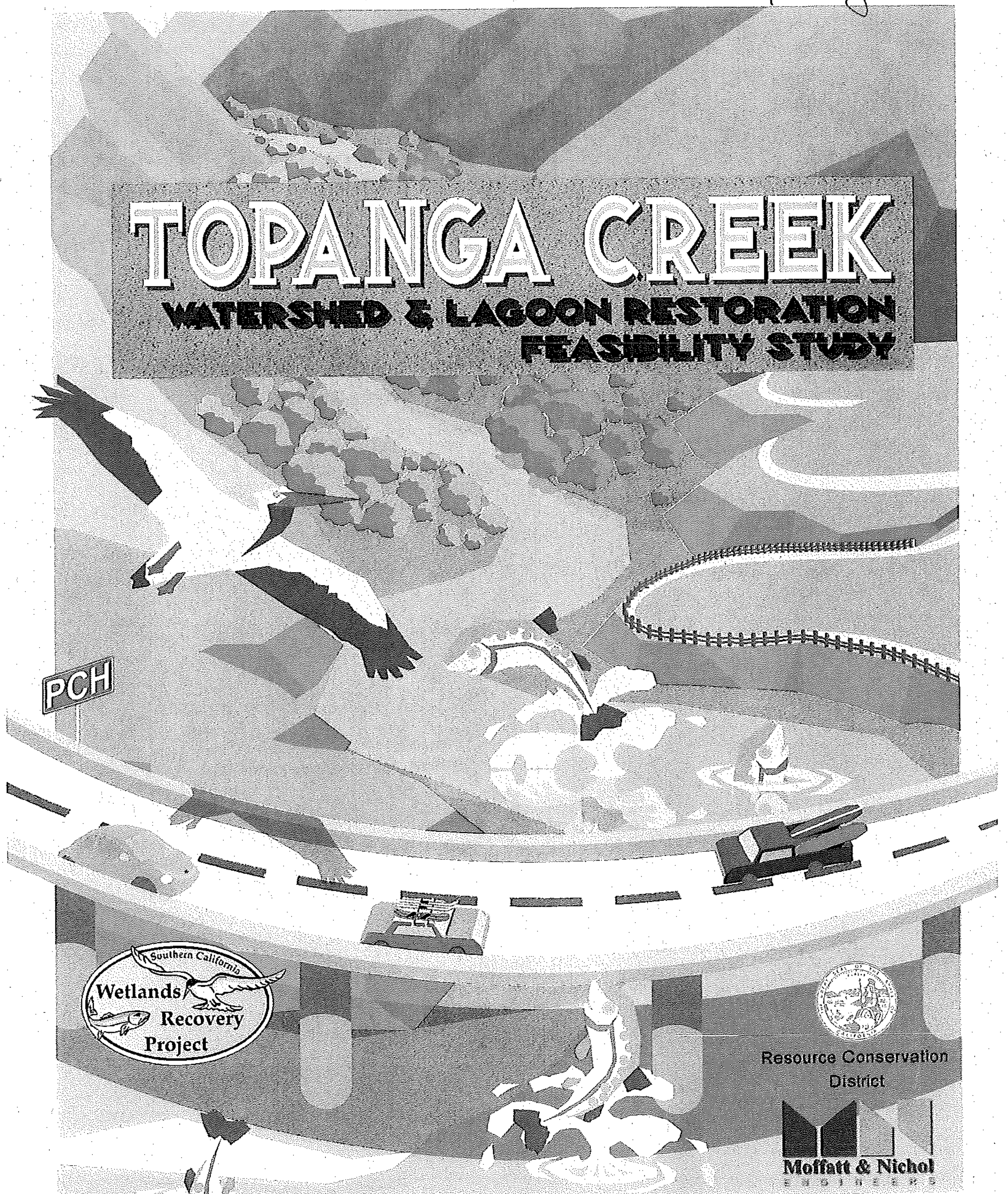
TOPANGA CREEK
WATERSHED & LAGOON RESTORATION
FEASIBILITY STUDY
PCH
Southern California
Wetlands
Recovery
Project
Resource Conservation
District
Moffatt & Nichol
ENGINEERS

FINAL REPORT

TOPANGA CREEK WATERSHED AND LAGOON RESTORATION FEASIBILITY STUDY

Prepared For:

SOUTHERN CALIFORNIA WETLANDS RECOVERY PROJECT
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April 29, 2002

EXECUTIVE SUMMARY

The Topanga Creek Lagoon and Watershed Feasibility Study was initiated in order to fulfill the need for a comprehensive, integrated study of watershed processes that would provide the basis for coordinated restoration and management. The specific objectives of the study were to identify ways to improve water quality at Topanga Beach, improve habitat for endangered fishes and other aquatic species, reduce flood hazard, and improve recreational opportunities, without changing the surf break.

Topanga Creek is relatively unique among coastal watersheds in Southern California, in that it still retains a strong ecological integrity, despite the impacts from encroaching urbanism along the wildland interface. At 18 square miles, Topanga is the third largest watershed draining into the Santa Monica Bay in the City and County of Los Angeles. Approximately 8,000 of the 12,800 acres in the watershed are publicly owned. This exceptional riparian system is not yet lost, but is in need of preservation, enhancement, and restoration in order to ensure long-term sustainability.

Restoration of the historic lagoon at the mouth of Topanga Creek is an extraordinary opportunity. Los Angeles County has lost over 95% of its wetlands, contributing to the loss of over 90% of all wetland areas within the state of California. The historic lagoon at the mouth of Topanga Creek once covered almost 30 acres. In 1934, all but 2 acres were filled by Caltrans when Pacific Coast Highway (PCH) was re-aligned, severely impacting its function. Now that all of the filled areas are in public ownership, the time is right to evaluate how the lagoon might be restored to some or all of its former function. The Lower Topanga State Park Interim Plan, SCWRP Wetland Inventory, the Santa Monica Bay Restoration Project and the Draft Topanga Creek Watershed Management Plan each identify lagoon restoration as a priority action.

Numerous sensitive and endangered species are found along the north-south trending creek and its tributaries. In the upper watershed, Southwestern Pond Turtles are a target species for restoration. In the lower watershed, habitat for numerous amphibians and reptile species of special concern is abundant, with well established populations. The lower creek also provides spawning and rearing habitat for endangered Southern Steelhead Trout. At the lagoon, a recently established population of endangered Tidewater Gobies has been documented. Restoration and habitat enhancement for these species is also a goal.

Habitat degradation along the creek has occurred throughout the watershed, primarily from road maintenance practices along Topanga Canyon Boulevard, and other transportation routes. Additional impacts come from installation of unengineered streambank protection, landslides, lagoon infilling, channel bridging at PCH and input of non-point source pollutants. The most pressing problem is encroachment with fill into the creek, generating increased flow velocities that cause bed scouring, bank undermining and landslides, which yield more sediment than the creek can deliver. Excess sedimentation appears to be the most serious problem within the watershed. Other water quality parameters are well within the range needed to support diverse aquatic life, although fecal bacteria levels at Topanga Beach and lagoon are a concern, especially when the lagoon entrance is open.

In order to restore the watershed and lagoon, it is necessary to evaluate the current physical processes at work throughout the watershed that impact the creek mouth. Concurrent studies of hydraulics, hydrology, flooding, sedimentation, water quality, land use, wildfires, and species diversity have been in progress since 1996. The Feasibility Study attempts to integrate the information provided by all studies into a comprehensive picture of the baseline processes at work. Existing conditions were used to calibrate a numerical computer model (MIKE-11) and develop a series of Geographic Information System overlays. Due to budget and time constraints, this synthesis should be considered a baseline, understanding that further study will be necessary.

Several specific locations throughout the watershed were targeted for intense scrutiny, as they were identified as having significant impact on creek dynamics. Potential solutions for these sites have been conceptually designed, then tested for their performance using numerical modeling and analytical methods to identify the preferred alternative(s) for consensus-based decision making. The Technical and Landowners Advisory Committee supports moving forward with the next steps to further refine these solutions for eventual implementation.

Additionally, three alternative configurations for lagoon restoration have been designed and analyzed. These alternative concepts include: 1) expansion of the lagoon to the west of the creek and south of PCH; 2) expansion to the west of the creek both north and south of PCH, and 3) expansion of the creek on all sides, to almost the extent of the historic lagoon documented by the 1876 US Coast Survey map. Based on results of the study, the larger lagoon design (Alternative Concept 4) appears to best achieve the stated restoration goals. Therefore, restoring the lagoon to much of its former extent is feasible, given the existing and future watershed conditions.

Based on the comments received from the landowners (State Parks and LA County Beaches and Harbors), as well as other members of the Technical and Landowners Advisory Committee, the consensus appears to support the most extensive lagoon restoration possible. Potential constraints that will need to be incorporated into the final design include: adequate parking, safe crossings to the beach, access for lifeguard/emergency vehicles, integration of historic structures and visitor services, and protection of the existing lifeguard station.

Given the fact that wetland and riparian restoration is a continually evolving science, it seems prudent to build into the process a strategy for adaptive management. Even with all the best data available, it is important to note that unintended consequences are possible. Incorporating a research plan into the design, implementation and monitoring phases of the restoration projects will provide valuable information regarding coastal and creek dynamics, and most importantly, establish a conceptual framework for adjusting the restoration program along the way. Thus, as unexpected developments arise, there will be a strategy for management, adjustment and eventual resolution of any problems.

This study provides basic data useful for all stakeholders, especially landowners (State Parks, LA County, and Caltrans), and permitting agencies to develop a comprehensive plan for action. The Technical and Landowners Advisory Committee will continue to work with the State Parks Dept. planning process to develop a final integrated design for lagoon restoration. Funding has already been secured to develop a more detailed engineering plan, allowing better estimation of costs for construction, operation, and maintenance. Environmental review and permitting should proceed concurrently with the design process. Applications for additional funding will also be needed to evaluate the composition of the fill soil for possible beach replenishment or nearshore disposal, as well as complete final engineering plans and begin actual restoration implementation.

ACKNOWLEDGEMENTS

This project was funded by grants from the Southern California Wetlands Recovery Project and the Santa Monica Bay Restoration Project.

Support for this project was extensive. In addition to the grants and contracts listed below that contributed significant bodies of data, numerous groups and individuals played a crucial role in the process. In particular, we would like to recognize the contributions of the following supporters of Topanga Creek Watershed and Lagoon Restoration efforts.

Caltrans District 7

CA Department of Parks and Recreation –Angeles District, Southern Service Center

Los Angeles County Department of Beaches and Harbors

Los Angeles County Department of Public Works – Watershed, Hydrology Divisions

Los Angeles County Supervisor Zev Yaroslavsky

Roto Architects

Sadderthwaite and Rodriguiz Landscape Architects

Santa Monica Bay Restoration Project

Santa Monica Mountains National Recreation Area

Southern California Wetlands Recovery Project

State Senator Sheila Kuehl

Topanga Canyon Floodplain Citizens' Advisory Committee

Topanga Creek Technical and Landowners Advisory Committee

Topanga Creek Watershed Committee

Topanga Creek Stream Team Volunteers

In addition, staff at the Resource Conservation District of the Santa Monica Mountains (M. Murman, K. Reagan, S. Williams), and the staff at Moffatt & Nichol Engineers, (W. Jin, C. Frampton, P. Schibuola, S. Tonkin) were also crucial to the completion of the task at hand. Aerial Information Systems assisted with the initial GIS mapping. Dr. Antony Orme, Dr. Amalie Jo Orme and Kimberly Saunders prepared the Topanga Creek Erosion and Sediment Delivery Study report.

Additional Grants and Contracts:

CA Department of Conservation – Topanga Creek Watershed Coordinator Grant
CA Department of Fish and Game – Survey of Southern Steelhead Trout in Topanga Creek
CA Department of Forestry and Fire Protection – Environmentally Sensitive Fuel Modification Strategies for the Topanga Creek Watershed
Los Angeles County Department of Public Works – Sensitive Species Inventory of Infrastructure in the Topanga Creek Watershed
State Waters Resources Control Board 205j - Topanga Creek Water Quality Study, 1992-2001
Santa Monica Bay Restoration Project – Erosion and Sediment Delivery Study of the Topanga Creek Watershed
Santa Monica Bay Restoration Project – Phase II: Topanga Lagoon and Watershed Restoration Study

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1.0 INTRODUCTION AND BACKGROUND

The Topanga Creek Watershed and Lagoon Restoration Feasibility Study is an attempt to address baseline data needs recognized by the 1996 Draft Topanga Creek Watershed Management Study. With the inception of the Topanga Creek Watershed Committee (TCWC) in 1998, it was decided that further watershed management planning required additional information about watershed processes. Basic questions concerning water quality, flood and fire hazard prevention, preserving biodiversity, and promoting best management practices to identify ways to sustain the Topanga Creek Watershed over time needed answers. The Resource Conservation District of the Santa Monica Mountains (RCDSMM), in cooperation with the TCWC, initiated a series of grant funded research projects to identify problems and possible solutions.

With funding support from the Southern California Wetlands Recovery Project, an integrated watershed model has been developed and study performed incorporating information from previous and concurrent research studies. This report provides a comprehensive summary of the study. It presents the current understanding of past and present physical, chemical and biological processes at work in the Topanga Creek Watershed.

1.1 OBJECTIVES OF THE TOPANGA CREEK WATERSHED FEASIBILITY STUDY

The objectives of the Feasibility Study are as follows:

- Identify problem locations within the watershed where restoration will restore and/or protect creek function.

- Identify measures to reduce the flood hazard.

- Identify a restoration design that will create a self sustaining lagoon, improve water quality at Topanga Beach, reduce flood hazards, restore habitat for steelhead trout and tidewater gobies, and maintain/enhance recreational opportunities, without changing the surf break.

- Facilitate coordinated restoration planning between all necessary landowners and responsible agencies.

1.2 STUDY SCOPE

In order to determine the feasibility of restoring Topanga Lagoon, it was necessary to evaluate the current physical processes at work throughout the watershed that impact the creek mouth, including flooding, sedimentation, hydrology, water quality, land use, wildfires, and impacts of invasive exotics. This study provides basic data necessary for all stakeholders, State Parks, Los Angeles (LA) County, Caltrans, and appropriate permitting agencies to develop and implement a comprehensive plan of action.

The Feasibility Study is composed of the five complimentary components listed below (1.2.a-1.2.e). Data pertinent to all of these components have been incorporated into a GIS database that allows for more detailed analysis of potential restoration options. Using the MIKE-11 model, a watershed assessment integrating the verified hydrologic model (including rainfall/runoff, peak storms, etc.) with erosion and sediment transport, and analytical methods to assess impacts on water quality identified from point and non-point sources has been completed and the results provided herein.

1.2.a Feasibility Study Design

An integrated, comprehensive watershed and lagoon analysis was required in order to evaluate restoration possibilities within the context of existing watershed conditions. A Request For Proposal was issued to solicit and select bid proposals. Moffatt and Nichol Engineers were chosen to develop an integrated feasibility study using the data from on-going research, existing historical and digital resources, and perform any additional hydrologic analysis required.

The design and integration was accomplished using the MIKE-11 Model to characterize continuous (potentially catastrophic) storm events, as well as calculate more common low flow conditions pertinent to the enhancement of the lagoon. Water quantity under a variety of conditions plays a major role in defining creek and lagoon configurations. Erosion and sediment delivery patterns play a major role in the geomorphologic evolution of the creek. The physical processes influence the distribution and density of biological resources. The MIKE-11 model supplemented by analytical methods allowed for the integrated analysis of these parameters.

The MIKE-11 model was selected for this study due to its ability to couple models of hydrology, hydraulics, sediment transport and water quality for a seamless comprehensive package, rather than running and trying to interface between several different public domain models to accomplish the same goal. MIKE-11 also provides a GIS interface to archive, analyze and display results.

The following four scenarios of lagoon configuration within the present watershed context were evaluated:

a) the existing lagoon;

b) the lagoon area is expanded to include the filled area to the west of the creek, south of Pacific Coast Highway (PCH);

c) the lagoon is expanded both west of the creek both south and north of PCH, into both LA County and the former LA Athletic Club property; and,

d) the lagoon is expanded further to include much of both the western and eastern portions of the historic lagoon on the south and north sides of PCH. The results are discussed in detail in Section 3.0.

1.2.b Hydrologic Analysis

The hydrologic analysis included the following:

- Evaluate the change in hydrological characteristics of the lagoon/watershed system under each condition.
- Describe tidal circulation potentials and how these designs might reduce flood hazards.
- Evaluate the role of the PCH bridge, as well as the possibility of lengthening the PCH bridge and how this could improve lagoon function.
- Identify a phased approach to achieving lagoon and watershed enhancement/restoration, including a scope of work and budgets.
- Perform hydrological modeling for the watershed under each of the four lagoon scenarios that incorporates documented conditions and leads to the best estimates for evaluating the worst case conditions, and long term viability of an enhanced/restored lagoon and watershed. Identify the factors needed and critical parameters for achieving an enhanced/restored lagoon and watershed. Data used included: cross sections developed by the RCDSMM and/or LA County, run-off coefficients for saturated conditions, both LA County and volunteer generated rainfall data, and LA County stream gage data, historical photographs and topographic maps of Topanga Lagoon, water quality and sediment study data. The completed work is presented in the Final Report for the study.
    - Develop a model relating the amount of runoff to land use type and burn history.
    - Develop a runoff and water balance model to identify volumes of water anticipated to flow into the lagoon under both burned and unburned conditions.
    - Evaluate the role of anthropogenic constraints (Topanga Canyon Blvd., PCH and the bridge, fill areas, adjacent structures, etc.) on the creek and lagoon system.
    - Provide digital data that can be integrated into ArcView Geographic Information System (GIS).
    - Integrate associated studies on erosion and sediment delivery, water quality and biological resources with the hydrologic analysis.
    - Provide an interim report presentation to the community presenting analysis of opportunities and constraints at the June 2001 Topanga Watershed Committee meeting, and a final presentation in December 2001.
    - Provide a summary report in both print and digital format to the RCDSMM.

1.2.c Water Movement Study

With the assistance of the Topanga Stream Team Volunteers, gauges were installed at six bridge locations throughout the upper Topanga Creek Watershed in early 2001. During two separate storm events in January and February 2001, volunteers were stationed at each location for over an hour during the intense portion of the storm. Synoptic records of stream rise during those times provided insight into water movement patterns in both the main stem and Old Topanga drainages. Both flow velocity and water stage were measured. This provided real world calibration data for specific storm events in the watershed. These data were incorporated into the larger hydrologic study and used to calibrate the numerical hydrologic and hydraulic models.

1.2.d Sediment Study

In order to complete the field study of erosion and sediment delivery within the lower creek and lagoon, funding from this grant provided additional sampling for erosion at several locations where roadside berms were of particular concern as sediment sources. This work was coordinated with the associated Topanga Creek Erosion and Sediment Delivery Study under the direction of Dr. Antony Orme and the RCDSMM (See Appendix B for summary of results).

1.2.e Water Quality Study

In order to better understand the relationship between poor water quality measured at Topanga Beach and the contributions of both the upper watershed and Topanga Lagoon, samples were taken in the lagoon according to the methodology of the Topanga Creek Water Quality Study. Samples were sent to a qualified laboratory monthly to measure total and fecal coliform bacteria, *E. coli*, and total suspended solids. Samples were also taken following the first 0.75-inch rain storm event and towards the end of the rainy season following a storm event when the lagoon entrance was still open. Samples were taken by wading knee deep into the lagoon by the concrete wing wall located on the east side of the lagoon near the lifeguard tower. On-site data regarding water temperature, salinity, dissolved oxygen, pH, and turbidity were measured when each sample was collected. Tests for nitrogen, ammonia, phosphates and conductivity were done according to the procedure identified in the QA/QC Plan filed for the Water Quality Study.

The majority of water quality data (funded by 205j grant) was collected weekly at five locations and monthly in an additional ten locations throughout the watershed, with the lowest site located 2.2 miles upstream from PCH. Additional data were collected by the City of Los Angeles at Topanga Beach (See Appendix A for summary of results). These data were used in the analytical water quality analysis of each lagoon alternative.

1.2.f Engineering Analyses

Engineering analyses for this study consist of:

1. Numerical modeling of creek and lagoon flows;
2. Concept designs of lagoon alternatives;
3. Identification of a preferred alternative based on modeling;
4. Cost estimating of the preferred alternative; and
5. Preparation of a "road map" of implementation actions.

This report presents results of each task listed above.

Modeling of creek and lagoon systems was completed using a numerical model named MIKE-11 for hydrology, hydraulics and sediment transport. Analytical methods were used to assess lagoon water quality at the first order, owing to non-complex conditions at the site and limitations of the available data.

Numerical modeling included the following subtasks:

1. Model set-up.

2. Model calibration and verification using the period of 1997 through 2001.

3. Modeling of existing flow conditions for floods and low flows. Modeling periods included 1977-79 (post-burn and high floods, 1980-84 (severe floods) and 1997-2001 (average conditions with moderate floods).

4. Modeling of three lagoon alternative concepts including: 1) existing conditions; 2) expansion to the south of PCH and west of the lagoon; 3) expansion to both sides of PCH and the lagoon with limited eastward expansion; and 4) expansion to both sides of PCH and the lagoon with greater expansion east of the creek.

Analytical modeling involved calculation of bacteria concentrations for each alternative, given lagoon volume expansion from existing conditions. It was assumed that the input concentrations remain constant at the levels required to generate existing concentrations. As lagoon tidal volume increases when the entrance is open, bacteria concentrations decline. Salinity levels at the lagoon are addressed qualitatively as available data are not sufficient for modeling, but are adequate for first-order analysis of patterns related to creek and lagoon processes. Nutrients in the lagoon are not analyzed, as levels of nitrates, phosphates and ammonia are non-detect on all sampling dates, and thus are not a water quality concern.

1.2.g Integrated Information Management

All of the data collected for this project were integrated into a comprehensive GIS based watershed analysis that allows queries to better understand how the physical, chemical and biological components of the watershed interact. This work was completed with assistance from the National Resource Conservation Service, National Park Service, Caltrans and LA County, California Department of Parks and Recreation, Aerial Information Systems, and Roto Architects. See Appendix F for a summary of data files generated.

Geomorphic analyses were augmented with GIS map layers of historic aerial photographs, topographic maps and the U.S. Coast Series 1876 survey map. Using computer generated models, the changes in channel and lagoon configuration over time became more visible, allowing evaluation of the impacts of current anthropogenic constraints on the creek and lagoon. This analysis also provided the baseline of lagoon conditions before the significant impacts of man. This baseline is considered a target in concept design for lagoon restoration alternatives to re-create the optimum habitat quality at the site.

1.2.h Project Oversight and Community Liaison

Any potential restoration plan needs the complete support of a host of involved landowners, agencies and the general public. The key to developing this support was to establish a coordinated on-going dialog to present all information gathered during the study to the community throughout the process. This effort was coordinated by the staff of the RCDSMM.

1.3 OWNERSHIP AND REGULATORY REQUIREMENTS

Approximately 8,000 acres of the 12,800-acre Topanga Creek Watershed (roughly two-thirds) are publicly-owned, with the majority of the land included in Topanga State Park, administered by the California (CA) Department of Parks and Recreation. Within the upper watershed (upstream of the small town and confluence of Old Topanga Creek and the Main creek), there are several restoration sites that were evaluated as part of this feasibility study.

- The streambank stabilization site known as "Lake Topanga" is located in the 700 block of North Topanga Canyon Blvd. Ownership at this location includes Caltrans and Los Angeles County to the east and in the creek channel, with private owners on the west bank.

- The streambank stabilization site just south of Topanga School Road is under Caltrans jurisdiction on the east bank and in the creek channel, with private owners on the west bank. The bridge is owned by Los Angeles County.

- The entire area south of the town of Topanga to Topanga Beach is now within Topanga State Park. The parcels formerly owned by the LA Athletic Club were purchased by CA Department of Parks and Recreation during the course of the feasibility study, in August 2001. The residences and businesses located in Lower Topanga near PCH are all rental units, now administered by State Parks.

- The area south of Pacific Coast Highway is owned and maintained by Los Angeles County Beaches and Harbors. Pacific Coast Highway is the responsibility of Caltrans, as is Topanga Canyon Blvd. (State Highway 27).

Jurisdiction over aquatic resources is shared by several state and federal agencies. In the case of Topanga Creek, the U.S. Army Corps of Engineers (USACE) is responsible for the protection of the creek under the federal Clean Water Act. A 404 permit would be required to implement the restoration actions recommended, as they all fall within the creek channels.

Since Topanga Creek has not yet been formally included in the Southern California Evolutionarily Significant Unit (ESU) for the Southern Steelhead Trout, the National Marine Fisheries Service and the U.S. Fish and Wildlife Service are not responsible agencies at this point in time. With the expectation that the ESU will eventually be extended to include Topanga Creek, communication with representatives of both agencies was conducted during the study. Research permit requests for work with the Steelhead Trout are pending.

