techniques are not employed.

The Narrows and Lagoon projects are similar in that both entail modifications to Topanga Creek in sensitive biological areas. Both projects will involve modifying streambanks and streambed widths, removing hardscaping, implementing bioengineering techniques, enhancing habitat for sensitive aquatic species, and improving water quality. For this reason, the mitigation measures to minimize impacts to sensitive resources are similar.

During the planning stages, the sites should be properly studied to determine with as much detail as possible the biological, chemical, physical, hydrological, and geological processes at each location. Early consultation and coordination with applicable resource agencies is imperative to gain direction and proper guidance. Avoidance techniques should be thoroughly examined and implemented as much as possible, especially during sensitive breeding/spawning periods, before committing to compensating mitigation. Cut slopes should also be avoided as much as possible to reduce erosion probabilities. Goals and success criteria for mitigation need to be defined and timeframes need to be developed for their implementation and completion. Lastly, enhancement and improvement techniques should be employed as much as possible to improve the characteristics of the site.

Once planning is complete and the project moves into the design stage, other strategies should be integrated into the project to minimize impacts to natural resources. First, the design of the streambanks needs to be carefully planned in terms of what plants are planted where, especially in regards to the natural flow lines. It is important, however, to try to plant the vegetation as close as possible to the stream flow while keeping this in mind. Bare-rooted native plant cuttings should be utilized to retain local native plants on-site. Maintaining vegetated buffers and straw bale barriers adjacent to the stream, and mulching and seeding exposed areas that would be dormant for long periods of time could be solutions for controlling erosion within the streambed and bank. In designing the stream channel gradient, care should be taken so as not to create any unnatural or unwanted sediment build-ups or wash-outs. In terms of water flow dissipaters, concrete dams and riprap can be placed in the streamflow with enough spacing to create resting pockets of minimal velocity for fish. Low-flow notches must be employed in this type of design to allow for continual water passage. Boulders should also be large enough so they do not become dislodged. Above all, bioengineering methods should be employed unless it is necessary to combine traditional methods because of unusual circumstances.

During construction of the two projects, more mitigation measures should be employed to ensure protection of sensitive biological resources. If avoidance of sensitive aquatics is not possible during construction, then relocation efforts should be conducted with the guidance of resource agencies to remove the species from direct harm. For plant cuttings, they should be planted in the right timeframe and in the correct order within the construction schedule so they are not inadvertently impacted by equipment and maneuvering. Once planting is complete, an adequate plant establishment period is required to ensure successful vegetation growth and survival. Lastly, once establishment is over, stakes, wire, mesh, etc. should be removed to allow for natural growth.

Post-construction activities also need to be completed in these areas. First, regular mitigation monitoring of the site is required in case there are problems that need to be remedied. Secondly, regularly scheduled maintenance should be performed in a timely fashion to keep the system functioning properly. After plant establishment unnecessary maintenance activities in the affected area should be minimized as much as possible to avoid needless impacts to the vegetation.

4.3 Solutions to Routine Maintenance Impacts

In order to alleviate impacts caused by maintenance activities, a number of actions need to be employed by crews. These actions should be incorporated into the regular routines of maintenance personnel while performing their work. By taking these actions, many environmental resources in the canyon can be better protected from harm.

4.3.1 Slough Removal

Berming of soils and other material sloughed from eroding hillslopes cause impacts to a number of resources in Topanga Canyon. Instead of berming the material, maintenance crews should locate and use a proper disposal site in the canyon to dump excess soils. The crews could easily haul the debris to the disposal site, and then reuse the material if needed in other places along SR-27. If the site gets full, efforts can be undertaken to remove the soils to another appropriate dump site to free up space for more debris. With the use of a disposal site, the aesthetics problem with berming is solved.

If locating a proper disposal site takes a long time, then in the meantime certain measures can be incorporated into maintenance practices that would mitigate for the impacts caused by berming. First of all, berming of soil and debris should not occur within the drip line of native oak trees. Secondly, berms created next to riparian corridors should have erosion and sediment control measures incorporated in order to prevent soil sloughing into those habitat areas. With these practices in place, impacts from berms in the watershed will be greatly reduced.