The CA Department of Fish and Game is responsible for protecting the listed Species of Special Concern found in the Topanga Creek Watershed, including Steelhead Trout, Tidewater Gobies, CA Newts, Southwestern Pond Turtles and Two Striped Garter Snakes. A 1601 Streambed Alteration Agreement would be required in order to implement the restoration recommendations of this study. Permits for scientific study of these species are held by the RCDSMM biologists and their consultants.

Caltrans plays a major role in the eventual implementation of many of the recommended restoration actions. The restoration of streambank sections, as well as the possible replacement of the existing Pacific Coast Highway bridge to accommodate a larger lagoon require cooperative planning with Caltrans.

Compliance with local regulations and permits would also be necessary from the Los Angeles Regional Water Quality Control Board (Section 401C Certification) Los Angeles County (grading and building permits), and the California Coastal Commission (Coastal Development Permit) in order to implement the restoration actions.

Finally, the entire project will need to comply with the California Environmental Quality Act (CEQA) project review process.

1.4 TECHNICAL AND LANDOWNERS ADVISORY COMMITTEE

In order to keep all parties actively involved in the evaluation of restoration possibilities, a Technical and Landowner Advisory Committee (TLAC) was convened. The members provided input and comments for the Request for Proposals (RFP's) prepared by the RCDSMM for contractors to bid on the feasibility study. The TLAC interviewed and selected the contractor based on a competitive bidding process. The TLAC has reviewed the progress of the modeling throughout the course of the study and provided input into the final recommendations presented in this study. (See Section 6).

Technical and Landowners Advisory Committee members include:

- Mark Abramson, Heal the Bay
- Jack Ainsworth, CA Coastal Commission
- Shirley Birosik, Los Angeles Regional Water Quality Control Board
- Rabyn Blake, Topanga Creekside Homeowners Association
- Maurice Cardenas, CA Dept. of Fish and Game
- Paul Caron, Caltrans
- Larry Charness, Los Angeles County Beaches and Harbors
- John Crawford, Topanga Canyon Citizen's Floodplain Management Committee
- Menerva Daoud, Los Angeles County Dept. of Public Works
- Rosi Dagit, Resource Conservation District of the Santa Monica Mountains
- Paul Edelman, Santa Monica Mountains Conservancy

Vern Finney, Natural Resources Conservation Service
Craig Frampton, Moffatt and Nichol Engineers
Laura Gajdos, Los Angeles County Dept. of Public Works
Suzanne Goode, CA Dept. of Parks and Recreation
Weixia Jin, Moffatt and Nichol Engineers
Jack Liebster, CA Coastal Conservancy
Barbara Marquez, Caltrans
Brenda McMillan, CA Dept. of Parks and Recreation
Iraj Nasseri, Los Angeles County Dept. of Public Works
Antony Orme, consulting Geomorphologist for RCDSMM
Clay Phillip, CA Dept. of Parks and Recreation
David Pritchett, For the Sake of the Salmon
Alfred Ramos, Natural Resources Conservation Service
Kevin Reagan, Resource Conservation District of the Santa Monica Mountains
Allen Reed, Surfrider Foundation
Ray Sauvajot, National Park Service
Robert Schroeder, Los Angeles County Fire Dept.
Irving Sherman, Topanga Canyon Citizen's Floodplain Management Committee
Richard Sherman, Topanga resident, Topanga Creek Watershed Committee
Anthony Spina, National Marine Fisheries Service
Clark Stevens, Topanga resident, Topanga Creek Watershed Committee
Jeff Stump, American Land Conservancy
Camm Swift, consulting Ichthyologist for RCDSMM
Jack Topel, Santa Monica Bay Restoration Project
Chris Webb, Moffatt and Nichol Engineers
Marti Witter, Topanga Canyon Citizen's Floodplain Management Committee
Paul Yamazaki, Caltrans
Fred Zepeda, LA Athletic Club

1.5 PUBLIC INVOLVEMENT

The public is involved with the project through the Topanga Creek Watershed Committee (TCWC). The TCWC is a voluntary, consensus-based group of stakeholders seeking to identify sustainable ways to live within the watershed. Keeping all stakeholders informed as the project progressed has been a key part of the Feasibility Study. To that end, a formal presentation to the TCWC was made in June 2001 at the start of the modeling, soliciting input from the stakeholders and informing them of the scope of work. At the October 2001 State of the Watershed meeting, an informal design charette to solicit input for the development of the Lower Topanga State Park

Interim Planning process was coordinated by the TCWC and State Parks. In November 2001, the watershed education classes for the 5th graders at Topanga Elementary School included another design charette, and the students developed visions of the Lower Topanga park which were presented to State Parks for consideration. Finally, in December 2001, Moffatt and Nichol Engineers formally presented the preliminary results of the comprehensive modeling to the TCWC, in conjunction with presentations on all other aspects of the coordinated research. Information provided to the public at these meetings is summarized in Appendix E.

In addition to the formal presentations at TCWC meetings, informal updates were provided to the TCWC on a monthly basis. Frequent stories appeared in local newspapers, as well as in the TCWC minutes posted on the web site (www.TopangaOnline.com)

2.0 DESCRIPTION OF THE TOPANGA CREEK WATERSHED

2.1 GENERAL

Topanga Creek and Lagoon are located within Southern California just to the west of Los Angeles. They are located approximately 13 miles west of Santa Monica and 30 miles west of Hollywood. Figure 2-1 shows the location of the watershed within the Los Angeles vicinity. The watershed is separated from the Los Angeles topographic basin by the Santa Monica Mountains. It is 18 square miles in area and varies in elevation from approximately mean sea level to approximately 2,200 feet above sea level. It is still in a largely natural condition with only partial development. Figure 2-2 shows a general topographic map of the watershed. The watershed is small, steep and rugged. It is, however, the third largest watershed draining into Santa Monica Bay. Of the 12,800 acre watershed area, 11,082 acres or 87 percent are undeveloped or held by state and federal park agencies as part of the Santa Monica Mountains National Recreation Area.

2.2 CLIMATE

The Topanga Creek Watershed lies between sea level and approximately 2,200 feet within the Santa Monica Mountains. Ringed by steep canyon walls, the regional Mediterranean climate (wet winters and warm dry summers) is modified by numerous micro-climate zones. In the upper reaches of the watershed, especially along the ridge tops and the main stem of Topanga Creek (the sub-drainage known as Garapito Creek off Cheney Road) the summers are quite hot, with little to no influence from the coastal marine layer. Areas in the Old Topanga Canyon sub-drainage tend to have the coldest temperatures in the canyon, reaching freezing during the winter months. The influence of the coastal marine layer reaches up the canyon to an elevation of approximately 1,000 feet, where an inversion layer frequently forms. Santa Ana winds frequently gust up to 60 miles per hour into the canyon, and their drying effects have a major influence on vegetation distribution and species composition within the watershed. Exposed north east slopes tend to support northern mixed chaparral communities, with fewer representatives of species requiring more moisture.

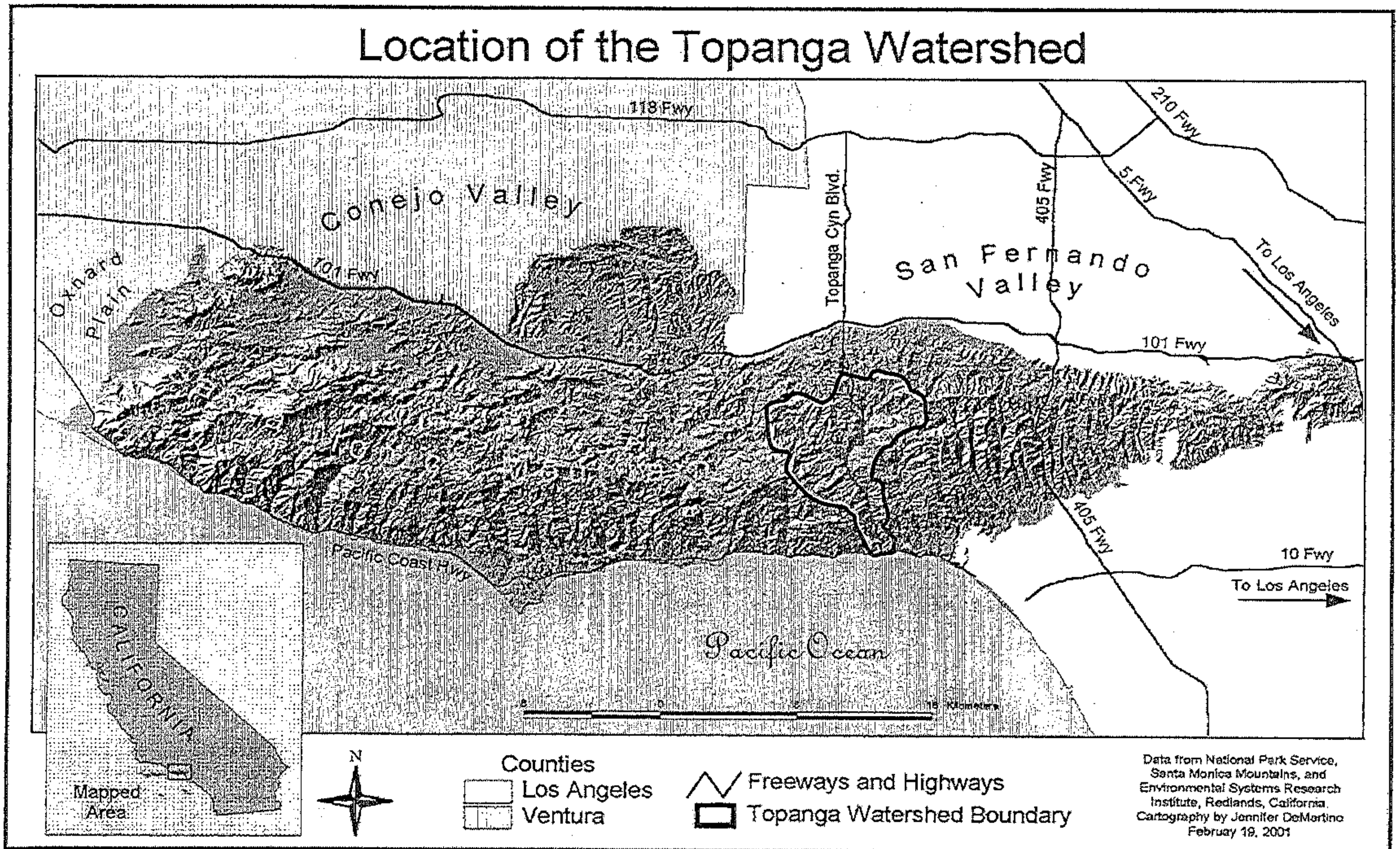

Figure 3-1. Location of the Topanga Watershed.

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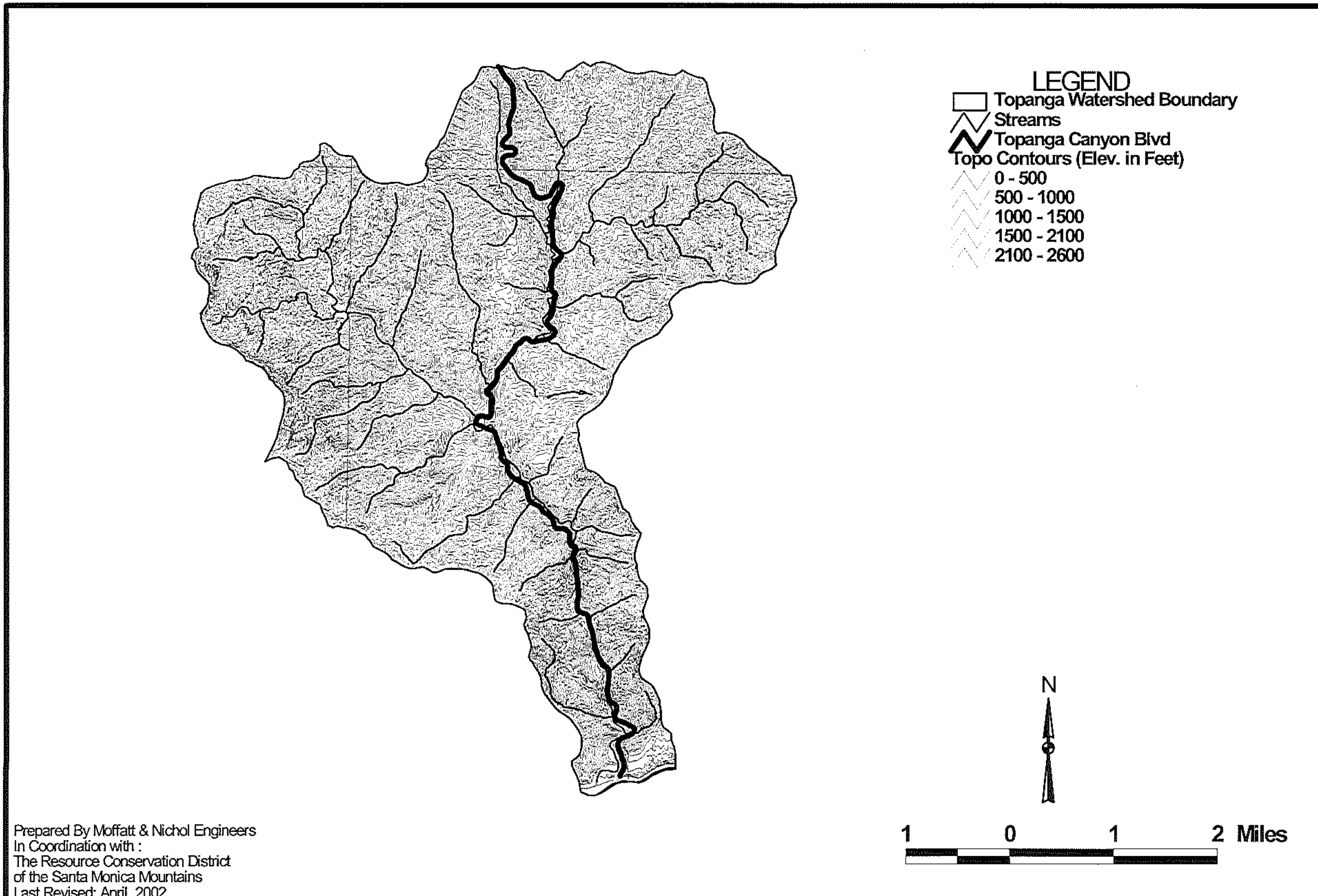
Last Revised: 29 April 2002

Map Source: Orme, et al...

Topanga Creek Watershed And Lagoon Watershed Restoration Feasibility Study	THE PROJECT VICINITY AND LOCATION	Figure 2-1



Topanga Creek Watershed And Lagoon Restoration Feasibility Study

WATERSHED TOPOGRAPHY

Figure 2-2

Rainfall patterns indicate slightly greater precipitation along the western and northern flanks of the watershed, diminishing as storms travel eastward. Rainfall amounts vary both within the watershed drainages, and from year to year. Table 2.1 summarizes the yearly precipitation and classifies years based on degree of wetness. Since records began in 1928 (73 years), Topanga has experienced 13 wet years, 16 above normal rainfall years, 14 normal years, 16 below normal years and 14 dry years. The variability between years (ranging from 7.9 to 56.5 inches) makes it difficult to characterize a "normal" rainfall year, although the average annual rainfall is 24.4 inches based on data from the gage maintained by the County of Los Angeles (gage number 6). Figure 2-3 shows the annual rainfall record for Topanga. In general, Topanga experiences higher precipitation than that recorded for the City of Los Angeles, which has an 124 year average of 15.04 inches, with a range of 4.56 to 40.29 inches (LA Times, 2002).

For the purpose of this study, records from several recording weather stations, as well as data collected by local volunteers were used to identify trends and illustrate patterns.

2.3 GEOMORPHOLOGY

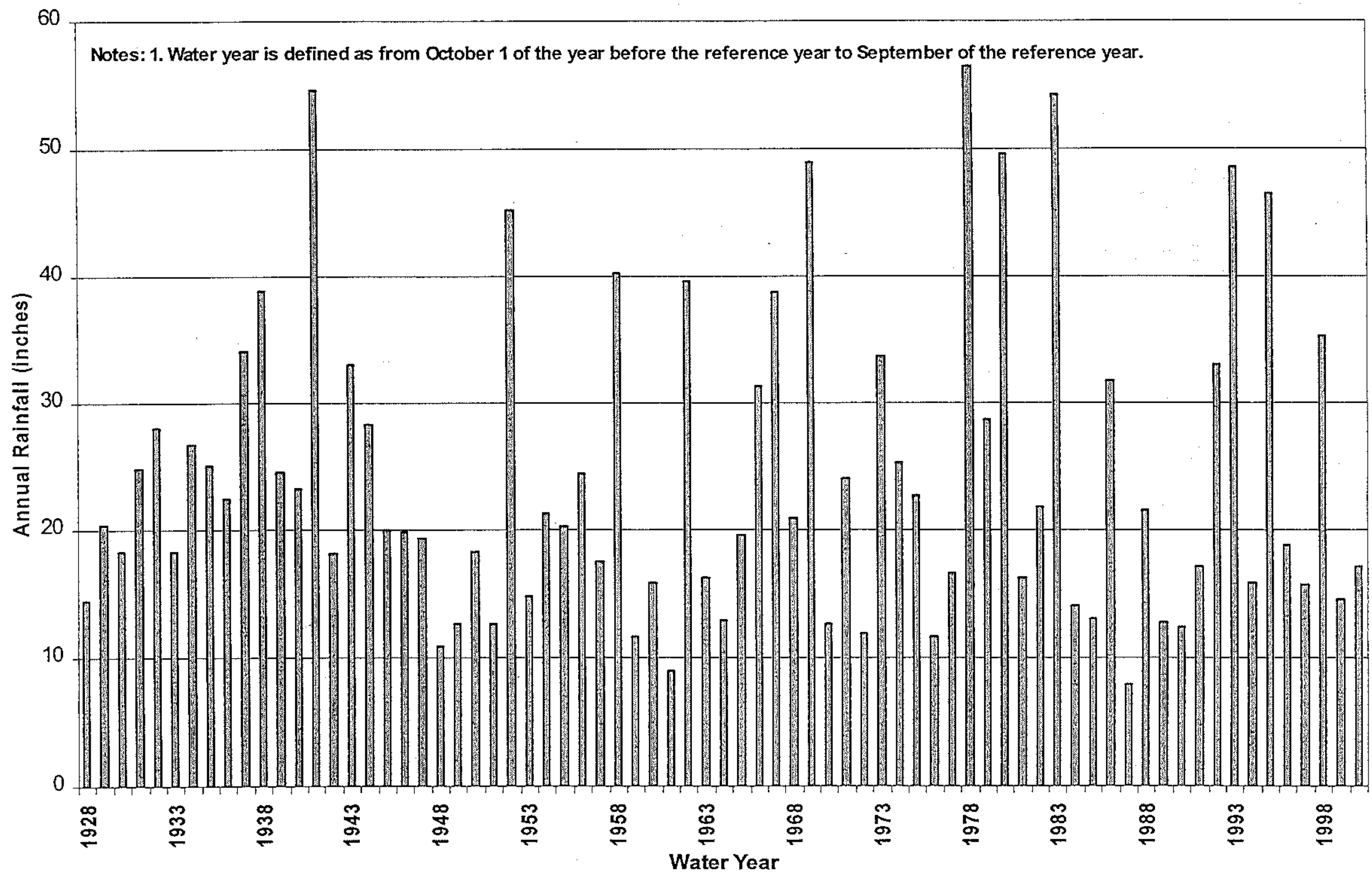
2.3.a Geological Setting

The geological setting of Topanga Creek is described in the Topanga Creek Erosion and Sediment Delivery Study (Orme, et al, 2002). The Topanga Creek watershed lies across the south side of the Santa Monica Mountains. These mountains are formed of late Cretaceous and Paleocene marine sandstone and conglomerate, overlain by later sandstone, conglomerate, siltstone and claystone.

The mountains have been rising rapidly since their formation. This rapid uplift has created unstable and very erosive terrain. The rocks to the south of the watershed are prone to fracturing and faulting; the rocks to the north of the watershed are typically young and unconsolidated. The terrain throughout the watershed is vulnerable to rapid erosion.

2.3.b Sediment Sources: Hillslopes and Roads

The Topanga Creek Erosion and Sediment Delivery Study evaluated sediment sources and transport during the water year 2000-2001. During this water year, the Topanga precipitation gage never showed precipitation rates greater than 1 inch per hour, the threshold at which widespread slope failure could be expected to occur. Since much of the erosion in the Topanga Creek watershed is believed to result from slope failures, only limited quantitative conclusions can be drawn from the study. Nevertheless, a framework for watershed planning and later investigations has been provided.



Topanga Creek Watershed And Lagoon Watershed Restoration Feasibility Study

ANNUAL PRECIPITATION RECORDED BY LACDPW GAGE #6

Figure 2-3

Approximately 99% of the Topanga Creek watershed is hillslope. A mix of chaparral and coastal sage covers about 75% of the watershed, and a further 10% is covered by native oak, walnut and riparian woodland. Most of the remaining 15% of the watershed has been subject to significant human impacts, including planting of non-native species. This disruption of the native vegetation has generally accelerated slope processes and reduced channel stability. Gophers and other burrowing animals play an important role in preparing soil for erosion, particularly enhancing throughflow and piping.

Hillslope erosion and sediment transfers in the Topanga Creek watershed arise primarily in response to storm-related precipitation and resulting changes in slope hydrology that generate overland flows and debris flows. Rockfalls and deep-seated landslides can occur many days or weeks after precipitation events. Dry ravel occurs between precipitation events. Debris flows, which are expected in winters with more frequent, intense and persistent rains, can quickly yield abundant sediment to stream channels, transforming normal floods into mudflows, with potentially devastating consequences. Many pre-existing landslides adjacent to streams remain near the threshold for slope failure.

The highest erosion rates measured during the benign 2000-2001 water year ranged from 0.1 to 0.4 ounces per square yard per day. These high erosion rates occurred on steep, north- and west-facing slopes, underlain by coarse clastic substrate, and poorly protected by chaparral and coastal sage owing to relatively recent fires. The erosion rates were highest on north- and west-facing slopes because precipitation during the wet season mostly approached the watershed from the west-to-northwest – leading to more particle detachment due to rain-splash. North-facing slopes also remain damper between rains, leading more quickly to saturated overland flow during subsequent rains.

The lowest erosion rates of up to 0.1 ounces per square yard per day occurred on gentle, south- and east-facing slopes underlain by fine clastic substrate and covered by grassland and oak savannah. However, grassland sites are expected to be much more vulnerable to erosion during very wet years: such sites, particularly those covered by dense shallow root mats of alien grasses, become unstable at higher rainfall intensities, leading to debris flows.

Roads, both paved and unpaved, are a source of sediment to the stream channels within the basin. Of the 26-mile margins of Topanga Canyon Boulevard and Old Topanga Canyon Road, berms comprise 40%, cut banks 46% and open frontages 14%. Large berms can be eroded by overland flow along roads, and are a potentially large source of sediment in the lower canyon. However, it is the cut banks, constituting almost half the road margin, that are the main sources of sediment from surface erosion and mass movement. By definition, they are cut into hillslopes, decreasing slope stability and tending to accelerate surface erosion and mass movement. Both during and after heavy rains, cut banks along most roads yield surface flows, seepage waters and debris. Cut banks can also fail in landslides and rotational slumps. Beyond the paved roads, dirt roads and hiking trails often cause serious erosion through poor design and inadequate maintenance.

2.3.c Sediment Sources and Sinks: The Channel System

Two very different parts of the Topanga Creek watershed can be distinguished, divided at a point 550 yards south of the Dix Canyon confluence with the main-stem. In the upper part, Topanga Creek and its tributaries have negative exponential profiles typical of developing drainages, generally with mild slopes. In the lower or main canyon part from Dix Canyon to the mouth, the main-stem exhibits a deep, almost linear profile. These profiles almost certainly reflect accelerated tectonic uplift involving extensive faulting.

In hydrodynamic terms, upper Topanga Creek and its main tributaries are behaving in a predictable manner, with sediment transported from the steeper slopes and deposited temporarily in lower-gradient reaches immediately downstream. Field observations reveal episodic pulses of erosion and sediment storage within these channels.

Lower Topanga Creek is dominated by the main canyon. Any debris which reaches the dividing point 550 yards below the Dix Canyon confluence moves rapidly downstream. Debris rarely accumulates within this canyon, other than temporarily within incised meander bends; debris first begins to accumulate 2000 yards above the river mouth, where the channel gradient lessens again. Above the Dix Canyon confluence, the channel bottom remains bedrock for a further 650 yards upstream, indicating that net scour and sediment loss are presently working their way upstream from the main canyon.

Garapito and Santa Maria Creeks emerged as major contributors of suspended and bedload sediment during the study period, especially upstream from their confluence. The Old Topanga Creek system, including Red Rock Creek, was a far less active erosion and sediment delivery system during the study period, probably because flows were less and channels were better stabilized by riparian woodland and engineering structures. However, a large quantity of loose hillslope sediment remains stored within this system and will likely be mobilized in future high magnitude events.

Moving further downstream, any sediment delivered to the head of the main canyon near Fernwood is likely to make its way to the 2000-yard long estuarine section. During major floods, a significant portion of the coarse fraction will reach the sea and will be deposited immediately offshore. The medium fraction will form the bulk of sediment available for beach nourishment but this soon moves eastward. The fine fraction settles within Santa Monica Bay, and contributes little to local beaches.

The river mouth showed three distinct phases during the study period. The barrier-lagoon system inherited from summer 2000 persisted until January 2001, subject to occasional overwash and one temporary breach. From January to March 2001, the barrier was breached by storm-related discharges and remained open. The open estuary mouth closed again on March 29, and remained closed to the end of the water year. This behavior is representative of benign water years.

Table 2-1 Water Year Types for Topanga Creek Watershed Based on Runoff and Basin Precipitation

Water Year	Annual River Runoff**		Annual Basin Precipitation		Water Year	Annual River Runoff		Annual Basin Precipitation	
	Runoff Volume (acre-feet)	Water Year Type	Precipitation (inches)***	Water Year Type		Runoff Volume (acre-feet)	Water Year Type	Precipitation (inches)	Water Year Type
1928	****	****	14.5	BN	1965	886	BN	19.65	N
1929	****	****	20.5	N	1966	7,270	W	31.29	AN
1930	****	****	18.4	BN	1967	5,070	AN	38.63	W
1931	705	BN*	24.9	AN	1968	1,570	N	20.94	N
1932	3,590	AN	28.1	AN	1969	29,400	W	48.99	W
1933	2,240	AN	18.4	BN	1970	902	BN	12.68	D
1934	6,420	AN	26.7	AN	1971	4,560	AN	24.00	AN
1935	1,360	N	25.1	AN	1972	809	BN	11.85	D
1936	1,490	N	22.5	N	1973	6,250	AN	33.68	AN
1937	6,620	AN	34.0	AN	1974	4,110	AN	25.30	AN
1938	15,310	W	38.7	W	1975	2,200	AN	22.81	N
1939	****	****	24.6	AN	1976	214	D	11.60	D
1940	2,080	N	23.3	N	1977	405	D	16.70	BN
1941	18,940	W	54.6	W	1978	23,480	W	56.50	W
1942	540	BN	18.2	BN	1979	5,180	AN	28.70	AN
1943	8,720	W	33.0	AN	1980	23,236	W	49.60	W
1944	6,970	AN	28.3	AN	1981	1,279	N	16.30	BN
1945	1,090	N	20.0	N	1982	1,066	N	21.80	N
1946	1,390	N	19.9	N	1983	19,241	W	54.30	W
1947	994	BN	19.4	N	1984	1,445	N	14.10	D
1948	168	D	10.9	D	1985	943	BN	13.10	D
1949	99	D	12.6	D	1986	7,211	AN	31.69	AN
1950	379	D	18.4	BN	1987	****	****	7.89	D
1951	74	D	12.6	D	1988	****	****	21.62	N
1952	16,900	W	45.2	W	1989	283	D	12.79	D
1953	725	BN	14.9	BN	1990	****	****	12.40	D
1954	1,820	N	21.4	N	1991	****	****	17.20	BN
1955	354	D	20.2	N	1992	****	****	33.00	AN
1956	1,030	N	24.4	AN	1993	****	****	48.60	W
1957	374	D	17.6	BN	1994	****	****	15.90	BN
1958	7,460	W	40.3	W	1995	****	****	46.53	W
1959	785	BN	11.7	D	1996	****	****	18.90	N
1960	422	BN	15.9	BN	1997	****	****	15.78	BN
1961	58	D	9.0	D	1998	17,640	W	35.12	W
1962	7,720	W	39.5	W	1999	839	BN	14.56	BN
1963	454	BN	16.3	BN	2000	2,030	N	17.16	BN
1964	178	D	13.0	D					

* Wet, Above Normal, Normal, Below Normal and Dry classes determined by exceedence analysis using 20 percent intervals for each class (e.g. driest 20% of the years -dry)

** Runoff volume is based on LACDPW Gage #F54

*** Precipitation is based on LACDPW Gage #6

**** No data

Over the longer term, stream characteristics in the Topanga Creek watershed appear to be changing. Along many reaches, floodplains are being incised and channel banks appear less stable, for example, in Upper Topanga, Garapito and Santa Maria Creeks. Most likely, the impact of discharged imported water, concentrated road runoff, vegetation conversion, and other land-use changes have combined to disrupt the previously stable system.

2.3.d Response of System Following Wildfires

Fire is a recurrent feature of the Topanga Creek watershed, as a result of summer drought, Santa Ana winds, and the flammable chaparral and coastal sage vegetation. The removal of plants and plant litter by fire exposes the surface to direct raindrop impact and overland flow, and allows dry ravel.

Fire can also modify the soil structure and texture, by generating very high surface temperatures (~1100-1800°F) that destroy organic matter, consume nutrients, and fuse soil particles. Fire can also vaporize waxy organic substances at the surface. These waxy substances can condense further down the soil profile. In chaparral, coastal sage, and certain woodland soils, this can lead to the accumulation of dense water-repellant layers below the surface that inhibit infiltration and lead to increased surface flows and so to accelerated erosion.

Vegetation recovery in the chaparral is a slow process, and surface erosion typically remains at elevated levels until the perennial vegetation canopy is fully restored. That process can take several years depending on the survivability of root systems, seedling dynamics and other factors.

Some portions of the watershed, particularly in the upper Garapito Creek basin and Greenleaf Canyon, have not burned for more than 30 years. Vegetation in the lower basin was burned in 1973 but has become re-established. In contrast, a swift moving fire in autumn 1993 consumed most of the vegetation west of Old Topanga Creek and locally farther south, west of the main canyon. Vegetation in these areas has yet to recover sufficiently to provide good protection. For example, the sites measured by the Erosion and Sediment Delivery Study that had the highest average sediment yields were within the Red Rock Canyon area, just within the margins of the 1993 fire.

Numerical modeling was performed for this study to quantify effects of fires on runoff and sediment yield. The results indicate that runoff can substantially increase, depending on the amount of area burned. Burning of the entire watershed would result in an increase in runoff by approximately 30 percent, with lesser increase as smaller areas are burned. Sediment yield will also increase significantly after a fire, but this was not modeled due to limitation of available data. Qualitatively, sediment yield after wildfires that burn the entire watershed would increase by more than 30 percent because the relationship of sediment yield from runoff is exponential and not linear.

2.4 HYDROLOGY

2.4.a Watershed Description

Topanga Creek possesses unique hydrology. The watershed is small (18 square miles) relative to many other coastal watersheds in the Southern California region. It extends from Santa Monica Bay northward into the ridgelines of the Santa Monica Mountains. The watershed is oriented primarily from north to south, and is wider in the upper reaches and narrower toward its base. The irregularly-shaped area is seven miles long by nearly six miles wide across its wide-point. It is significantly undeveloped (98.7 percent undeveloped, 1.3 percent developed) with mostly pervious surfaces and large areas of undisturbed vegetation cover.

The watershed drainage system is dendritic and subdivided into the upper and lower watershed. The creek meets the ocean at Topanga Point, and extends upstream approximately nine miles. Lower Topanga Creek extends from the ocean to the town of Topanga approximately four miles upstream, and splits into the tributaries of Old Topanga Creek and Upper Topanga Creek. Figure 2-4 shows the creeks and tributaries of the watershed. Old Topanga Creek extends another three miles or more upstream toward the northwest, and Upper Topanga Creek extends over four miles upstream along Topanga Canyon Road into Garapito Creek for another 4 miles.

Several hydrologic subareas exist within the lower and upper reaches of the creek. These subareas drain into smaller tributary creeks that feed Old Topanga Creek and the Upper Creek. The smaller tributaries include Brookside Creek, Dix Creek, Greenleaf Creek, Hondo Creek, Red Rock Creek, Garapito Creek and Santa Maria Creek and several unnamed drainages. Figure 2-4 also shows subdrainage areas within the watershed. Each subarea acts as an individual hydrologic unit and some receive inputs from upstream while all discharge to downstream areas.

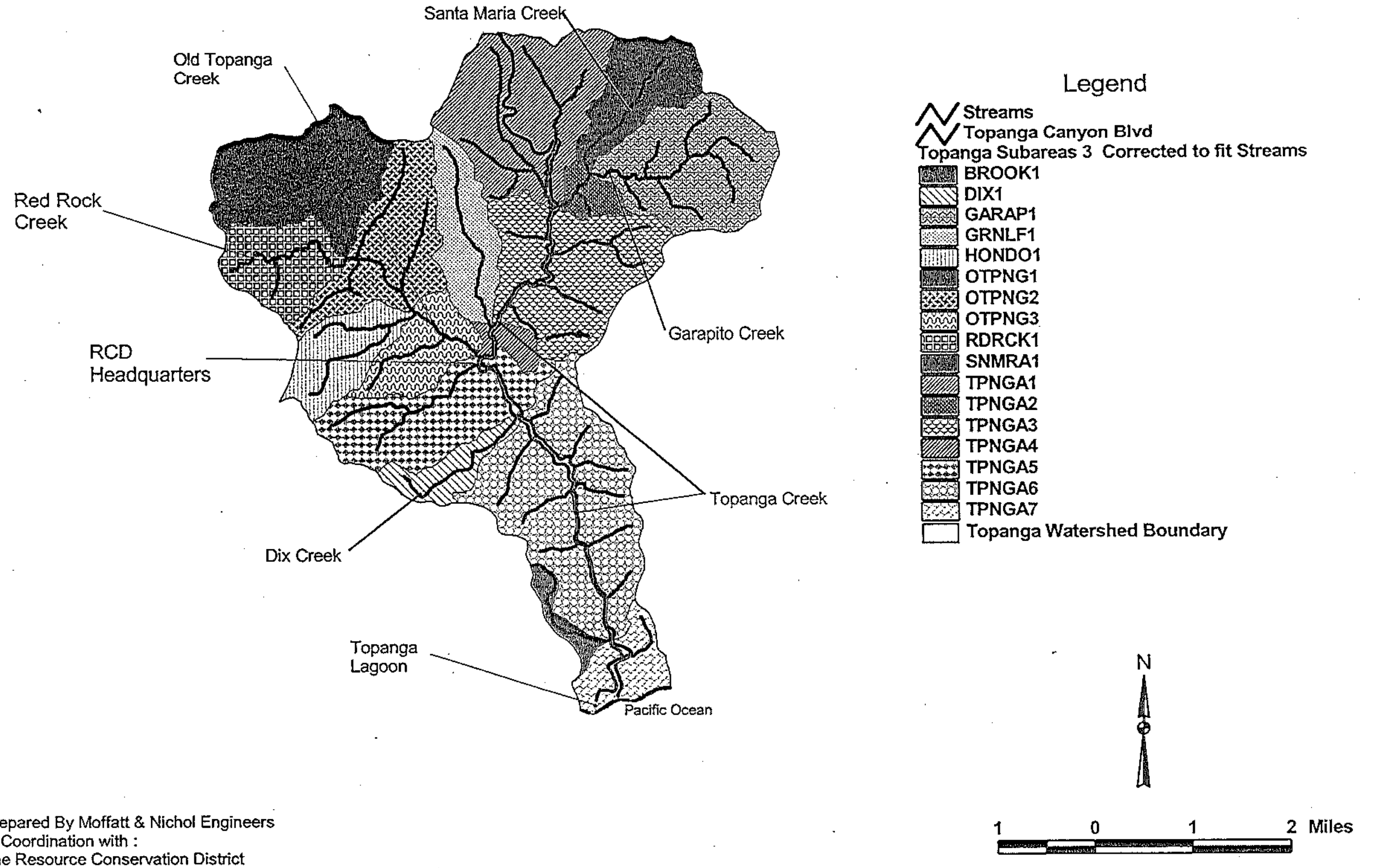
2.4.b Streamflow Characteristics

Precipitation and streamflow are closely related in the watershed. Data for both are available. As shown in Figure 2-5, three precipitation gages exist in the watershed near Santa Maria Creek, (not functioning since 1988), Old Topanga Canyon and the town of Topanga. Several others are located just outside of watershed boundaries. Complete precipitation records from Topanga Patrol Station are available from 1928 to the present. This Topanga station has been a continuous recording digital gage since 1996 and so provides the most detailed data for analysis. Additionally, rain gages at Old Topanga Canyon, Santa Ynez Reservoir, Malibu Hills, Malibu Big Rock Mesa and Cheesboro were used to provide regional context.

A stream gage station maintained by LA County is located on the lower creek two miles upstream of the mouth. The gage records extend from 1931 to the present, with a gap during 1985, 1987, and between 1990 and 1997. Discharge data are daily averages prior to 1990. Data were not recorded from 1990 to 1997. Since 1997, the gage is digitally automated, and the data are short-interval (five to ten minutes). These data are best suited for analyses.

Table 2-1 in Section 2.2 shows long-term annual records of precipitation and runoff. Figure 2-6 shows the annual runoff record. There is no observable trend between wet and dry periods within the rainy season. Figure 2-7 shows mean daily flow by water year type. Average daily stream discharge varies from a maximum of 100 cubic feet per second (cfs) during wet years to near zero during dry years. Discharge also varies seasonally. Figure 2-8 shows discharge from 1997 to 2001. High flow events are episodic with long periods of low flows in between. Low flows typically occur from April to November, with potentially higher flows occurring in the balance of the year.

The watershed is characterized by steep and rugged terrain throughout much of its area. Slope angles vary, but many are 45 degrees or greater, especially in the lower watershed. As a result, runoff is high and infiltration is low. Generally, the watershed is characterized by rapid runoff from the tributary area to the creek, and high discharges over short time periods. Floods follow quickly after rains, have high peaks, and drop off rapidly again when rains subside. Figure 2-9 shows a typical storm hydrograph from a four-year storm in 2001.



Prepared By Moffatt & Nichol Engineers
In Coordination with :
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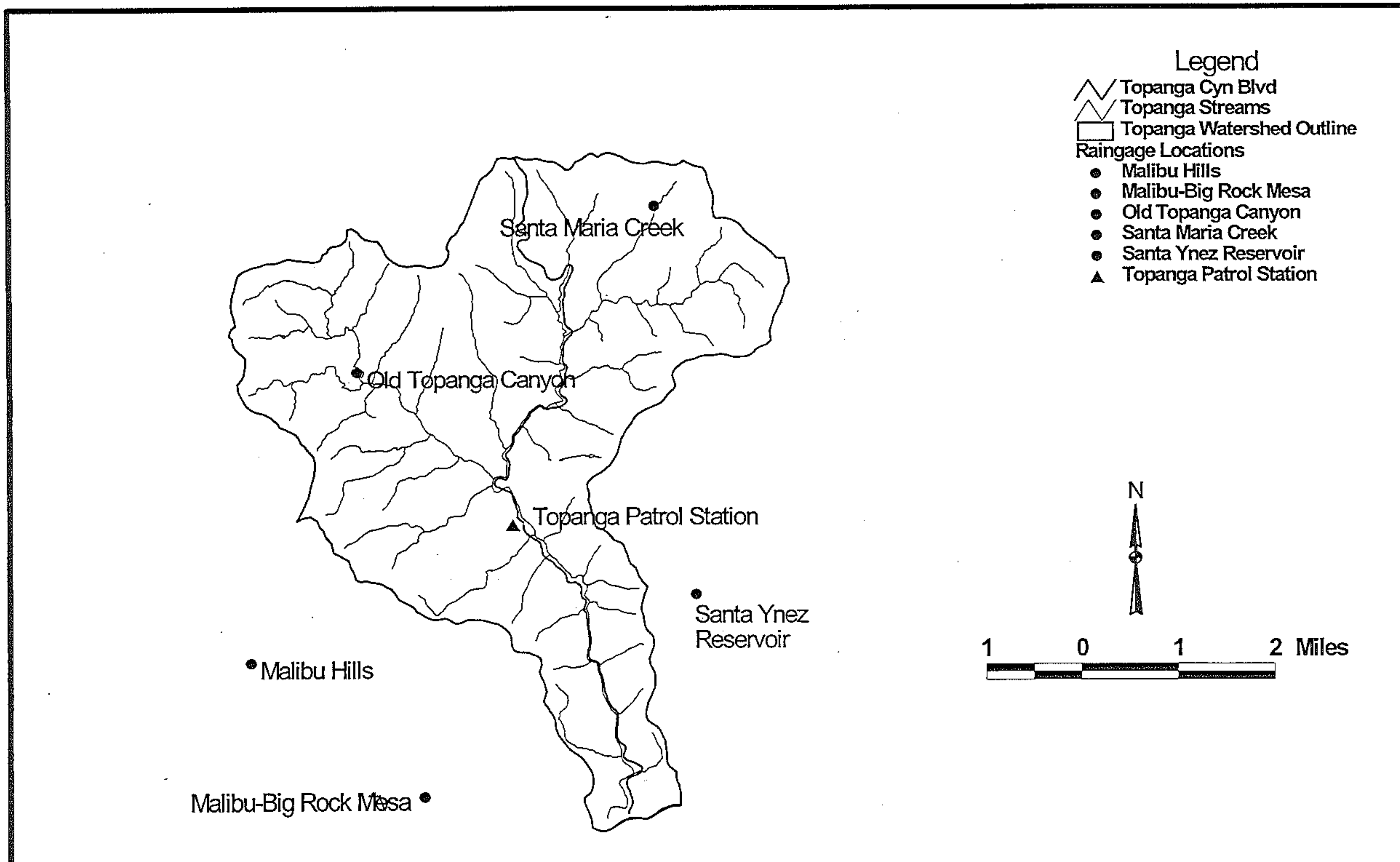
Last Revised: February, 2002

Topanga Creek Watershed And Lagoon Restoration Feasibility Study

SUBDRAINAGE AREAS WITHIN THE WATERSHED

Figure 2-4



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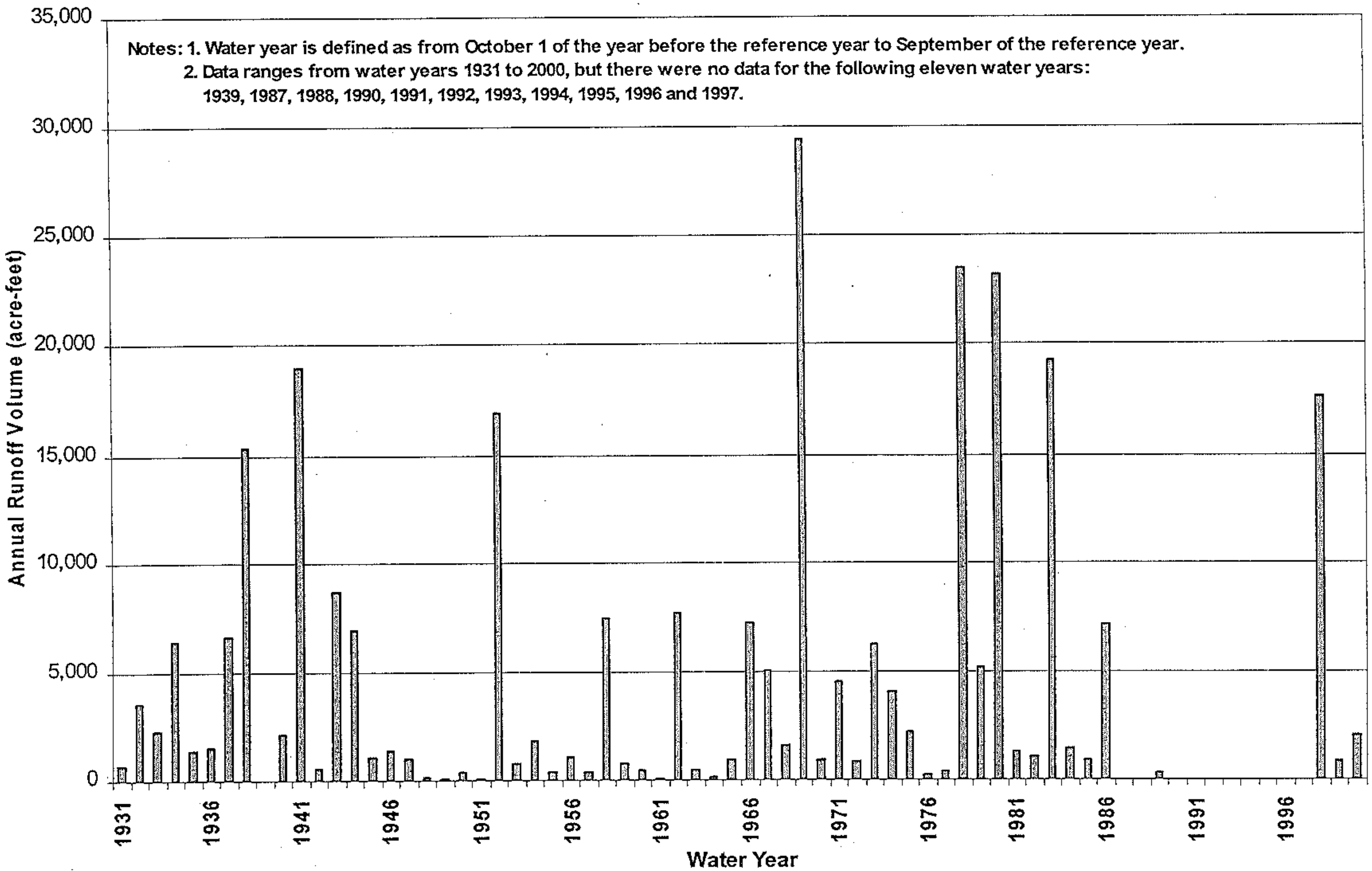
LOCATION OF PRECIPITATION GAGES AND THE STREAM GAGE