4.3.2 Vegetation Mowing

Vegetation mowing practices can also be greatly improved in the canyon to alleviate some of the impacts. Vegetation can be cut at ground level in order to retain root structures that bind to the soil, thus preventing some of the erosion of the hillsides. If possible, maintenance crews should plant native vegetation that is fire resistant so mowing would not have to be conducted as much as with other flammable plants. If these native plants are utilized, adequate plant establishment periods are essential to ensure the survivability of the individuals. It must be noted that in Topanga Canyon, maintenance crews have already decreased the width of slope mowing from a standard 10 feet required by the County Fire Department to a 6 feet width. This reduction was enacted in response to public concern for the cutting of vegetation along the highway.

Slope mowing has other detrimental effects on vegetative communities and consequently there are mitigative measures that can ease these impacts. Slope clearing on a regular basis has decreased the amount of habitat available for sensitive plants to thrive because of the disturbance. In order to compensate for this loss, maintenance crews can be more discrete in the slopes that need to be cut. If certain slopes are moist and contain fire resistant plants, then perhaps mowing is not needed at those areas.

For those areas that experience an increase in invasive exotic plants due to shoulder mowing, maintenance crews can attempt to plant native vegetation along the shoulders that can outcompete the exotic species. An adequate plant establishment period is required for the natives to thrive. Native species planted in the clear recovery zone should only be herbaceous or shrubby plants as a safety precaution for motorists. Invasive exotic species encountered within the highway right-of-way should be mechanically uprooted and properly disposed in order to prevent their spread.

Where shoulder mowing affects sensitive riparian or wetland areas, other measures should be incorporated into maintenance practices to alleviate these effects. First, the timing of shoulder mowing in these areas should be scheduled outside of aquatic species' breeding period. In addition, wetland areas should not be mowed for fire prevention since the area is moist and not conducive to spreading fires. Secondly, where wetlands are located next to the roadway, certain protections, like guardrails, should be installed to prevent vehicles from disturbing the areas. In fact, incorporated into the planned safety improvement project is a guardrail installation next to a natural seep wetland that contains amphibians every year.

The trimming or removal of mature native trees (over 3-inch diameter at breast height (dbh)) should only be conducted when safety is compromised. In order to alleviate the impact that removal has, maintenance crews should replant three seedlings/cuttings for every one tree removed. The location shall be determined in consultation with qualified state biologists. Trimming of mature native trees should only be done by a qualified arborist so as not to harm the individual.

4.3.3 Hardscaping

The cleaning of culverts is seldom done in Topanga, but it is a maintenance task that does need attention every so often. When culverts need to be cleaned, maintenance crews should install erosion/sediment control measures where feasible. The disposal of excess debris shall be outside the bank and never in any waterway or wetland area. On culverts greater than 6 feet, maintenance crews should remove 10 feet of brush upstream and downstream of the structure to ease passage for larger wildlife. If invasive exotic species are present, efforts should be made to remove the species upstream of the culvert to prevent further spread downstream. Work shall be performed in low-flow periods when possible and water shall be diverted if present to minimize materials entering the water. Unless the work is an emergency situation as defined by regulating agencies, no cleaning shall occur in natural streams without proper permits. If sensitive aquatic species are present in the affected stream then coordination with state biologists and resource agencies would be required. Any culvert in Topanga Canyon should be inspected and cleaned if necessary prior to the rainy season whenever possible.

Maintenance crews that clean bridges also should incorporate measures to mitigate for impacts to sensitive biological resources. Paint and other hazardous material should never enter the water, so appropriate steps need to be taken to ensure this does not occur. When pressure washing, sandblasting, or scraping structures over streams, clock deck drains and scuppers should be temporarily blocked to prevent contaminated water from entering the stream and vegetated areas. Environmentally sound methods should be employed to clean the bridge. The timing of work should also be completed so as not to interfere with sensitive aquatic resources. When removing debris from the bridge decks, care should be taken to ensure none of it falls into the riparian area. If brush needs to be cleared next to bridges, the amount of removal should be minimized to the least amount necessary, unless it is an invasive exotic plant. If possible, fish passages should be installed to compensate for impacts incurred while cleaning the bridge.