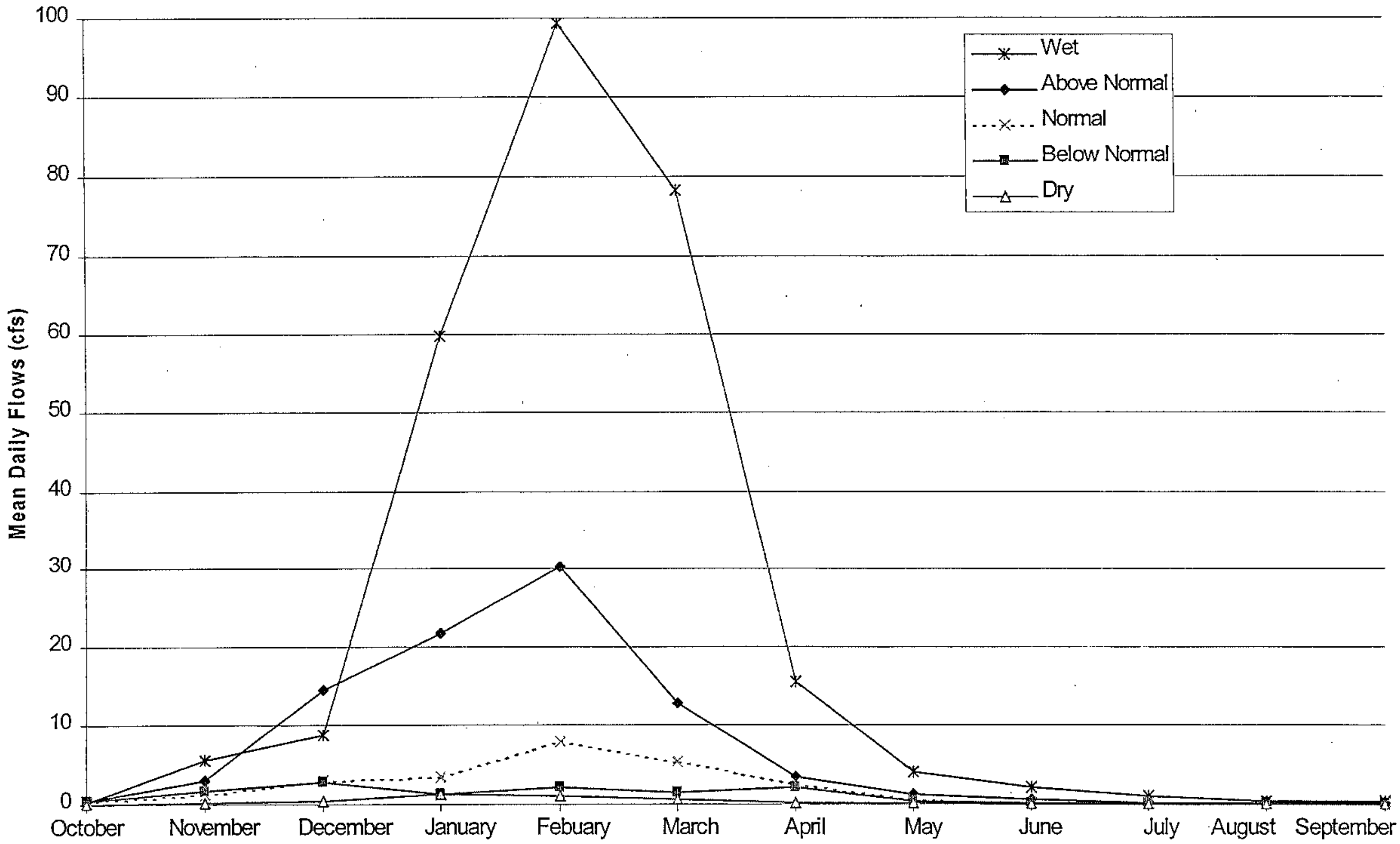
Figure 2-5



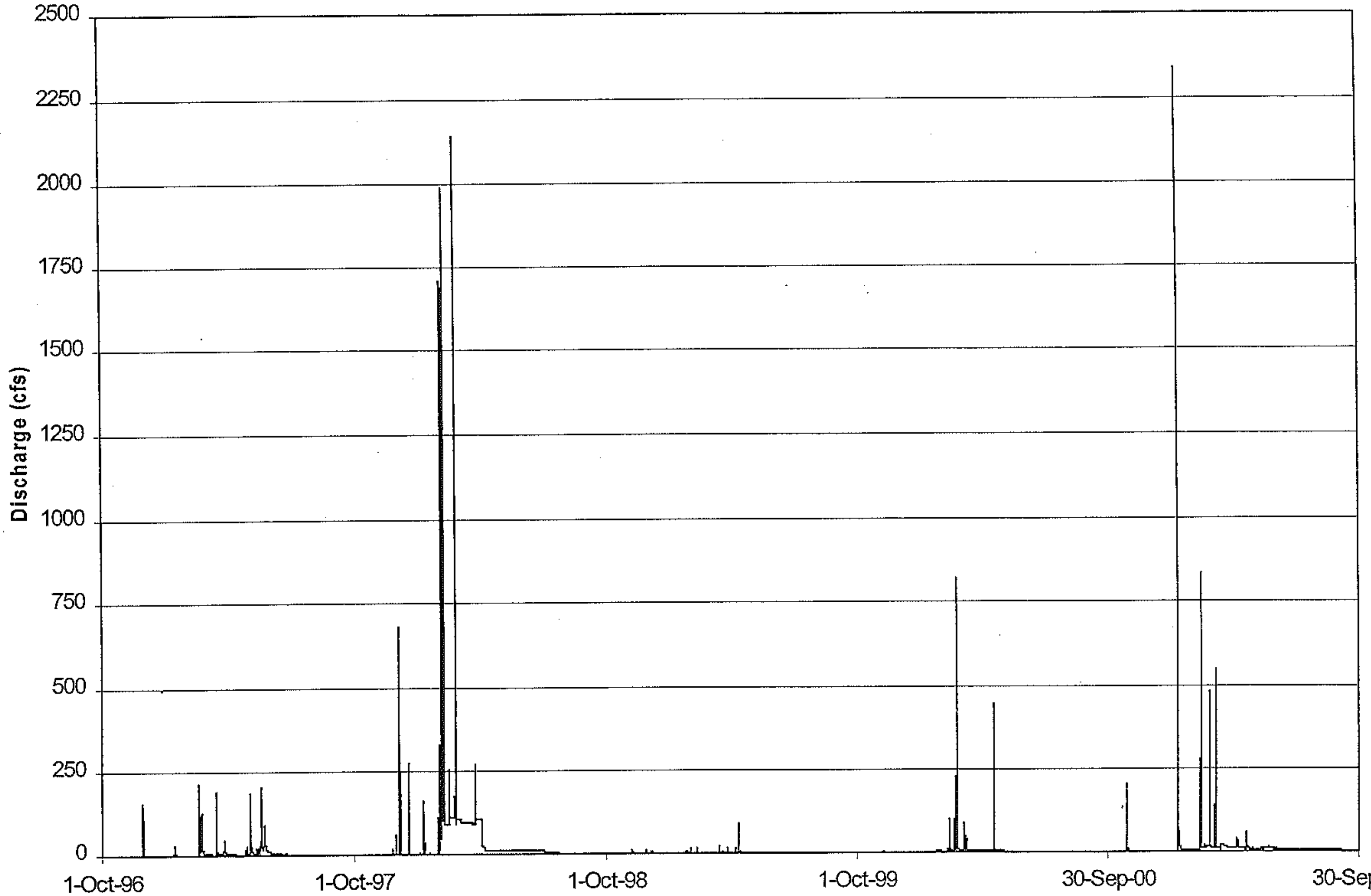
Topanga Creek Watershed And Lagoon Watershed Restoration Feasibility Study

ANNUAL RUNOFF RECORD

Figure 2-6



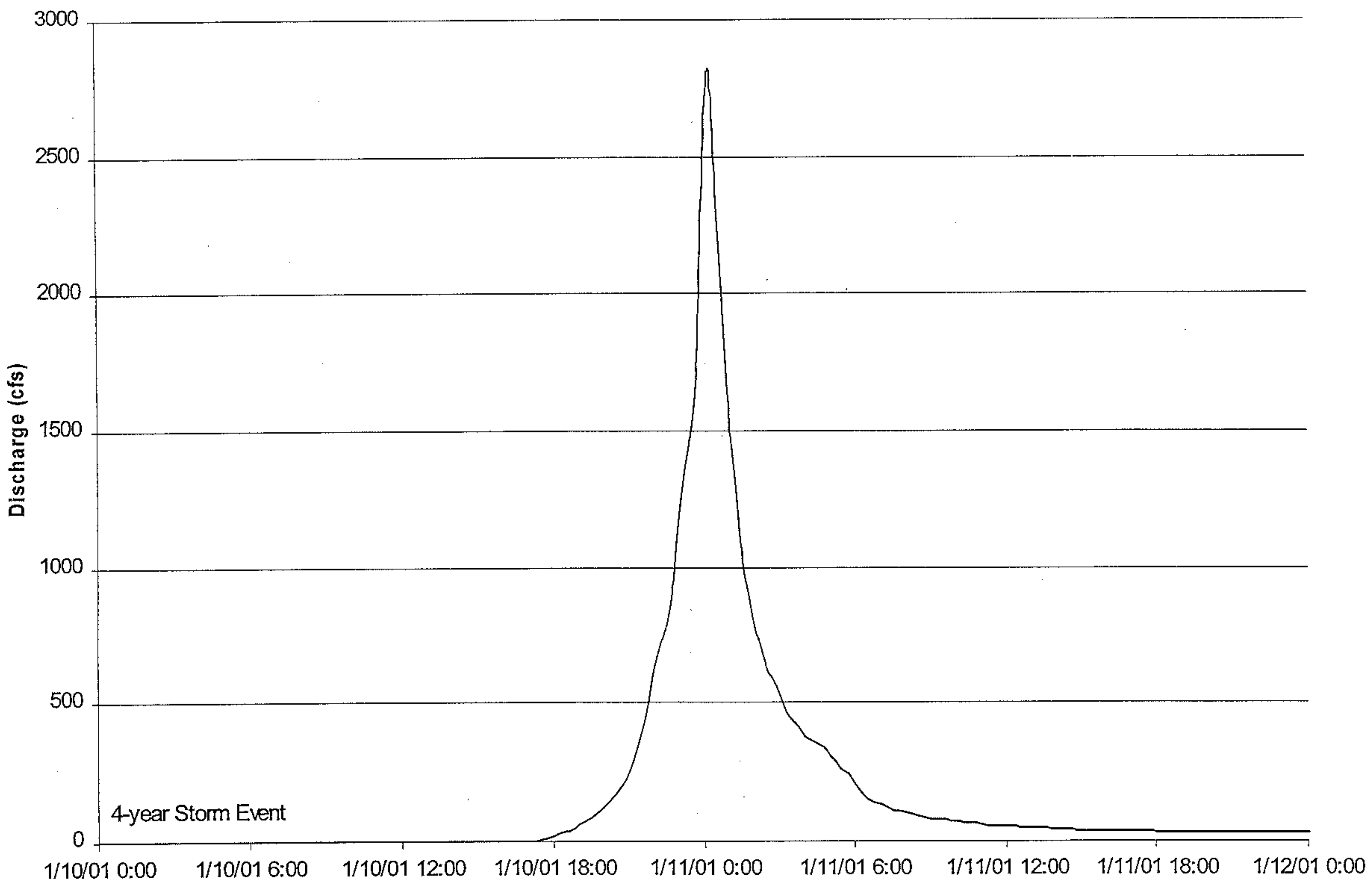
Topanga Creek Watershed And Lagoon Watershed Restoration Feasibility Study	MEAN DAILY FLOWS BY WATER YEAR TYPE	Figure 2-7



Topanga Creek Watershed And Lagoon
Watershed Restoration Feasibility Study

DISCHARGE FROM 1997 TO 2001

Figure
2-8



Topanga Creek Watershed And Lagoon
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HYDROGRAPH OF THE
JANUARY 11, 2001 STORM

Figure
2-9

As an example, the storm on March 25, 1988 yielded 4.04 inches of rain recorded at Fernwood, 2.5 miles upstream of the gage, from 12:30 AM to 7:30 PM with rain peaking at 5:00 PM. The stream gage on the creek began to record increased discharge at 5:30 PM and peaked at 8:00 PM, indicating that the concentration time for runoff from Fernwood is very short. Similar conditions exist throughout the rest of the watershed. Figure 2-10 shows precipitation at Fernwood plotted against runoff at the stream gage for the storm.

2.4.c High Flows and Flood Events

High storm flows have occurred episodically over time causing flooding. Stream discharges in 1938, 1969, 1978, 1980 and 1983 represent high flows. Table 2-2 shows their magnitudes. The 1980 flood was the worst on record and resulted in severe damage to Topanga Canyon Road and other infrastructure. Physical changes caused by this flood are still visible today. Water stage near PCH bridge during high floods reaches within ten feet or less of the bridge soffitt (underside of the deck). Flow velocities during floods can reach 20 feet per second (fps).

Table 2-2 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

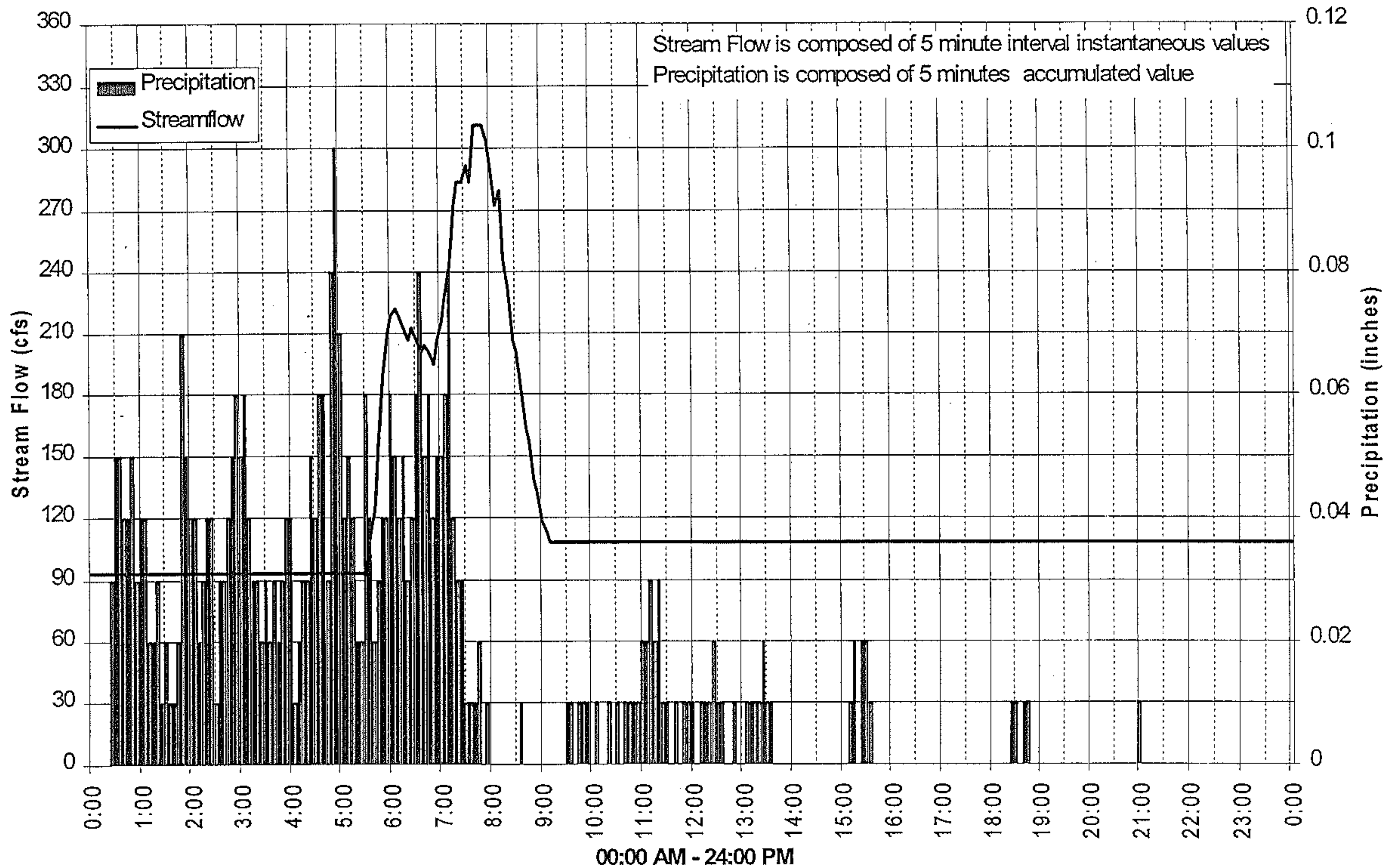
Source: County of Los Angeles Department of Public Works

2.4.d Low Flow Conditions

Low flows exist most of the time and are generally below 1 cfs. Extended periods of low flows occur in spring, summer and fall of nearly every year. They consist of baseflow from the watershed. Water stage during low flows is near mean sea level at PCH bridge and flow velocities are negligible through the creek. Upper portions of the watershed go dry during low flows, but the lower creek always has several feet of water in it.

2.4.e Runoff and Human Impacts

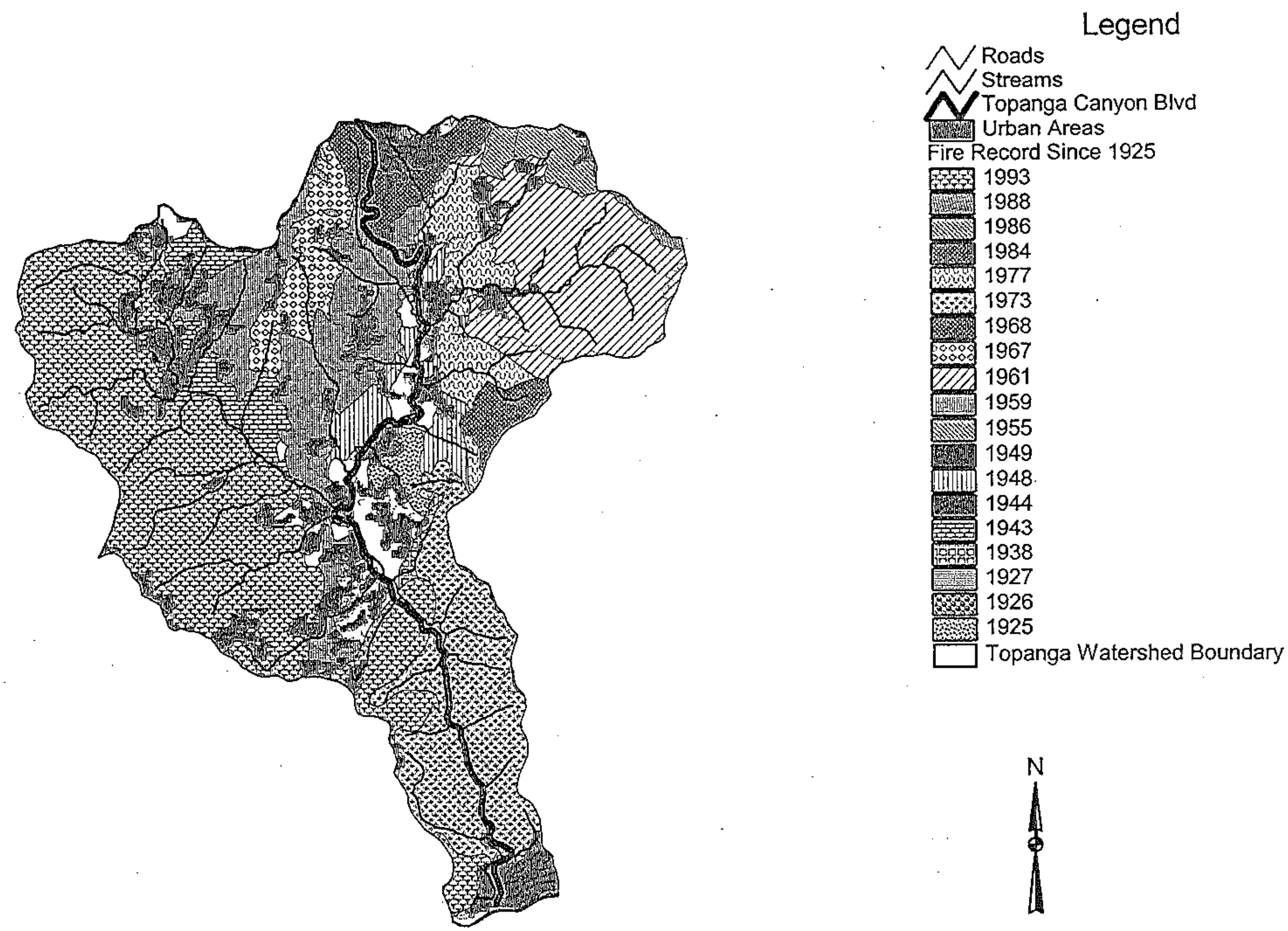
Fires in the watershed have the effect of stripping the protective vegetation cover, leaving the surface exposed to rainfall and runoff. Figure 2-11 shows historic burn areas. Runoff from the watershed then increases in volume for a given storm, and the lag time between the occurrence of rain and increased stream discharge decreases.



Topanga Creek Watershed And Lagoon
Watershed Restoration Feasibility Study

PRECIPITATION AND STREAM DISCHARGE ON MARCH 25, 1998

Figure 2-10



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Last Revised: April, 2002

Topanga Creek Watershed And Lagoon Restoration Feasibility Study

HISTORIC BURN AREAS

Figure 2-11

Historic stream flow data are not of sufficient detail to accurately quantify the effect of fire on runoff and stream discharge at Topanga Creek without extensive work beyond the scope of this study. Qualitatively, however, the effect will be to increase the amplitude of the peak of the hydrograph and shorten the concentration time of runoff from the watershed. A shorter concentration time means that increases in stream discharge relative to the timing of rainfall will occur sooner. The flood after fire will therefore occur sooner and be greater magnitude than a flood not following fire.

The watershed is understood to have high potential sediment and debris yield. The draft Erosion and Sediment Delivery Study indicates that the watershed yields a range of 0.013 feet/thousand years to 6.17 feet/thousand years of sediment per year under average conditions. This is in excess of the rate of 1.0 feet/thousand years of tectonic lift. Exposure of the surface to mass erosion from the effect of fire would likely increase sediment yield significantly. Increased sediment yield from the watershed would cause sedimentation at certain reaches of the creek. Sedimentation would likely be most significant at the downstream reach near the lagoon where the stream gradient (slope of the bed from downstream to upstream along the centerline) is lowest. Also, the constraining effects of PCH bridge on hydraulics results in a localized backwater effect upstream of the bridge and a decrease in flow velocities. Sediment may "drop out" of the creek flows where flow velocities decline causing sedimentation. Sedimentation could cause build-up of the streambed and increased colonization of riparian vegetation at this location.

Land use changes from development within the watershed have led to greater impervious surfaces and runoff to the creek. Increased runoff leads to greater flood and low flow discharges in the creek and even greater sediment yield. The watershed is nearly built-out so the existing condition of development, runoff and sediment yield can be considered to represent future conditions.

2.4.f Imported Water

The volume of imported water brought into the Topanga Creek Watershed is based on estimates, as the Los Angeles County Water District #29 records cannot be broken down on a watershed level. Using the average of 1,723 gallons per household per day (LA County Waterworks District 29, personal communication), the approximately 3,000 households in Topanga consume 5.2 million gallons of water per day. Annual imported water use per year is approximately 5,800 million acre/feet. This varies seasonally, although irrigation needs in Topanga tend to be less than in more urbanized or agricultural areas, since much of the landscape remains covered in drought tolerant vegetation.

As the number of households has increased over the years, so to has the amount of water imported into the watershed. Before 1954, all water was drawn from local wells and springs. A study completed in 1954 indicates that each of the estimated 4,200 people consumed 26 gallons of water each day (Stork, 1992). Today, there are still some households that maintain wells or tanks providing individual water supply, but the majority of homes are hooked into the municipal system.

2.4.g Sea-Level Changes

Predictions of future sea level rise are uncertain, depending on the influence of global warming. The state of the art predictions generally range from 0.5 feet to 1.2 feet by the year 2050 (Titus, 1995; Woodworth, 1990; Douglas, 1992).

Relative sea level rise throughout most of Southern California, including Topanga, is influenced by local uplift and subsidence as well as global (eustatic) changes in sea level. However, the subsidence has been offset by the "Southern California Uplift" (Ewing et al, 1989). A sea level rise of 0.02 feet per year, or 1 foot over 50 years, is a reasonable estimate. The final engineering design for the lagoon restoration will need to take this into consideration.

2.4.h Steelhead Migration Flow Events

Migration of adult fish upstream and back to the ocean is thought to occur during the winter months on the receding edge of storm events, after base flows have been established and the lagoon entrance is opened. Typically, these storm events occur between January and March, with the greatest frequency occurring in February.

An analysis was done of daily streamflows occurring at the LA County stream gage between the potential steelhead migration period of December through May when flows are sufficient to maintain the open lagoon mouth. The stream gage record from October 1996 to the present was used as it is considered a period of relatively average flow conditions and the only period of continuous stage recording. The data were analyzed for water depth (stage) and flow velocity, as these are the two criteria considered critical to determine fish passage suitability (Table 2-3).

Table 2-3 Criteria for Steelhead Migration Up and Downstream

	Adult Steelhead	Juvenile Steelhead
Max. average Water Velocity (fps)	6.6	6.6
Mini average Water Velocity (fps)	0.6	0.6
Minimum Flow depth (ft)	0.8	0.3
Q hp	89 cfs	20 cfs
Q lp	3 cfs	1 cfs
High flow condition: % annual Exceedance Flow	1%	10%
Low flow Condition: % Annual Exceedance Flow	50%	95%

Source: CDFG Culvert Criteria for Fish Passage Workshop, 2001

Suitable fish passage conditions are determined to exist for adult steelhead trout if the water depth is 0.8 feet or greater. Juvenile steelhead trout need water depths of 0.3 feet or greater. The data indicate that from 1997 to the present, considered an average period and the only period of continuous stage recording, the probability that sufficient water depth will exist to support adult fish passage is 3.7 percent on average. Under all but extreme flood conditions, fish are able to migrate into and out of Topanga Lagoon while the inlet is open. This translates to only about 13 days per year of sufficient water depth for adult fish passage at this location. The probability that sufficient water depth will exist for juvenile fish passage at the same location over the same time period is 12 percent, translating into 44 days per year. Table 2-4 shows the data. Opportunities for the fish to pass through the lagoon during peak flood events is enhanced by lagoon restoration Alternative Concepts 3 & 4, where the flood flows are reduced providing a longer time window for upstream and downstream migration.

Table 2-4 Average Probability of Suitable Fish Passage Conditions Existing on Topanga Creek

Water Year, Parameter	Probability of Minimum Creek Depth of 0.8 Feet (%)	Probability of Minimum Creek Depth of 0.3 Feet	Probability of Flow Velocities Between 6.6 and 0.6 fps
1997	0.55	5.47	16.01
1998	16.32	42.48	63.95
1999	0.03	0.71	4.58
2000	0.36	3.36	23.08
2001	0.92	8.88	30.86
Average	0.04	12.18	27.70
Number of Days/Year	13	44	101
Required Discharge	75 cfs	7.5 cfs	Not Applicable

The other fish passage criteria of flow velocity was also analyzed. Steelhead trout passage conditions are considered optimum if flow velocities are between 0.6 feet per second (fps) and 6.6 fps. The probability of this range of flow velocities occurring from 1997 to the present at the LA County stream gage is 28 percent, translating into 101 days per year.

The distance steelhead need to travel in Topanga Creek has never exceeded a maximum of 8 miles, and since the1980 flood has been restricted to less than 4 miles of unimpeded creek access to areas with suitable spawning and rearing habitat.

2.5 WATER QUALITY

Water quality in Topanga Creek has been an issue of great concern to the community, since all households rely upon on-site septic systems for waste disposal, and there are numerous potential non-point sources of pollution within the watershed, such as corralled animals and greywater systems. The Los Angeles Regional Water Quality Control Board 303(d) list includes two impairments for the watershed, lead in the upper watershed and coliform bacteria at Topanga Beach. In order to determine if these impairments were accurate, as well as to identify possible sources and relationships to land use, a 205j grant from the CA State Water Resources Board funded a two year study of water quality throughout the Topanga Creek Watershed from July 1999-2001. This study was further augmented by funds from the CA Coastal Conservancy Southern CA Wetlands Recovery Project when it was discovered that data from Topanga Lagoon itself was needed. Monthly samples have been taken within Topanga Lagoon from November 2000 – January 2002. Summaries of all data are found in Appendix A.

2.5.a Summary

Overall, despite the potential for pollution problems, water quality in Topanga Creek is good. A table summarizing the conditions of the fifteen study sites is found in Appendix A. Impacts from development have not yet exceeded the natural capacity of the creek to cleanse itself. The strong diversity of sensitive aquatic species, and the presence of so many endangered species, such as steelhead trout that have very limited tolerance for pollution indicates that Topanga Creek remains a vibrant, healthy system throughout much of the watershed.

2.5.b Algae Growth and Eutrophication

Some level of algal growth is natural and desirable. A normal pattern of summer growth and winter dieback of both surface and attached green and brown algae was observed, but whether this level was "normal" or "excessive" could not be conclusively determined within the scope of the study. All of the nutrients can support rapid algal growth, which in turn reduces available dissolved oxygen and causes eutrophication.

Review of the data for each site illustrates several patterns. First, the amount of canopy cover over the site plays a major role in algae growth. Sites with more exposure had the highest levels of algae growth. The nitrate levels at some locations peaked during the winter months, followed by a significant decrease of nitrates but increase in algae cover as the nutrients were used to foster growth. However, since nutrient levels at all but three locations were consistently low to non-detectable, it appears that algae cover in Topanga Creek is driven more by sun exposure than excess nutrient inputs.

2.5.c Physical Parameters

Water temperature was found to vary seasonally and according to the amount of canopy cover over the sampling site. Shallow, exposed sites reached up to 30 degrees Celsius in the upper watershed during the late summer, but most locations stayed within the range of 8 to 25 degrees Celsius. Water temperature did not drop below 8 degrees Celsius at any location during this study. Optimal temperatures for steelhead trout were maintained throughout the year in many sections of the creek.

Another parameter of concern is pH. Typically, animals have a narrow range of tolerance for changes in pH. All sites stayed between pH levels of 7 to 8.5, well within the desirable range to support a wide variety of aquatic plants and animals.

Dissolved oxygen is constantly changing throughout the day, in response to wind, flow rate, water temperature changes and biological oxygen demand. As temperatures rise, dissolved oxygen typically falls. Stagnant or slow moving pools also cause dissolved oxygen levels to drop. Levels below 3 milligrams/liter (mg/l) often result in the death of aquatic life. Observations indicate that a normal seasonal cycle was found at all sites, with the majority of sites staying within an acceptable range of 3 to 15 mg/l.

Salinity ranged from 0 –4 parts per thousand (ppt) in the upper watershed, and 0-7 ppt in the lagoon. This is well within the fresh to brackish range. Seawater typically is 33-37 ppt, and those levels were only found near the lagoon/ocean interface. Periods of stratification due to saltwater intrusions was documented when the inlet was open in the winter.

2.5.d Nutrients

Nutrient levels (nitrates – N, orthophosphate, ammonia – N) were low and well within standards at all locations for the duration of the study. This is a notable difference from other watersheds draining into the Santa Monica Bay, like Malibu Creek.

One of the questions that arose during the course of the study was how the water quality in the Topanga Creek Watershed compared to that in other watersheds in the Santa Monica Bay. Data collected within the Malibu Creek Watershed by Heal the Bay and the City of Calabasas was compared to that collected in Topanga Creek. At 109 square miles, Malibu Creek is the second largest watershed draining into the Santa Monica Bay. It is far more urbanized than Topanga, and has numerous additional problems from a sewage treatment plant and dam.

Parameters from two locations in Malibu (Cold Creek outlet and Cross Creek near Malibu Lagoon), were compared with Site 6:TC Bridge at MM 2.2 in Topanga in Table 2-5. This site was selected as the reference point for Topanga, since it is the furthest downstream. The Cold Creek location in Malibu is considered to be one of the least impacted areas, while the Cross Creek location just upstream from Malibu Lagoon represents the lowest sampling point in Malibu Creek.

Nitrate levels at both Topanga Creek Site 6 and Malibu Creek - Cold Creek remained consistently below 2 parts per million (PPM). This is in stark contrast to Malibu Creek – Cross Creek located near Malibu Lagoon, which had consistently higher nitrate levels, reaching as high as 13 PPM on several occasions. Levels of ammonia as nitrogen and phosphates were both much lower and more consistent between Topanga Site 6 and Cold Creek. Overall, Topanga Creek has better water quality at its most downstream location than the least impacted site in the Malibu Creek watershed.

Table 2-5 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 Summary For 1999-2000

2.5.e Suspended Sediments

Total suspended solids and turbidity were measured to evaluate the role of fine sediment transport within the watershed. Total suspended solids are of concern due to their potential impact on benthic aquatic organisms. There are no standards in Los Angeles for receiving waters, but the discharge concentration limit is 20-30 mg/l for sewage. Commonly, levels less than 10 mg/l in non-storm conditions are considered desirable. There are many different sources of suspended solids, including physical, chemical and biological. Further evaluation of suspended solids is in progress under a grant to evaluate erosion and sediment delivery, funded by the Santa Monica Bay Restoration Project. Consistently low readings only changed during storm events. Sediment loads appear to be of larger particle size with limited suspension time.

2.5.f Heavy Metals

Concentrations of heavy metals are effected by water hardness, and have varying criteria based on four-day and one-hour concentrations. Using the most stringent objective criteria, Topanga Creek had very low, to non-detectable levels of cadmium, copper, nickel, lead and zinc. The objective criteria for chromium are based on drinking water standards (50 micrograms/liter, ug/l) rather than freshwater aquatic standards. Again, levels were well below the objective limits. Results of sampling for heavy metals on three separate occasions (first flush storm events, and at the end of the rainy season 1999-2001) are summarized in Appendix A.

2.5.g Bacteria

A comparison of the total and fecal coliform, and *E. coli* levels between Site 6, the lowest sampling point in the watershed, and Topanga Beach and Lagoon are presented in Table 1, Appendix A. High bacteria counts at Topanga Beach do not appear to be a result of inputs from the upper watershed. They do appear somewhat related to whether the lagoon entrance is open or closed. Further study is needed to identify sources of bacterial contamination in the lowest reach of the watershed (below Site 6, 2 miles upstream), in the lagoon, and at the beach. A grant proposal has been submitted to identify bacteria sources through DNA fingerprinting, and to begin viral assays to establish a correlation between bacteria levels and pathogenicity.

Although there were several sites in the upper watershed with consistently high bacteria levels, by the time the water moved through the uninhabited, steep, narrow canyon leading down to the bridge located 2 miles upstream from the ocean (Site 6), levels were generally well within primary contact limits at all but three sampling events (storm-related).

2.6 BIOLOGICAL RESOURCES

A multi-year effort to document the status of species diversity and ecological complexity of the Topanga Creek Watershed is underway. The biological inventory information has been collected primarily by the Resource Conservation District of the Santa Monica Mountains and is summarized from the following studies:

- 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.

As the third largest watershed draining into the Santa Monica Bay, Topanga is somewhat unique in that it retains much of the natural vegetation community, numerous wildlife linkages, and relatively good water quality. This is a result of clustered development and the retention of almost 8,000 acres of open space. These factors contribute to the retention of high species diversity and the presence of reproducing populations of numerous sensitive species. For a complete list of sensitive species found in the watershed, see the website at www.TopangaOnline.com.

2.6.a. Flora Composition and Function

Northern mixed chaparral is the dominant vegetation assemblage in the Topanga Creek Watershed, covering almost 7,600 of the 12,800 acres. Due to the varied topography and north-south orientation of the creek channel, there are numerous micro-climates that support a variety of other plant associations. Several state listed communities of concern are found in the watershed, from Southern Walnut Woodland, to Riparian Woodlands. Populations of endangered Santa Monica Dudleya (*Dudleya cymosa ssp. ovatifolia*) cover moist north facing volcanic rock outcrops. Santa Susanna Tarweed *(Hemizonia minthornii)* is also present along exposed ridges.

The integrity of riparian vegetation is critical to the long-term sustainability of Topanga Creek. Identified as one of the most threatened plant communities statewide, the willows, alders, sycamore and bay trees provide extensive bank protection with massive root systems that stabilize the banks and collect silts. Tree canopies are critical to softening effects of storm runoff and providing leaf litter and woody debris essential as habitat and food sources for numerous aquatic species. The diversity of the Topanga riparian community is directly tied to the composition and density of the streamside vegetation.

Threats to the flora of Topanga include the spread of invasive exotics like *Arundo donax*, Cape Ivy, Castor Bean and Yellow Star Thistle, as well as fragmentation resulting from development and fuel modification for fire safety. Table 2-6 lists existing flora.

Table 2-6 Major Floristic Communities in the (Topanga Creek Watershed (Modified Holland Classification, based on 1996 data from NPS)

Floristic Community	Number of Acres
Northern Mixed Chaparral	7,600
Coastal Sage Scrub	1,700
Coast Live Oak Woodland	900
Riparian Woodland	318
Chamise Chaparral	300
Non-native grassland	169
Walnut Woodland	10

2.6.b Macro-Invertebrates

Over 600 species of insects have been reported as potential residents of the Topanga Creek Watershed (Stork, 1992). The first synoptic survey of aquatic macro-invertebrate populations in all the watersheds of the Santa Monica Bay began in spring 2000, coordinated by Heal the Bay, the National Park Service, and the US. Geological Survey. Data has been collected for this study by the Topanga Creek Stream Team according to the Rapid Bio-Assessment Protocol of the CA Department of Fish and Game. This effort will lead to the development of an Index of Biological Integrity for Southern California creeks and streams. Macro-invertebrates are good indicator species, since different species have varying degrees of tolerance and sensitivity to water pollution from nutrient loading, increased temperatures, reduced levels of dissolved oxygen, and sedimentation.

Preliminary results of these surveys indicate that the species diversity and density in Topanga is sufficient to support a wide variety of predators, from fishes to amphibians, reptiles and birds. The aquatic macro-invertebrate species assemblage is dominated by moderately tolerant species that are able to survive the high disturbance regime typical of southern California intermittent streams. In Topanga Creek, nutrient levels, temperatures and dissolved oxygen levels are at beneficial levels for aquatic invertebrates. The most significant limiting factor to species richness appears to be sedimentation patterns. The most dominant species were mayflies, caddisflies and true flies, all of which are important food sources for steelhead trout and other sensitive aquatic amphibians. The most sensitive group of species are the stoneflies, two species of which were present in the Topanga samples. Table 2-7 lists invertebrates.

Table 2-7 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

2.6.c Sensitive Amphibians and Reptiles

A survey conducted by the Southwest Herpetological Society in 1986 revealed that of all the coastal watersheds draining into the Santa Monica Bay, Topanga had the highest diversity of amphibian and reptile species present (7 of 9 possible amphibian species, 16 of 23 possible reptile species). Since spring 2000, a coalition of local groups (National Park Service, U.S.

Geological Survey, CA. Dept. of Parks and Recreation, Heal the Bay, Resource Conservation District of the Santa Monica Mountains, Pepperdine University) have undertaken a more quantitative and systematic approach to documenting species distribution and density. Data in the Topanga Creek Watershed was collected by trained volunteers of the Topanga Creek Stream Team. Results of the spring 2000, 2001, and 2002 surveys indicate that Topanga Creek still retains high population diversity and density.

CA Red legged Frog (*Rana aurora draytonii*) Federal and State Endangered Species

These now endangered species were found in Topanga until the mid –1960's. No sightings have been verified since that time. A remnant population in East Las Virgenes Creek in the upper Malibu Creek Watershed gives hope that perhaps there is some chance for these frogs to recolonize former habitats.

CA Newts (*Taricha torosa torosa*) CA Species of Concern

This species is abundant in the lower main stem of Topanga Creek, and common throughout the rest of the watershed. Considered to be an indicator species due to its sensitivity to poor water quality, the distribution of this species is restricted in other coastal watersheds with less desirable water quality. The high numbers found in Topanga Creek are a strong indicator of the overall health of the watershed.

Western Pond Turtle (*Clemmys marmorata*) CA Species of Concern

Overall, populations of the Western Pond Turtle in the Santa Monica Mountains have been dropping since the 1980's. Several sightings of adults and juveniles in the Old Topanga Canyon drainage were confirmed since 1996. Since then, an informal study has found three additional areas of the watershed with populations of pond turtles. A population density and diversity study is scheduled to begin in spring 2002.

San Diego Mountain Kingsnake (*Lampropeltis zonata pulchra*) CA Species of Concern

Several adults have been documented from throughout the watershed, although sightings are more common in the Old Topanga sub-drainage and in the main stem of lower Topanga Creek.

Two-Striped Garter Snake (*Thamnophis hammondii*) CA Species of Concern

Numerous adults and juveniles were noted during the spring and summer creek surveys, 2000, and 2001. Density is quite high in the main stem of Lower Topanga Creek.

2.6.d Fishes

Several species of native fish have been documented in Topanga Creek in 2000-2002. Arroyo Chub (*Gila orcutti*) are widespread throughout the system, although as far as is known are not native to the creek (Swift, et al. 1993). Both adult and juvenile Steelhead Trout (*Onchorhynchus mykiss*) are found in the lower watershed. Tidewater gobies (*Eucyclogobius newberryi*) were found in Topanga Lagoon, along with larval grunion and staghorn sculpin in June 2001. Most notable is the lack of any exotic fishes. Seining and snorkel surveys throughout the watershed reveal that the only exotic invasive animal found was a small population of crayfish confined to a disturbed reach in the upper watershed. Efforts to eradicate this population is on-going.

The presence of two federally endangered fishes in the Topanga Creek Watershed make restoration of suitable habitat and protection of existing habitat for all life stages of the fishes one of the major priorities for evaluating the effectiveness and benefits of proposed restoration alternative concepts.

Steelhead Trout (*Onchorhynchus mykiss*) Federal and State Endangered Species

Steelhead Trout (anadromous form of Rainbow Trout), spend most of their lives in the ocean where they are known to migrate as far north as Alaska, and then return to coastal creeks where they move upstream to spawn. Unlike salmon, southern steelhead are more opportunistic in their choice of spawning streams, and may not necessarily return to their natal stream. This is thought to be a response to the erratic nature of streams in Southern California coastal watersheds, which have a high degree of variability from year to year. Typically, adult trout will move into the freshwater streams during the winter rains to spawn. Some return immediately to the ocean, while others have been known to remain in the streams through the summer. Adults are known to spawn in multiple years. Juvenile fish seek shelter in boulder pools and may go to sea as early as their first winter. In some cases, the fish will remain in the stream for extended periods of time, like the resident Rainbow trout. Genetic studies indicate that Steelhead and Rainbow Trout are one species, with different lifestyle characteristics.

Females require highly oxygenated gravel beds in which to excavate a depression where she deposits her eggs. More than one male can fertilize the eggs, which are then covered with gravel. These nests are called redds. Deposition of fine sediments can clog the gravel and smother the eggs or developing fry. High temperatures can also be a limiting factor, with mortality of eggs beginning at 56°F (McEwan and Jackson, 1996). Adults are more tolerant of warm temperatures, but become stressed once 70°F is reached. Recording thermometers in two pools inhabited by steelhead during the summer and fall of 2001 indicate that the creek remains well within the preferred temperatures with only a few spikes to 70°F of short duration.

Historically, Topanga Creek was known as a place to catch your limit of Steelhead Trout. CA Department of Fish and Game records indicate that mature adults were found several miles upstream near the town of Topanga until 1980. For several years during the 1970-1980's, rainbow trout were stocked at a local summer camp in a seasonally dammed section of the stream in the upper watershed. No stocking has occurred since 1985. No fish were found again until July 1998, when a single young of the year was seen. Then in April 2000, two adult steelhead were found, and more focused surveys begun. In June 2001, a population of 6 adults and over 100 juveniles was confirmed. It is known that at least 3 adult fish have remained in the system since spring 2000. The April 2002 survye again found over 30 young of the year steelhead, along with over 50 juveniles between 4-8 inches long, and 3 adults.

Presently the NMFS Southern California Steelhead Evolutionarily Significant Unit extends only as far south as Malibu Creek. A petition to extend the listing south to San Mateo Creek in San

Diego County is pending. Therefore, the steelhead trout in Topanga are currently protected only by CA State law, not the federal Endangered Species Act.

Supported by a grant from the CA Dept. of Fish and Game, a study of instream habitat conditions, migration patterns, spawning, rearing, and residential use of Topanga Creek by steelhead is underway. Results of the summer instream habitat survey were used in this report to help evaluate the potential benefits associated with the proposed restoration actions throughout the watershed.

Restoring habitat for Steelhead Trout is a major goal of the restoration efforts in the Topanga Creek Watershed. Steelhead are sensitive to poor water quality, excessive sedimentation and barriers to passage throughout the creek system. As such, they can serve as a keystone species useful in gaging the overall health of the watershed. Restoring habitat in Topanga Lagoon will provide a direct benefit to juveniles as both a nursery area and transition zone allowing them to acclimatize to more saline ocean conditions. Increased opportunities for migration both up and downstream could be obtained by implementing both the lagoon and upstream streambank restorations proposed. It is a goal of the Topanga Creek Watershed Management Plan to enhance and protect the steelhead, knowing that sustaining this sensitive species means that other associated sensitive aquatic resources will be protected as well.

Tidewater Gobies (*Eucyclogobius newberryi*) Federal and State Endangered Species

Tidewater gobies were documented in Topanga Lagoon in the 1920's and subsequently disappeared. Surveys since the 1970's have failed to find Tidewater Gobies in Topanga Lagoon until June 2001, when a population of several hundred was discovered. It is thought that colonization was possible since the reintroduction and reestablishment of the population in the early 1990's at Malibu Lagoon, located approximately 9 km upcoast from Topanga. Specimens were collected and DNA analysis is in progress to establish genetic relationships, which would help identify the source of this new population.

Tidewater Gobies are native to lagoons and coastal brackish marshes having low salinity and minimal wave action (Swift et al., 1989). Spawning takes place throughout the spring and summer, with males excavating and caring for eggs laid in burrows in soft sediments and sands. The fish can spawn several times, but generally live for only 1 year. Adult fish take refuge upstream in protected pools during the winter months.

Restoration efforts proposed for the Topanga Lagoon will potentially enhance habitat for the gobies and support the continued establishment of this population.

2.6.e Birds

During the past 30 years, volunteer birders in the Topanga Creek watershed have documented the presence over 200 species of birds, with confirmed nesting by 35 species. Raptors like the Cooper's Hawk and Red Shouldered Hawk are common in Topanga, but are less common regionally. Thanks to diverse and relatively large areas of protected open space, Topanga is an important migratory stop for passerines in the upper watershed. Belted Kingfishers, Snowy Egrets and Great Blue Herons have all been seen regularly along the creek throughout lower

Topanga. Nesting is confirmed only for the Belted Kingfisher. These three species in particular are possible predators of arroyo chub and juvenile steelhead trout.

Bird surveys of Topanga Lagoon have not been regularly conducted. Commonly, Western and California Gulls are seen resting and bathing in the lagoon. Coots and mallards are regular visitors. No nesting locations have been identified near the lagoon. Brown Pelicans are seen foraging off the beach.

2.6.f Mammals

Records indicate that over 59 species of mammals have been seen in the Topanga Creek Watershed (Stork, 1992). Top level predators like mountain lions, bobcats, ringtail cats and badgers are consistently seen. At least four species of bats, including the Western Mastiff Bat (CA Species of Concern) are also found in the watershed. Linkages between Topanga State Park and other adjacent watersheds have been compromised by development. However, despite the fragmentation, wildlife movement still occurs. As the surrounding lands are ultimately developed, the concern is that the open space in Topanga will become more isolated and may not be large enough to support high level predators with large territories, like the mountain lion.

2.6.g Potential Limiting Factors for Steelhead Trout

The present conditions in Topanga Creek are able to support a small population of steelhead trout, but several key factors limit further utilization by the fish. First, the status of the regional southern steelhead population is not clear, although it is clearly endangered. A combination of impacts due to climatic conditions, ocean current changes, decline of their main ocean food source, northern anchovies, as well as limited access to historic spawning areas appear to have decimated the population south of Ventura. The larger river systems (Ventura, Santa Clara, etc.) are considered to host the larger "source" populations, and smaller creeks like Malibu and Topanga are "sinks" for opportunistic use based on climatic conditions. Therefore, there may be only a few mature trout left in the Santa Monica Bay region. Any adults recruited to the population from Topanga or Malibu thus represents a significant contribution. It could be that with the loss of habitat in the larger systems, small coastal creeks in fact function as "source" populations.

In Topanga specifically, there are several possible limiting factors for the fish. First, due to it's small size and narrow channel, opportunities to enter and exit the creek at Topanga Lagoon may be limited to a few events seasonally when flow conditions are suitable. Second, as the fish move upstream there are a series of four landslides which have dammed the channel, again impeding both up and downstream migration opportunities. At two locations, natural bedrock ledges create barriers to passage during low flow conditions. A 12 foot chute created by two enormous boulders restricts passage into the upper watershed. During the low flow conditions in summer and fall, several sections of the lower creek dry out, completely restricting movement towards the lagoon.

The last important factor to consider is the limited availability of suitable spawning gravels due to sedimentation from both upstream sources and the landslides. The Summer 2001 instream habitat survey of 5800 meters of Topanga Creek found that steelhead are currently utilizing only 2100 meters (36%) of the creek upstream of Topanga Lagoon. Using CDFG records as a basis, it is estimated that the fish formerly were able to utilize the whole creek from the coast to the town of Topanga, at least until 1980. The proposed restoration actions could significantly increase the available suitable fish habitat.

2.7 LAND USE

Topanga Creek Watershed encompasses 18 square miles (12,800 acres) within unincorporated Los Angeles County. Land use is governed by the Los Angeles County General Plan, the Santa Monica Mountains North Area Plan and the Malibu Local Coastal Plan (which is currently under revision). Most parcels in Topanga are under 40 acres and regulated by Hillside Management Criteria which restricts square footage according to the slope of the property.

Of the 12,800 acres in the Topanga Watershed, almost 8,000 acres are dedicated public open space. The remaining 4,800 acres are privately held. Existing development of approximately 1,718 acres includes: two residential sub-divisions; and a mobile home park at the northern end of the watershed; three small commercial areas (under 20 acres each) along Topanga Canyon Blvd.; a strip of commercial development along Pacific Coast Highway; and approximately 3,000 single family residences located in areas of historic small lot sub-divisions or on private lots throughout the canyon. It is anticipated that future development will be the continued incremental construction of single family homes on existing undeveloped lots.

2.7.a Public Ownership

The largest landowner in the Topanga Creek Watershed is the CA Department of Parks and Recreation. Topanga State Park extends from the upper watershed of Topanga to the beach, covering 5,628 acres, primarily in the eastern section of the watershed.

The newly acquired 1,640 acre Lower Topanga State Park land formerly belonged to the LA Athletic Club, and contains approximately 49 residential rentals and 11 commercial businesses. The Draft Lower Topanga Interim Plan indicates that the majority of the residences will be removed, and the future of the businesses will depend on the final lagoon restoration configuration, preservation of designated historic structures, and a master plan for recreational use identified by State Parks.