When bridges need repair, maintenance crews should consider using bioengineering practices instead of traditional hardscaping as much as possible. Refuse material should be placed above the bridge deck so it does not impact waterways and wetlands. Measures should be conducted to ensure that fresh concrete does not come in contact with the stream. Disposal of material should be done properly at an off-site location away from streams. Any concrete truck chute clean-out area should be located in an appropriate place and the operator should be required to use it at all times to protect sensitive riparian areas.

Other hardscaping in Topanga Canyon has environmental impacts that need mitigation. The retaining wall that is not aesthetically pleasing should be studied more thoroughly to determine its necessity. If it is determined that the wall is required then a new design should be constructed that fits into the surrounding landscape. Native vegetation could be planted nearby to disguise the hardscaping element.

Rock slope protection has many impacts on native vegetation, but mitigation can be developed to alleviate the problems. In order to minimize impacts to native oak trees, rock slope protection should be avoided within the dripline. Where RSP already occurs within the dripline area of an oak tree, it should be removed to enable the tree to thrive. Where RSP is installed within riparian corridors, bioengineering methods should be incorporated instead and RSP should be removed as much as possible. Native vegetation can be planted to shade the water. In fact, these measures are incorporated into the Narrows project that is now in the planning stage.

Other areas that have guardrails located next to the roadway have shown erosion of the slope supporting the highway. In order to mitigate for this erosion, when guardrails need maintenance, crews should incorporate erosion control measures such as silt fences or other appropriate devices to minimize the amount of sediment into adjacent streams.

5. Implementation of Mitigation Measures

Once the solutions to environmental impacts are identified, the implementation of these solutions must be determined. Without a proper method to carry out the solutions, no change may be effected and all efforts would be for naught. The implementation methods must be feasible and contained within a reasonable amount of time. If the execution of the solutions is completed according to plan, then the environmental impacts caused by the roadway should be alleviated and the surrounding environment improved.

5.1 Implementation of Existing Roadway Solutions

The existing roadway solutions involve improving wildlife connectivity, decreasing erosion, decreasing chemical content, and decreasing the incidence of light, exotics, and water temperature in the watershed. The implementation of these solutions is varied but mainly involves the coordination between Caltrans' Division of Environmental Planning (DEP), Maintenance, Landscape Architecture, Hydraulics, and Storm Water Units. The solutions and the corresponding responsible Division can be shown spatially throughout the watershed using maps produced by GIS software. It must be noted that the erosion solutions will be implemented as part of the routine maintenance activities as discussed in Section 2.2.3.

5.1.1 Wildlife Mortality Monitoring

In order to implement wildlife connectivity solutions, Maintenance crews should begin a wildlife mortality monitoring program to determine the number and frequency of roadkill events along SR-27 in the Topanga Creek watershed. If the numbers are higher than necessary to sustain populations, then a thorough study is warranted to mitigate for the impacts. This study and the mitigation efforts can be accomplished by themselves or as part of a planned project that would contribute to wildlife mortality increases. The implementation of the monitoring program should be coordinated by DEP and carried out by the Division of Maintenance.

5.1.2 Water Quality Monitoring

The chemicals content in the Topanga Creek watershed has not been shown to be a concern in the environment so far. Monitoring of the water quality should continue, however, to determine if chemicals increase. If they do, or if any new projects are planned which may increase the amount of pollutants, the solutions to decrease chemicals in the water should be implemented. DEP and the Storm Water Unit should coordinate to accomplish these tasks. A project would be initiated by itself or as part of a larger project to include better storm water filters, swales, and/or retention ponds.

5.1.3 Native Vegetation Establishment

The effort to reduce the incidence of light, exotic species, and water temperature is a multi-division effort headed by DEP. First, DEP and Landscape Architecture need to initiate a project to plant fire resistant native shrubs in the clear recovery zone to promote the increase in native vegetation while decreasing the probability of fire. DEP and Maintenance also need to coordinate on the timing and amount of vegetation removal during the growing season. Lastly, DEP, Landscape Architecture, and Hydraulics need to initiate a project to remove the existing rock riprap in the watershed and incorporate bioengineering methods where feasible. This effort is being planned at the Narrows location as one of the planned construction projects, but there are other areas within the watershed that contain riprap.