Topanga Beach is currently owned and managed by Los Angeles County Beaches and Harbors. Numerous other open space areas are owned and managed by the Santa Monica Mountains Conservancy (1,311 acres), the National Park Service (224 acres) and the Mountains Restoration Trust (402 acres).

2.7.b Private Ownership

Approximately 4,800 acres of the Topanga Creek Watershed are privately owned, with the majority of parcels consisting of less than a half acre within historic small lot subdivisions. Development in Topanga began with resident Gabrielino Indians, who had several large communities throughout the upper watershed, although they freely used all resources, from the ocean to the mountains. During the early 1800's several parts of Topanga were included in Mexican land grants. From 1852, when California became a state, until the 1930's, development in Topanga was minimal, restricted to several ranches, small cabins, resorts and a few stage coach stops. Until 1960, the population of Topanga was under 3,000, reaching almost 12,000 by of the year 2000. The majority of homes were built between 1970 and the present, with a surge of growth in the mid 1980's.

2.7.c Projected Growth

Of the 4,800 acres of privately held land in Topanga, development has already taken place on the majority of parcels which meet standards for septic system installation (approximately 1,718 acres). The remaining undeveloped land is primarily confined to steep slopes or sites with access problems. With the adoption of the Santa Monica Mountains North Area Plan in 2000, which designates land use in the upper watershed outside the coastal zone, projected development of the area outside the Coastal Zone is expected to be restricted to single family homes. No new commercial development is expected within the watershed. The Local Coastal Plan revision process is on-going, but it is not expected that the zoning for the portion of Topanga within the Coastal Zone will change substantially, and may in fact become more restrictive. Therefore, the majority of development possible in the Topanga Creek Watershed has already occurred.

Potential growth impacts are related more to traffic concerns than to land use. State Highway 27 (Topanga Canyon Blvd.), is a major commuter connector route between the San Fernando Valley and the coast. As population growth in the region continues, levels of traffic use of Topanga Canyon Blvd., are expected to increase. Road runoff and impacts associated with road maintenance are a major concern. Caltrans has an Environmental Corridor Study in progress, which is expected to identify sensitive resources within the Caltrans corridor and delineate Best Management Practices to mitigate future impacts.

3.0 UPPER AND CENTRAL WATERSHED PROPOSED RESTORATION SITES

Watersheds function as complicated, integrated entities, with all factors contributing to the ultimate health and sustainability of physical, chemical and biological processes. The goal of the Feasibility Study was to try and integrate these parameters so that impacts associated with changes to the creek morphology throughout the watershed could be better understood. Field visits and data analysis indicate that the most pressing overall problem in the watershed is encroachment with fill into the creek generating increased flood flow velocities that cause scouring, undermining, and landsliding, to yield more sediment than the creek can deliver. With that in mind, it still became clear that the Topanga Creek Watershed is functionally divided geomorphologically into upper and lower portions, each having different characteristics.

The upper zone of the Topanga Creek Watershed extends from the ridgelines to an elevation of approximately 700' where the confluence of the main stem of Topanga Creek merges with Old Topanga Creek. The town of Topanga is situated at this junction. Downstream of this confluence, the topography steepens significantly, and there is no development other than Topanga Canyon Blvd. within the narrow canyon until it reaches the floodplain near the ocean.

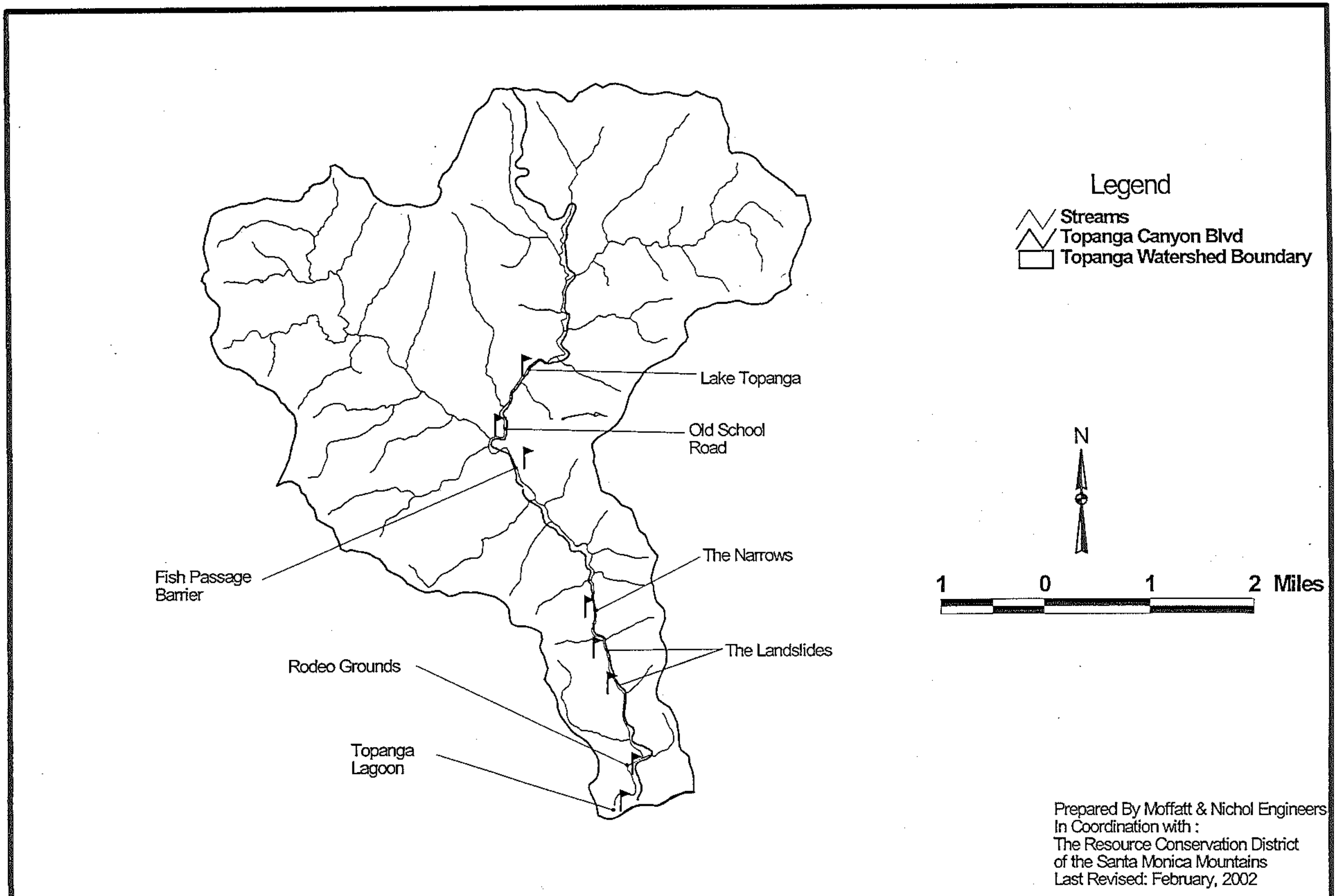
Potential restoration sites identified in the upper watershed were limited due to combined public and private ownership issues, with only two problem areas assessed in this study. Both sites (Lake Topanga and Topanga School Rd.) have streambank stabilization issues, are significant flood hazards, are potential public safety hazards, and offer opportunities for restoring creek habitat.

Within the lower main canyon, the location of restoration sites is primarily related to road maintenance. The velocity of flow through the area called the "Narrows" is significant, and undermining of the road bank is chronic. The existing grouted rip rap bank is severely undermined and unstable, presenting a critical public safety hazard. Several landslides have developed as a result of encroachments of the road into the creek channel. Topanga Canyon Blvd. is used by between 14,000 and 30,000 vehicles each day, and provides the major emergency access route for the community of Topanga. Protecting the integrity of the road by implementing bank stabilization restoration that serves to both upgrade the currently compromised bank protection and restore creek habitat within the State Park should be a major priority.

Unrelated to the road but still worthy of consideration, is the removal or reduction of two successive barriers to fish migration upstream of the narrows. Two separate barriers made of 20-foot-high (relative to the stream bed) large boulders occur within a short distance of each other in the upper creek, just below the town. They completely block fish passage. The rocks could be blasted and fractured or dislodged to allow for continued fish passage.

The locations of these sites can be found in Figure 3-1. The summary of current conditions and potential solutions that follow are focused on achieving the following goals:

- reduce flood hazard;
- improve water quality at Topanga Beach; and
- improve or preserve sensitive resources, especially habitat for endangered steelhead trout and tidewater gobies



Topanga Creek Watershed And Lagoon Restoration Feasibility Study

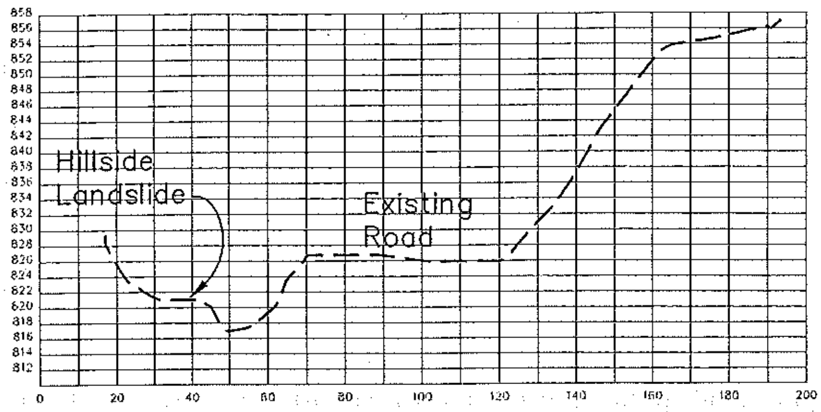
RESTORATION SITES IN THE TOPANGA WATERSHED

Figure 3-1

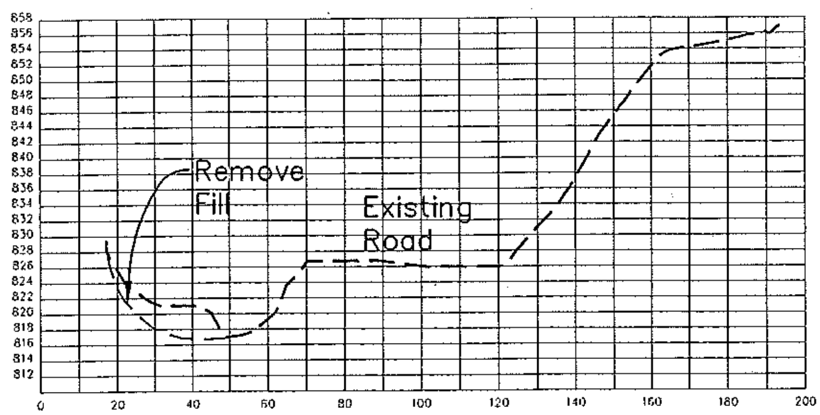
3.1 Upper Watershed: Lake Topanga Site

Problem description: A significant landslide located in the 700 block of N. Topanga Canyon Blvd. Was activated in 1994 by the possible combined impacts of illegal grading at the top of the slope and the Northridge Earthquake. A slug of loose sediments broke loose from the west bank and blocked the creek channel, causing flooding on Topanga Canyon Blvd. Eventually, some of the materials were excavated from the channel, but the site is still unstable and continuously threatened during flood events. This location is on a blind curve, causing a major public safety problem when the roadway is impacted by flood waters.

Proposed solution: The landslide is impinging significantly into the floodway of the creek. The creek cross-section is constricted to only a portion of its initial area. The landslide deposit should be cleared entirely from the creek floodway to restore it to its former cross-sectional area prior to the landslide. The landslide should concurrently be stabilized as required to prevent further sliding, and any future landslide deposits should be cleared from the floodway immediately. Figure 3-2 shows existing and proposed conditions. This will significantly improve public safety by reducing flood hazard in this section of Topanga Canyon Blvd.



Existing
Cross–Section
Horiz. Scale: 1'=50'
Vert. Scale: 1"=25'



Proposed
Cross–Section
Horiz. Scale: 1'=50'
Vert. Scale: 1"=25'

Prepared by: Moffatt & Nichol Engineers
April, 2002

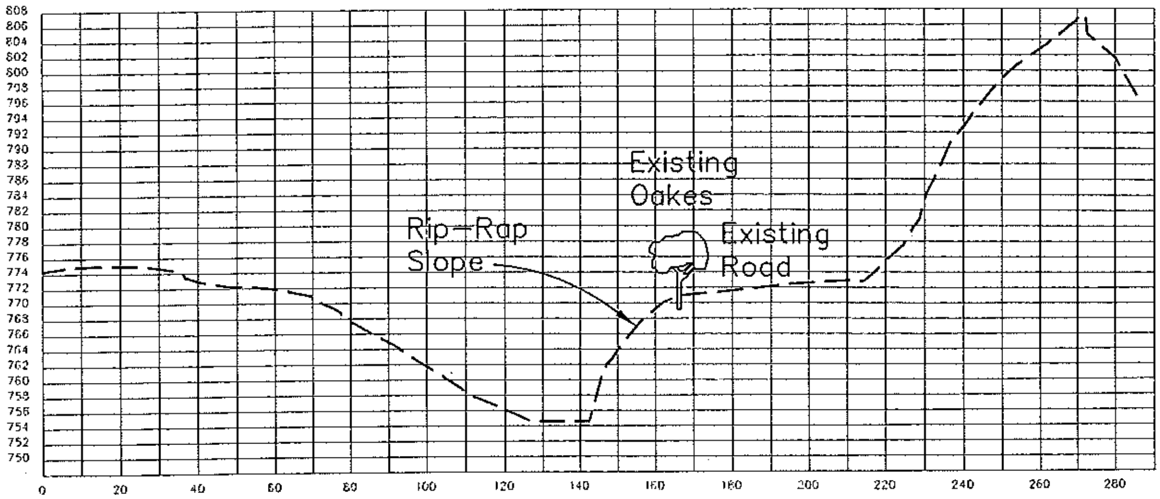
Topanga Creek Watershed And Lagoon Restoration Feasibility Study	LAKE TOPANGA EXISTING AND PROPOSED LOOKING UPSTREAM	FIGURE 3-2

3.2 Upper Watershed: Topanga School Road Site

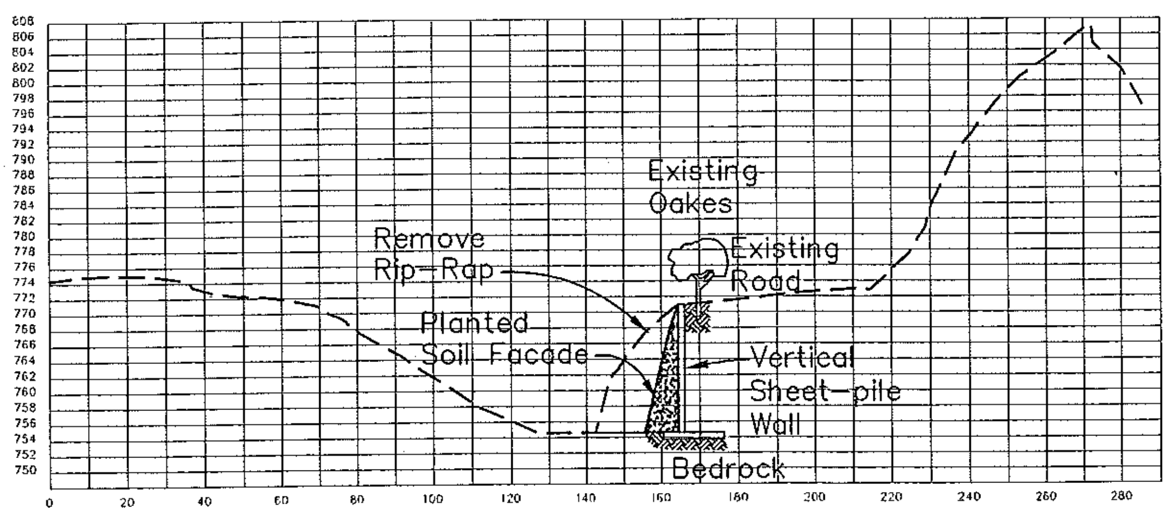
Problem description: The east (outer) bank of the creek at a meander is continuously subjected to high velocity flows during flood events which have repeatedly cause the bank to fail. Highway 27 is placed on fill along this outer bank. Caltrans repairs the bank as needed to protect the highway. The latest repair (completed in 1995 under emergency conditions) is composed of a grouted riprap wall along the upstream portion of the bank (placed to try and preserve the last remaining mature Coast Live Oak tree) and a vertical stone wall founded above bedrock in soft creek bed materials in the creek meander. The vertical wall section is presently being undermined. Two other oak trees were lost when the bank failed previously. The west bank is privately owned and covered with mature willow and sycamore trees. A large clump of *Arundo donax* formerly encroached into the channel on the southeast side of the Los Angeles County bridge. The present riprap bank protection occupies a significant portion of the creek cross-section. Topanga School Rd. is the only vehicle access to Topanga Elementary School. Threats to the integrity of the bridge, and the southbound lane of Topanga Canyon Blvd. pose a significant threat to the safety of the children going to and from school, as well as to the general traveling public.

Proposed solution: The solution to this problem involves two steps. One step is increasing the cross-sectional area of the creek just upstream of the meander by removing the riprap bank protection and installing a vertical wall driven into bedrock for the foundation. The wall concept would enlarge the creek cross-section downstream of the bridge and just upstream of the meander. Flood flow velocities will decline through the larger section. The other step is to replace the existing downstream vertical wall section with a new wall driven into bedrock to prevent undermining. A new vertical wall can essentially be extended from the bridge upstream of the meander all the way through the meander along the outer bank. It can be placed in the desired position to preserve sensitive trees. Then a thin soil façade can be placed in front of the new vertical wall and planted with native vegetation to restore habitat and improve aesthetics. The façade will only be temporary and will need to be repaired and/or replaced periodically in response to damage from flooding. Figure 3-3 shows the concept.

This solution will improve public safety by correcting the existing threat of flooding and undermining of the stability of Topanga Canyon Blvd. and the bridge under Topanga School Road.



Existing
Cross-Section
Horiz. Scale: 1'=50'
Vert. Scale: 1"=25'



Proposed
Cross-Section
Horiz. Scale: 1'=50'
Vert. Scale: 1"=25'

Prepared by: Moffatt & Nichol Engineers
Feb 2002

Topanga Creek Watershed And Lagoon Restoration Feasibility Study	TOPANGA SCHOOL ROAD RESTORATION CONCEPT	FIGURE 3-3

3.3 Main Stem: Caltrans Riprap Wall at the "Narrows" (Milemarker 2.3)

Problem description: The canyon is steep and quite narrow at this location, causing extremely high velocity flood events. Topanga Canyon Boulevard is placed on fill and elevated above the creek, and the fill occupies approximately one-half of the creek cross-section. Road failures at this location are chronic, with major repairs needed during the winters of 1980, 1993, and 1995. Each repair has been done by placing more rock along the bank in the cross-section, further constraining the creek and exacerbating the problem of high flow velocities and undermining. The grouted riprap bank is presently undermined by approximately six to eight feet, and appears prone to collapse in the not-too-distant future. The creek bed is nearly solid bedrock and the east bank is a near vertical wall of exposed rock. Due to the presence of several cold water springs entering the creek along the west bank, this reach is prime habitat for both adult and juvenile steelhead trout. These springs are also a major factor causing the failure and undermining of the riprap wall. Retaining the sole remaining sycamore tree and enhancing the canopy cover on the west bank is a priority. Figure 3-4 shows one section of the Narrows, and Figure 3-5 shows a solution.

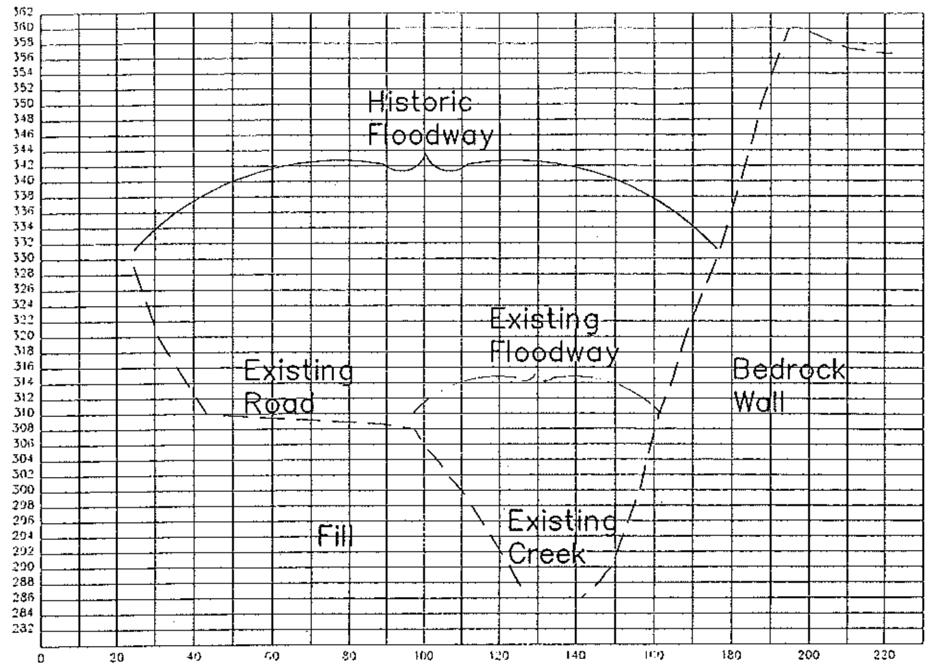
Proposed solution: The roadway fill should be substantially removed to restore the historic cross-sectional area to the creek. The highway may need to be supported on piles along this entire reach to allow the creek to flow under it. A pile-supported highway section, anchored to the west bank as appropriate is the concept solution. This strategy has been used very successfully in Glenwood Canyon, Colorado where I-70 is elevated for approximately 12.6 miles. Rather than incur repeated emergency repairs, which are expensive and short lived, this type of design would provide long term protection for that part of Topanga Canyon Blvd. preserving access between the coast and the valley. Use of this type of design may also be able to provide a dedicated bikeway and possible viewing areas for travelers through the State Park. It is anticipated that a well designed solution can substantially reduce emergency costs and provide substantial protection of public safety, as well as increase and improve habitat for endangered steelhead trout. Due to the extreme sensitivity of the habitat and the imminent failure of the undermined roadbed, implementation of restoration at this location is an extremely high priority.

Both Caltrans and State Parks have committed to exploring further design options to solve this chronic problem site. Funding for the next steps of this project have been provided by the Santa Monica Bay Restoration Project. Members of the Technical and Landowners Advisory Committee will develop the Request for Proposals and contract out this work within 2002.

Topanga Creek Watershed And Lagoon Restoration Feasibility Study

THE NARROWS LOOKING UPSTREAM

Figure 3-4

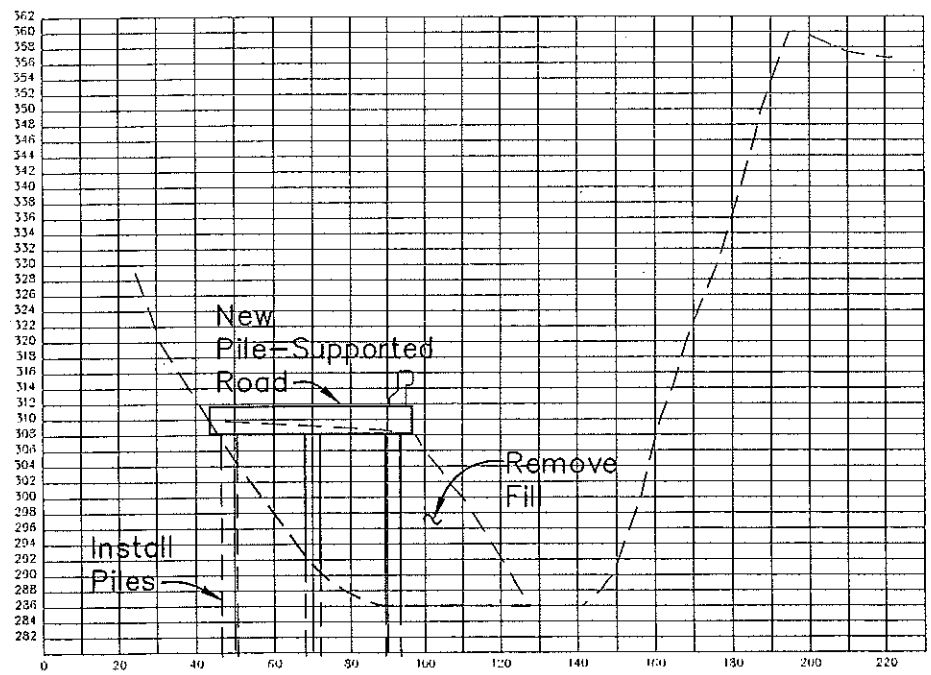


Existing Cross-Section

Horiz. Scale: 1'=50'

Vert. Scale: 1"=25'

Note:
Profile Looking Upstream



Proposed Cross-Section

Horiz. Scale: 1'=50'

Vert. Scale: 1"=25'

Topanga Creek Watershed And Lagoon Restoration Feasibility Study	THE NARROWS EXISTING AND PROPOSED	FIGURE 3-5

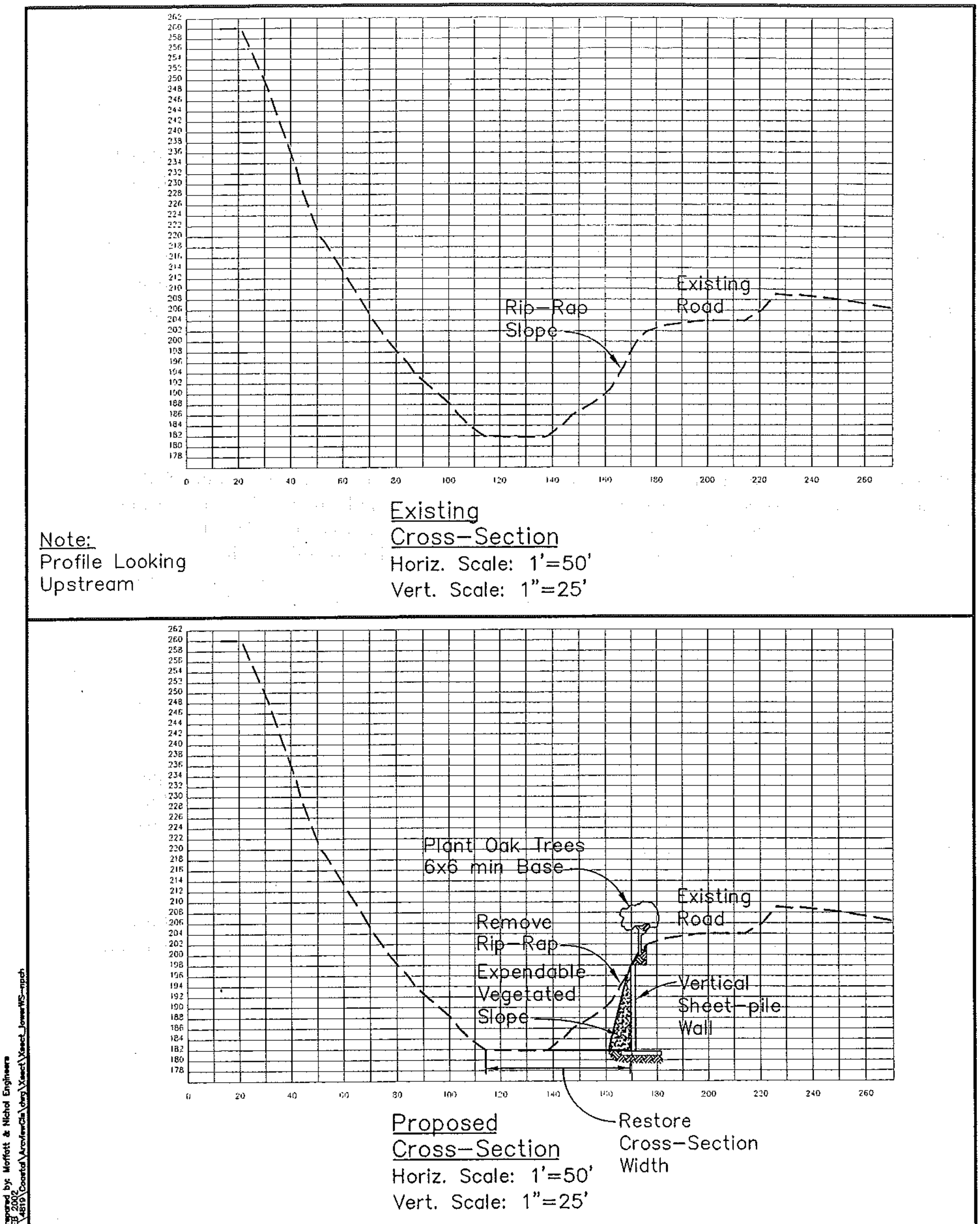
3.4 Main Stem: Landslides

Problem description: Four landslides have occurred along the reach of the creek immediately downstream of the bridge at milemarker 2.2. The landslides are likely caused by the two factors. First, high velocity flood flows exit the "Narrows" and pass into a meander just downstream of the bridge. The high velocity flows are directed along the outer bank of the meander undermining the canyon wall, causing the first landslide. Second, riprap bank protection along the highway downstream of the bridge has been placed within the floodway, significantly constraining the creek cross-section. The constrained creek erodes its banks and bed in response, and the bank opposite from the roadway collapses. The bank along the road is continually fortified by uncontrolled dumping of additional riprap as repair. Review of highway right-of-way (ROW) maps along this reach indicates that substantial filling by Caltrans has occurred outside of ROW within the creek channel, in some locations to over 100 feet. The landslides are all located just downstream of these encroachments.

Proposed solution: The first landslide downstream of the Narrows will be stabilized if the "Narrows" is reconstructed and widened. No further action would be required. The remaining landslides can be mitigated by removing the existing riprap and fill placed outside of the Caltrans ROW from the creek. The riprap can then be used along sections of this reach to rebuild an engineered bank that is steep enough to remain within the ROW and strong enough to withstand forces from flooding. It may also be possible to integrate willow and alder cuttings to restore canopy to this side of the creek. The toe of the landslide on the wet bank can be protected and stabilized using bio-engineered treatments, including revegetation with willows and alders. This will substantially increase the habitat quality, as well as reduce sedimentation and further slope failure. Removal of exotic invasive vegetation along the road shoulder and replacement with appropriate natives is also envisioned.

An engineered bank, possibly buried beneath a soil façade with native plantings should protect most sections of this reach. Certain sections, however, appear wide enough to not warrant use of hard structures for protection. In these instances, native plantings along the stream bank would be sufficient for reasonable bank protection. Other sections of this reach are so narrow as to require a vertical wall for protection.

Restoring channel capacity will reduce the undermining of Topanga Canyon Blvd., significantly reduce the need for emergency repairs and increase safety of the traveling public. Figure 3-6 shows the existing conditions and proposed conceptual solutions.



Topanga Creek Watershed And Lagoon Restoration Feasibility Study

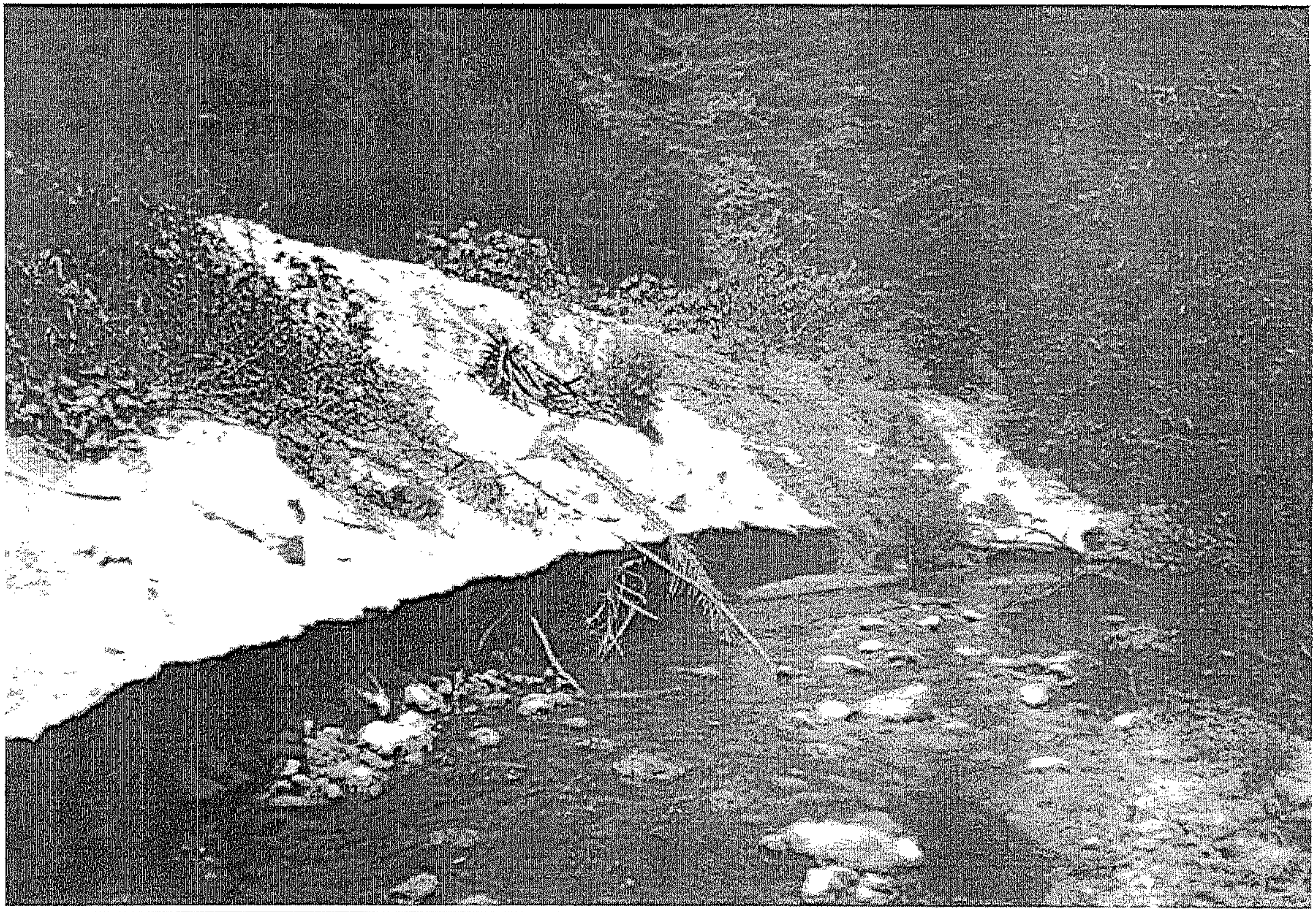
TYPICAL LANDSLIDE EXISTING AND PROPOSED

FIGURE 3-6

3.5 Concrete Levee at the Rodeo Grounds

Problem description: Following the 1980 flood, tenants filled the creek and constructed a concrete covered levee 25 feet wide, 20 feet high and over 200 feet long along a meander within the floodplain to protect their homes from flooding. The un-permitted levee encroaches significantly into the creek floodway and constrains the cross-section. As a result, the creek has eroded its bed and is actively undermining the concrete bank, threatening it with failure as shown in Figure 3-7. It has also redirected the main thalweg eastward, destabilizing that bank and completely disrupting the natural floodplain condition.

Proposed solution: The levee should be removed if the residences are removed. The creek cross-section would then be significantly enlarged to restore the historic floodway at this location. From historic topographic maps, the meander appears to have originally been at the location of the homes. Removal of the levee should be done during late summer or early fall, when potential for disturbing local amphibians or fishes is minimized. Concurrently, the stands of *Arundo donax* that have overtaken the native willows in that area should be mechanically removed.



Topanga Creek Watershed And Lagoon Restoration Feasibility Study

EXISTING RODEO GROUNDS LEVEE LOOKING UPSTREAM

Figure 3-7

4.0 TOPANGA LAGOON RESTORATION ALTERNATIVES ANALYSIS

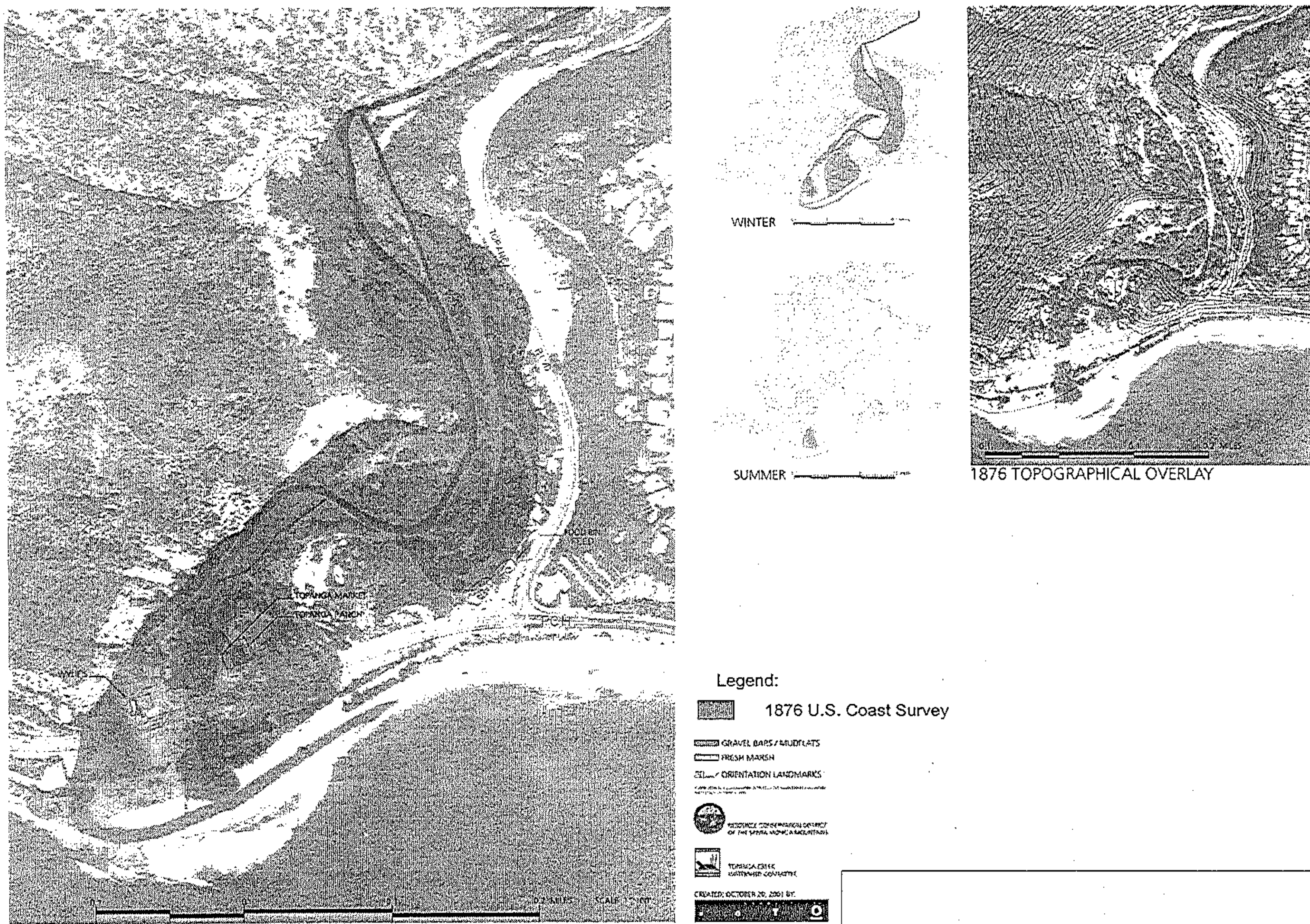
A major focus of the Feasibility Study was to evaluate the opportunity for restoring the historic Topanga Lagoon. The US Coast Survey Map of 1876 illustrates the extent of the lagoon prior to human impacts as shown in Figure 4-1. The canyon mouth was unconstrained by roads or fill, and provided almost 30 acres of seasonally and tidally inundated wetlands. The lagoon was substantial enough that the LA Athletic Club purchased the property in 1924 with the intention of creating a small yacht harbor. The first changes to the Lagoon occurred with the installation of Pacific Coast Highway bridge in 1924, rerouting traffic from the original small bridge crossing further upstream. The original bridge span was over 240 feet long and the function of the lagoon remained essentially unchanged. Figure 4-2 shows the bridge in 1926. Then in 1934, Caltrans decided to realign the highway inland, filling in all but 2 acres of the former lagoon with over 800,000 cubic feet of material cut from local hillsides. This buried the former lagoon under almost 35 feet of fill.

The present creek cross-section under the bridge is approximately one-half the size of the former creek cross-section. The existing bridge, constructed in 1934 simultaneous with placement of the fill, is 82 feet long and its opening is approximately 80 feet wide by 20 feet high for a cross-sectional area of 1,600 square feet. The former bridge constructed in 1924 was 240 feet long and 15 feet high for a cross-section of 3,600 square feet.

The constraints of high fill banks and a narrow creek cross-section under PCH bridge impede flood conveyance sufficiently to cause backwater of the flood and consequent sedimentation within the creek channel upstream of the bridge. Floodwaters are forced through a narrow gorge constrained by the fill pads and squeeze under a low and short bridge. Flood flow velocities and water elevations are therefore extremely high. In addition, the channel cross-section under the bridge becomes blocked by large debris during floods to exacerbate the condition, resulting in ponding of backwater upstream of the bridge. Figure 4-3 shows the existing lagoon and bridge configuration.

The alternative concepts presented herein address the downstream bridge and fill constraints at the lagoon. The 1876 US Coast Survey lagoon map is used as the optimal reference for restoring the lagoon to the maximum extent possible. Alternative concepts 1, 2, 3 and 4 were analyzed for their performance according to various criteria using numerical and analytical modeling. Criteria include flood conveyance, sediment transport, lagoon inlet conditions, water quality, biology, recreation, and relative costs for construction and maintenance.

Modeling methods, data and parameters are described in Appendix C. For the purposes of analyzing lagoon alternatives for this study, it is assumed that improvements identified in Section



Topanga Creek Watershed And Lagoon Restoration Feasibility Study

TOPANGA BEACH AND LAGOON: 1876 AND 1997

Figure 4-1

Topanga Creek Watershed And Lagoon Watershed Restoration Feasibility Study

TOPANGA LOWER WATERSHED AND LAGOON (Lower Left) IN 1926

Figure 4-2

Topanga Creek Watershed And Lagoon Restoration Feasibility Study

EXISTING TOPANGA LAGOON IN 1997

Figure 4-3

3.0 of this report are implemented upstream. The exception is for sediment transport modeling of the existing conditions. Due to changes in sediment imput, no upstream improvements were considered because the model became unstable and failed. A comparison matrix of all alternative concepts is presented in Table 4-1 at the end of this section.

Flood hydraulics were assessed for each alternative for conditions representative of the highest flood on record that occurred in 1980. The objective is to identify whether conditions would be severe enough to threaten existing structures and damage habitat. The long-term inlet condition will likely not change significantly for any of the alternatives. A temporarily enlarged inlet may form during severe floods, but the inlet will revert to its existing condition shortly after floods recede.

Water quality was analyzed using existing data recorded by the RCDSMM and assumed that future conditions of contaminant inputs to the lagoon remain the same as existing conditions. Contaminant concentrations for each lagoon alternative were estimated based on increased dilution resulting from larger water volumes within the larger lagoons.

Sediment transport and yield were estimated by replicating flows and estimated sediment yield during the last four and one-half years of recorded data, and predicting sediment transport and deposition for each of the lagoon alternatives.

This section of the report also presents relative information concerning costs for each alternative. Restoration costs include those for construction, operation and maintenance. While restoration costs may be relatively high for this site, the economic benefits provided by restoration should be greater. The economic benefits of wetland restoration include sensitive habitat restoration, shoreline enhancement, filtration of stormwater runoff and improved water quality, reduced flood hazard to Pacific Coast Highway, and increased attraction for public visitors. The aesthetic and recreational values of wetlands and beaches generate millions of dollars of revenue each year from visitors (King, 1999). Also, numerous commercially valuable fish species, plus endangered fishes rely on wetlands as nurseries for their young. Migratory birds rely upon wetlands along the Pacific Coast flyway for food and shelter along their yearly journeys. Although the scope and budget for this study was not sufficient to consider them, the values of these real economic benefits should be considered when evaluating the cost of restoration.

Further, this opportunity to restore a coastal wetland in Los Angeles County is extraordinary, given the immense pressure of urbanization, which has already destroyed over 95% of these resources. At this point in time, the Topanga Lagoon represents one of the few areas left where restoration could even be considered. The results of the Feasibility Study indicate that the present and future conditions within the Topanga Creek Watershed are suitable to support restoration and will benefit from the action. With the inclusion of the former LA Athletic Club property into Topanga State Park, the entire extent of the former lagoon is now in public ownership. This offers a unique chance to develop a more functional lagoon system providing improved water quality at Topanga Beach, improved habitat for endangered fishes and birds, and improved recreational opportunities while retaining the quality of the surf break at the point.

TABLE 4-1
Summary of Topanga Lagoon Restoration Alternatives
Reference Conditions: 1876 Lagoon and Floodplain = 30 acres

Criteria	Alternative 1	Alternative Concept 2	Alternative Concept 3	Alternative Concept 4
Restoration Footprint	0.0 acres	8.0	10.5	15.5
Lagoon Size (water level +6 feet MSL))	2.2 acres	4.0 acres	6.0 acres	8.0 acres
Lagoon Tidal Volume	80,000 cf	322,200 cf	617,500 cf	940,760 cf
1980 Storm Peak Flood Vel. at PCH Bridge	17 fps	12.8 fps	7.6 fps	4.9 fps
Water Surface Elev. (no debris PCH Bridge)	10.9 ft	11.6 ft	6.5 ft	6.0 ft
Bridge Span	82 ft	82 ft	340 ft	490 ft
Storm Intensity to Open Lagoon	Less than 1 Year Storm	Less than 1 Year Storm	Less than 1 Year Storm	Less than 1 Year Storm
Upstream Backwater Effect?	Yes, significant	Yes, significant	Minor	None
Probable Debris Problem at PCH Bridge	Yes	Yes	Minor	Least
Sedimentation Problem Upstream PCH Bridge	Yes	Yes	Significantly Reduced	None
Total Coliform	290,000 MPN/100 ml	69,000 MPN/100 ml	36,000 MPN/100 ml	24,000 MPN/100 ml
Fecal Coliform	2,100 MPN/100 ml	500 MPN/100 ml	260 MPN/100 ml	170 MPN/100 ml
Average Water Depth	2.44 ft	2.43 ft	2.63 ft	2.70 ft
Average Water Temperature	18.6 degrees C	Same	Same	Same
Average Dissolved Oxygen Level	12.8 mg/l	Same	Same	Same
Average Salinity	3.0 ppt	Same	Same (larger brackish area)	Same (largest brackish area)
Storm Exceeding Fish Passage Velocity	Est. 5 to 7 year return interval	Est. 10 year return interval	Est. 50 year return interval	Est. 100+ year return interval
Days Required to for Mouth to Close	14	Slightly More	Slightly More	Most
Fish Habitat Area (up to mean sea level)	0.5 acres	1.3 acres	2.7 acres	4.0 acres
Ocean Water Quality	Same, as adjacent septic systems stay in place	Same, as adjacent septic systems stay in place	Improved due to fewer septic systems	Most improved due to fewest septic systems
Optimal Steelhead Conditions	Passage restricted to falling stage of storms, limited habitat, least transitional area	Same, slightly more habitat area	Improved passage opportunities, habitat and transitional areas	Most improved passage opportunities, habitat and transitional areas
Optimal Goby Conditions	Limited habitat area, intense flows wash fish to sea	Same, slightly more habitat area	Improved habitat area, reduced flows prevent outwash	Most improved habitat and flow conditions
Vegetation Restoration for Filtration and Habitat Improvement	Limited to Removal of Invasives	Small wetland restoration possible with minimal upland	Larger wetland restoration possible, upland restricted on east side	Most wetland restoration possible, upland transition zones on all sides
Parking Area Available	35,000 square feet	35,000 square feet	35,000 square feet	17,500 square feet

*Note: Assumes open lagoon. State Standards are 10,000 for total coliform and 400 for fecal coliform

4.1 ALTERNATIVE CONCEPT 1 - NO PROJECT – EXISTING CONDITION REMAINS

4.1.a Hydraulics/Hydrology

Alternative concept 1 is the existing lagoon with upstream improvements in place as shown in Figure 4-4. Existing lagoon and PCH bridge conditions severely limit flood conveyance to the sea. Severe flood flow velocities modeled reach approximately 17 feet per second and water surface elevations reach approximately 11 feet above MSL, without the effects of debris damming under the bridge considered. Damage could be caused to the bridge and adjacent structures under these conditions. Conditions are worse with debris damming occurring.