5.2 Implementation of Planned Construction Activities' Solutions

Planned construction activities have an advantage in implementation in that they are already in progress and solutions can be readily incorporated into the plans. It is generally easier to incorporate solutions into the earlier project stages than the later stages, but there are always exceptions. The planned minor projects in the Topanga Creek watershed are mostly in the later stages of development while the major projects are at the beginning. The identified solutions can still be incorporated without many problems.

5.2.1 Minor Projects

The minor construction projects have already gone through the environmental review stage and are in the final design stage. The solutions that were identified for these projects generally involve implementing BMPs. These BMPs are determined at the beginning of construction and therefore can be applied to these projects. DEP should ensure that the appropriate measures are incorporated into each of the minor projects at the time of construction.

5.2.2 Major Projects

The solutions identified for the major planned construction projects can be implemented at each relative stage as identified in the previous section. Because the projects are still in the planning stages, DEP can ensure that the identified measures are incorporated into the environmental document and carried through into construction.

5.3 Implementation of Maintenance Activities' Solutions

The solutions involving maintenance impacts generally involve new or revised practices that need to be incorporated into routine activities. In order to implement these solutions, DEP, Hydraulics, Geotechnical Investigations (Geotech), and Maintenance need to work together to accomplish these tasks.

5.3.1 Disposal Site

In order to establish a disposal site in Topanga Canyon, DEP must work with Maintenance to locate a potential site and get it approved by applicable resource agencies and the public. A site has been identified for disposal of slough material, but ownership of the land and approval by resource agencies still need to be obtained. Once these steps are taken, the disposal site should alleviate the berming of material and all the associated impacts associated with the berms.

5.3.2 Retaining Wall Design

Another solution that was identified is the redesign of the retaining wall. In order to get this wall redesigned, DEP needs to work with Hydraulics and Geotech to study the wall and design a more appropriate structure that does not cause environmental impacts.

5.3.3 Maintenance Handbook

DEP and Maintenance need to also develop a working handbook illustrating the important sensitive areas in the canyon and where activities should and should not be performed. The handbook should contain maps of the area, timeframe for activities, and BMPs that can be employed while performing routine maintenance. The handbook can contain locations where/where not to berm (before a disposal site can be obtained), proper vegetation cutting measures, types of native planting to be completed, location of wetlands for protection purposes, and proper measures to trim mature native trees. The handbook can also direct maintenance crews in proper culvert cleaning techniques, bridge cleaning and inspection techniques, alternatives to installing riprap, and ways to implement bioengineering techniques.

It is important to note that this handbook should include detailed maps illustrating the identified solutions and responsible entities for their implementation. A spatial model will be most useful for a clear representation of the appropriate actions and timelines needed in the Topanga Creek watershed. An example of this would be a map detailing the locations of all riprap in the watershed. Colors could illustrate which agencies would be responsible for determining the effectiveness of the structures, and information about seasonal timelines could help them determine the appropriate temporal scale for implementing solutions.

5.3.4 Workshops

Lastly, in order to implement these changes in regards to maintenance activities, DEP needs to organize workshops to discuss the changes and receive feedback. One set of workshops should be geared toward maintenance staff members who regularly work in the canyon. A second set should be aimed towards the residents and property owners in Topanga canyon. These workshops should discuss the change in practices and how they will be accomplished. These workshops will also educate the public about the changes in maintenance practices to alleviate impacts on environmental resources.

5.3.5 Accountability

Accountability for the changes in maintenance activities can be accomplished in a variety of ways. The new public awareness will serve as an accountability measure to ensure maintenance personnel are implementing the changes. In addition, DEP personnel should periodically monitor activities and note observed maintenance practices. The roadkill monitoring can be recorded and transmitted to DEP to ensure it is being implemented correctly. Lastly, an environmental checklist can be filled out by maintenance personnel on a periodic basis to record new changes in practices to alleviate impacts to the environment.

With the implementation of the identified solutions to impacts in Topanga Canyon, the environment will benefit tremendously and further impacts will decline. It is important to realize that research is constantly being conducted to determine more ways to alleviate impacts caused by roadways in natural areas. For this reason, changes in practices should be reviewed approximately every five (5) years to incorporate these new findings. As long as solutions are implemented and updated on a regular basis, there is the likelihood that environmental resources in Topanga Canyon will be protected from impacts due to roadway activities into the foreseeable future.

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