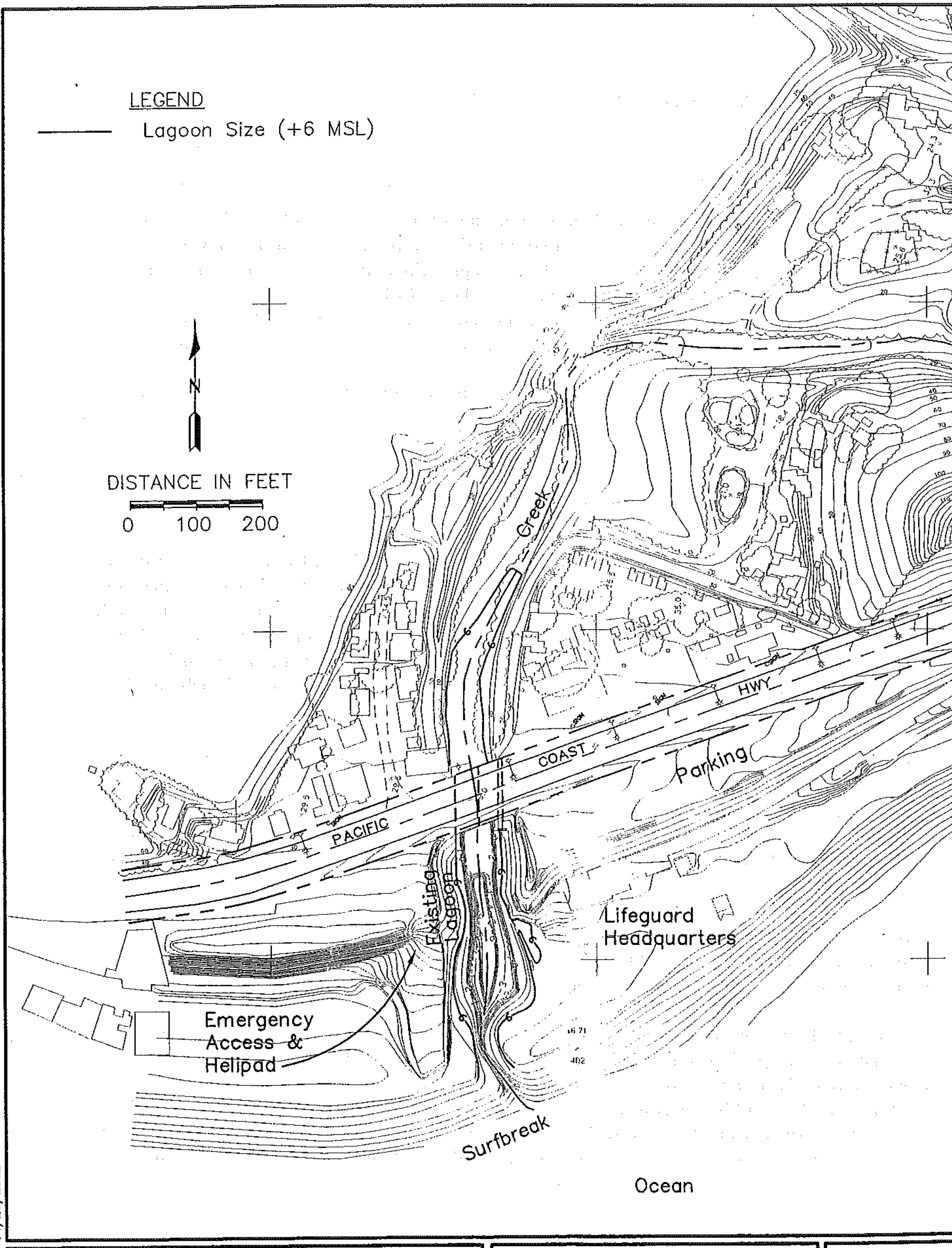
Flow velocities are too high to allow adult steelhead trout to migrate upstream during the peak of flood events. Flows are essentially bank to bank, occupying the entire floodplain. Migration opportunities for steelhead trout appear limited to a few days each year, on the falling edge of the storms, when flows through the bridge are suitable.

4.1.b Sediment Transport

Quantitative and qualitative analysis indicates that severe floods will experience a backwater effect from the small bridge cross-section constricting flows. A backwater effect is exaggerated pooling upstream of a channel constriction, a decrease in flow velocities and "backing up" of the flood. Sedimentation can occur in the backwater area as coarser sediments are dropped out of the flow. Sedimentation further constricts the channel cross-section causing additional hydraulic problems, and can damage habitat. It may reduce the sediment supply to the beach and ocean, preventing re-nourishment of the delta and losses to the littoral zone.

Topanga Creek receives inputs of sediment from the entire watershed. Empirical evidence indicates that sedimentation problems occur from man-induced effects along the creek from Lake Topanga through the Rodeo Grounds area downstream. The location of roads and bank protection structures constrain the floodway along portions of this reach. Constraint of the floodway causes bed scour, bank erosion and episodic landslides, yielding sediment at varying rates. The creek would be able to transport the sediment to the sea if it were not for the constriction imposed at PCH by the bridge. The bridge constraint causes backwater of floods and consequent sedimentation upstream of the bridge forming a long and high bar. The net effect is that under existing conditions more sediment is yielded from the watershed than can be transported to the ocean, so the lower watershed is in a depositional condition.

Figure 4-5 shows the existing longitudinal creek bed profile, and the profile proposed under Alternative concept 4, from PCH bridge to one-third of a mile upstream (the approximate upstream bounds of the lagoon as determined from aerial photographs). The existing creek bed as shown by the solid line is concave in shape throughout this reach. This indicates shoaling in the creek, as typical creek bed profiles are concave upstream. The historic bathymetry was mimicked by Alternative concept 4, and is shown by the dashed line in the figure. The area of the shoal is hatched. The elevation difference between the two creek beds is nearly five feet along portions of this reach.



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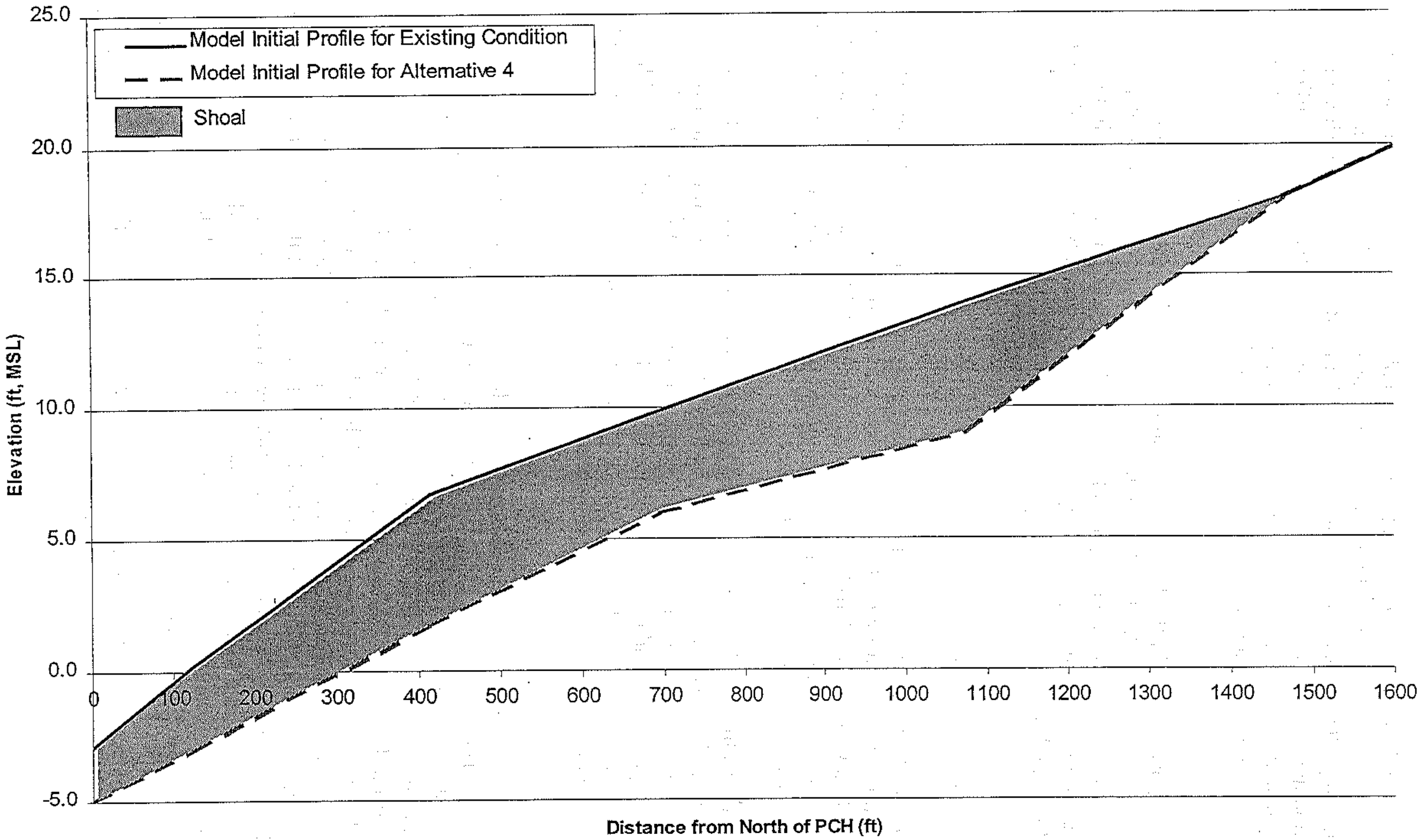
Topanga Creek Watershed And Lagoon Restoration Feasibility Study	EXISTING LAGOON ALTERNATIVE 1	FIGURE 4-4



Topanga Lagoon Watershed And Lagoon Watershed Restoration Feasibility Study

CREEK LONGITUDINAL PROFILE FOR ALTERNATIVES 1 AND 4

Figure 4-5

The ramifications of existing shoaling are that vegetation colonizes the shoal, constricting the floodway. This leads to further shoaling and more constriction, which causes additional backwater and shoaling. The process essentially feeds back into itself to promote shoaling and filling of the floodplain. Effects on the fish are negative, as habitat areas are filled and impassable bars created. Hydrology is also affected. Water depths throughout the shoal are minimal due to increased infiltration of creek flows, so fish have very shallow depths to navigate.

Finally, sediment deposition within the lower creek and lagoon means that less sediment passes through to the ocean to nourish the beach and littoral environment. There is a deficite of sediment to the local coastline, which causes beaches to erode. Storage of sediment in the creek exacerbates this condition. The surf break at Topanga Point was formed by sediment deposition during historic floods and does not receive the same rate of sediment delivery due to the PCH bridge constraint.

4.1.c Lagoon/Ocean Interface Dynamics

The existing lagoon is 2.2 acres in area and possesses a lagoon volume (storage volume between mean higher high water and mean lower low water relative to the ocean tide) of approximately 80,000 cubic feet. It is very small relative to other remaining coastal lagoons in the region. The site is essentially a pond in the dry season formed by continuous low inflow from upstream. In the wet season it serves as the flood channel to the sea.

In typical Southern California lagoon/tidal inlet systems, the inlet form and function is determined by opposing forces of wave-driven currents delivering sediment to the inlet from the sea and ebbing tidal currents eroding it away. Wave-driven currents are a function of the wave energy or height along the shore and their angle of incidence. High waves and/or those with high angles of incidence deliver sediment to an inlet at a relatively high rate, and vice-versa. Tidal currents are a function of the lagoon volume. Relatively high tidal currents occur at lagoons with larger lagoon volumes, and vice versa.

Stable inlets are those that stay open with minimal or no human assistance, and unstable inlets are those that do not. Topanga inlet is an unstable inlet in that the lagoon possesses insufficient tidal prism for the inlet to remain open over long periods of time. The condition of Topanga inlet is more dependent on upstream freshwater inflow than tidal prism. Freshwater ponding at the lagoon occurs until the lagoon level exceeds the elevation of the barrier beach and it overtops and breaches the barrier beach and drains to the sea. The inlet opens in the wet season after the first storm and can stay open through the winter due to continuous freshwater inflows. The inlet typically closes again in the spring due to wave forcing, and stays closed throughout the summer until the next winter storm, or until an extreme high tide overtops the barrier beach and fills the lagoon, causing drainage back out to sea with the next ebbing tide and formation a new temporary inlet channel. Tidal exchange to the lagoon occurs only while the inlet is open. Months can go by with no tidal exchange.

Topanga inlet forms over a relic cobble river delta. Storm flows or ebbing tides pass through the delta and fan out over the cobble rock bed. The channel over the cobbles becomes wide and shallow, and flow velocities decline. The flows are not sufficient to erode a channel through the cobble, rather they disperse over it and drain seaward through the most direct path. As the flow is dispersed and velocities decline, the flow is deflected toward the east with the drift of the nearshore ocean current. Ocean currents at this location are nearly always from west to east due to the predominant direction of wave approach and the direction of the prevailing winds. As the channel migrates east, it assumes a path parallel to the beach and eventually flows back out to the sea east of the lifeguard headquarters building. Thus the inlet plan form becomes S-shaped toward the east.

The present inlet condition appears to be similar to the historic condition. Although the historic lagoon was larger and its lagoon volume significantly greater, the cobble delta poses a significant armor layer resistant to erosion. Thus a true inlet channel never appears to have formed over a prolonged period of time. It is more of an opportunistic drainage channel for impounded streamflows at the lagoon.

4.1.d Water Quality

Water quality at the existing lagoon is relatively poor. High levels of bacteria have been measured over time that exceed State criteria. Exceedances have been measured for total coliform, fecal coliform and *E.coli* in the winter and spring of 2001 by the RCDSMM (See Appendix A). A short data record exists from November 2000 to December 2001. State criteria were exceeded for at least one indicator type of bacteria in fifty percent of the samples. Other water quality parameters such as temperature, dissolved oxygen (DO) and salinity have been measured and data summarized in Appendix A. Based on observations at other shallow lagoons, it can be assumed that conditions are more degraded when the inlet is closed in dry seasons and improve dramatically when the inlet reopens.

In addition, ocean water samples are taken near the Topanga lifeguard headquarters building by Hyperion Treatment Plant as part of a monitoring requirement. Heal the Bay reports the results and ranks the water quality from A to F (good to poor). For the time period from July of 1999 to May of 2001, incidents of marginal to poor water quality occur at the beach coincident with open lagoon mouth conditions, suggesting that the lagoon may be fouling the ocean. During the data record, the ocean never had poor water quality when the lagoon mouth was closed.

Alternative concept 1 will continue to generate relatively poor water quality at the beach and lagoon, assuming input concentrations to the lagoon remain the same over time. Contributions of nearby septic systems, non-point source pollution from stormwater runoff, and other possible inputs are not known at this time. The lagoon is relatively small, so dilution of contamination is minimal without influences of the tide or ocean. The only mechanism to reduce contaminant concentrations under existing conditions is to reduce input concentrations.

4.1.e Vegetation

The present lagoon is surrounded by steep fill slopes covered primarily by non-native plants. Eucalyptus, myoporum and tamarisk trees are found along the fill edges. The slopes are covered with iceplant. Invasive exotics including *Arundo donax*, castor bean, german ivy, morning glory and pampas grass are all well established.

Native vegetation is limited to a cluster of cattails located within the lagoon on the south side of the bridge abutment, and a small understory of willows at the edges of the lagoon. This is the only area where Tidewater gobies were found.

Canopy cover and shade is non-existent south of the bridge, and covers approximately 50% of the lagoon on the north side. There is no substantial habitat provided by the current vegetative assemblage. Filtration and sediment capture is limited.

4.1.f Biological Resources

Snorkel surveys and seining were conducted during summer and fall 2001, and winter 2002. In June 2001, a reproducing population of endangered Tidewater gobies was found. Several hundred individuals of several age classes were noted. A few specimens were taken for genetic analysis. A few adult staghorn sculpin were also found in the deeper thalweg under the bridge. Large schools of larval grunion and one dead adult were noted in the shallow areas adjacent to the beach. (The survey was immediately following a "grunion" tide.) No Steelhead Trout have been observed in the lagoon. During the winter months, the tidewater gobies moved further upstream into protected pools.

No formal surveys of bird use have been conducted, but casual observations indicate that the dominant bird species are Western Gulls, California Gulls, Ring billed gulls, Coots, and Mallards. A vagrant Whistling Swan rested in the lagoon for a month in Spring of 2001. Willets, whimbrels and sanderlings have been observed along the beach edge of the lagoon.

4.1.g Recreational Opportunities

Recreational opportunities in the vicinity of Topanga Lagoon include surfing at the point, sunbathing and swimming, boogie boarding and bodysurfing at the beach, walking, picnicing and sightseeing, and hang-gliding from the nearby bluffs. None of these activities will be changed for Alternative concept 1.

4.1.h Infrastructure Changes Required

Infrastructure at the lagoon includes PCH and the bridge, the County beach lifeguard headquarters building and utilities, the public parking lot, public access walkways and trails to the beach (east of the inlet), and an informal helipad and emergency beach access ramp west of the inlet. No changes to these facilities will occur from Alternative concept 1.

4.1.i Long-Term Management Issues

Continued long-term maintenance is recommended for Alternative concept 1, including removal of sediment, exotic vegetation and debris from the lagoon, and periodic repair of the PCH bridge. No change in long-term maintenance will be required for Alternative concept 1.

4.1.j Relative Costs

Alternative concept 1 requires no additional construction costs, but would require additional maintenance if actions listed in the previous paragraph occurred.

4.2 ALTERNATIVE CONCEPT 2 - LAGOON EXPANSION SOUTHWEST OF PACIFIC COAST HIGHWAY

4.2.a Hydraulics/Hydrology

Alternative concept 2 is similar to Alternative concept 1 in that the PCH bridge conditions continue to severely limit flood conveyance to the sea. Culverts are proposed along the west side of the bridge opening to improve flood conveyance as shown in Figure 4-6. The culverts would be two 12-foot diameter pipes, approximately 275-feet-long. They would be installed by tunneling through the existing fill. Friction through the pipes during floods would be severe and would restrict flows. Severe flood flow velocities modeled reach approximately 13 feet per second and water surface elevations reach approximately 12 feet above MSL without the effects of debris damming under the bridge being considered. As with Alternative concept 1, conditions would be worse with debris damming occurring. Damage could be caused to the bridge and adjacent structures under these conditions. Debris could become trapped at the entrance to or within the culverts during floods presenting a significant flooding and maintenance problem.

Under Alternative concept 2, flow velocities would again be too high to allow adult Steelhead Trout to migrate upstream during the peak flood event. Flows would essentially be bank to bank occupying the entire floodplain. Migration opportunities for Steelhead Trout might improve slightly compared to Alternative concept 1, but the fish are unlikely to use the culverts.

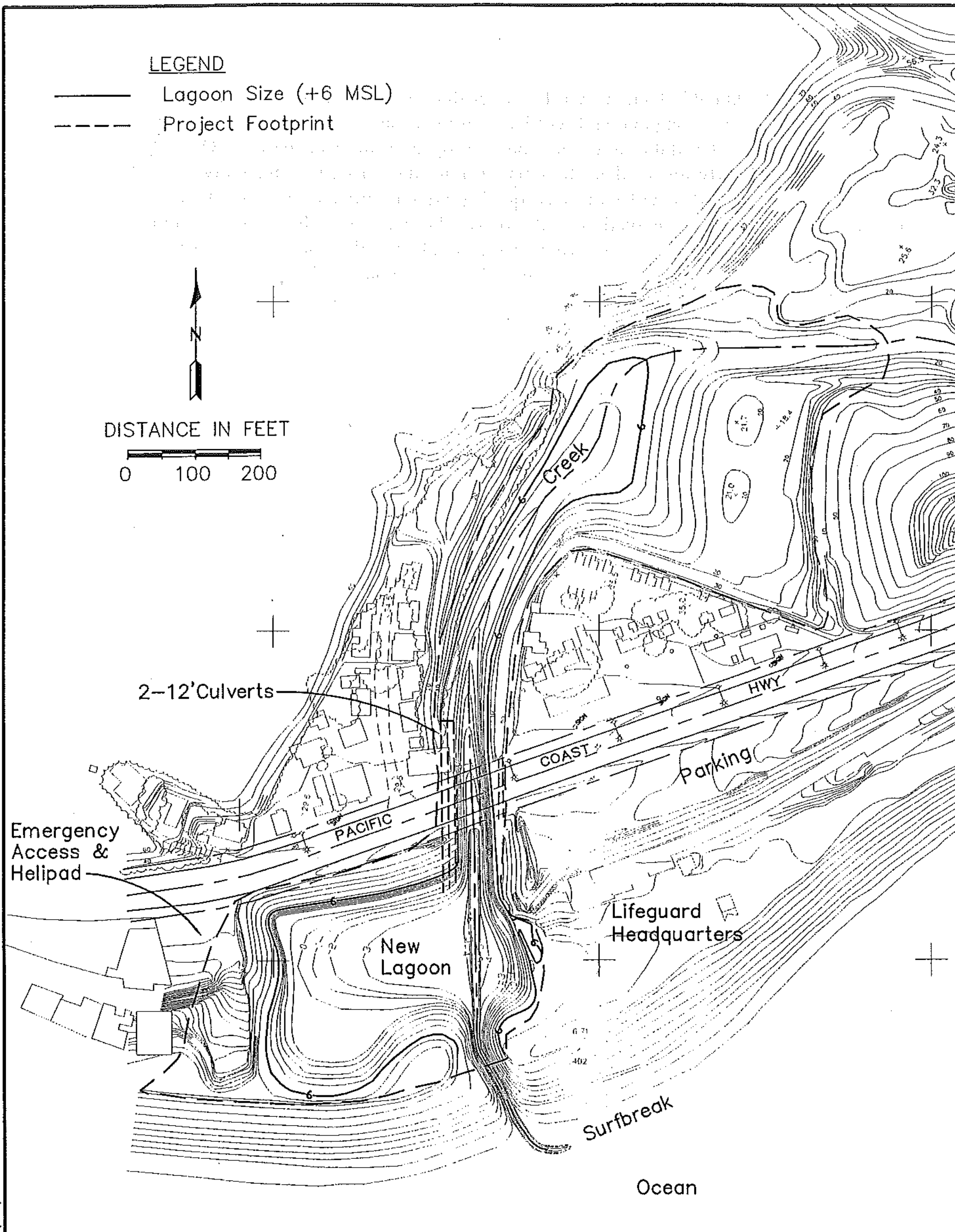
4.2.b Sediment Transport

As with Alternative concept 1, quantitative and qualitative analysis indicates that severe floods will experience a backwater effect from the small cross-sectional area provided by the bridge and the culverts constricting flows. Elevated water levels from backwater effects upstream of the bridge are the same for Alternative concept 2 as for Alternative concept 1. Sedimentation will occur in the backwater area and further constrict the channel cross-section causing additional problems for flood conveyance and habitat, and reducing the beneficial sediment supply to the beach, delta and ocean.

Numerical model results for Alternative concept 2 are presented in Appendix C and indicate that sediment deposition will occur in the lagoon. Sedimentation is expected, but will be more severe than for other alternatives because of the backwater effect of the PCH bridge and small lagoon proposed for Alternative concept 2. The predicted sedimentation rate is 1,230 cubic yards per year under average conditions. For the 4-acre lagoon area, this translates into an average annual rate of approximately 2.3 inches per year of sedimentation. Sediment gradation will range from boulders, to sand and silts. Sedimentation would occur in most flow events from low flows to severe floods due to the constriction under the PCH bridge that impedes flood conveyance and causes backwater.

4.2.c Lagoon/Ocean Interface Dynamics

The expansion proposed for Alternative concept 2 would be an approximately 8.0 acre restoration, with approximately 4.0 acres in lagoon area and possesses a lagoon volume of approximately 322,200 cubic feet. It will be larger than the existing lagoon, but less than one-half the size of the historic lagoon, and will have an inlet that is seasonally open depending on streamflow. It will be closed during dry seasons and open during wet seasons. Once opened, it may remain open slightly longer than the existing inlet due to its incrementally larger lagoon volume. However, the inlet will still close quickly after runoff subsides due to wave forced deposition and resulting reconstruction of the barrier beach. As with the other alternatives, a temporarily enlarged inlet may form during severe floods, but the inlet will revert to its closed condition shortly thereafter, as is the case with Alternative concept 1. It is anticipated that the thalweg will move slightly to the west to incorporate flow from the culverts.



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Topanga Creek Watershed And Lagoon Restoration Feasibility Study	LAGOON RESTORATION ALTERNATIVE CONCEPT 2	FIGURE 4-6

4.2.d Water Quality

As previously stated, water quality at the existing lagoon is relatively poor with regard to bacteria. The lagoon design for Alternative concept 2 will also maintain relatively poor water quality, due to its small dilution potential when the tidal inlet is open, assuming bacteria input concentrations to the lagoon remain the same over time (see Table 4-1). Based on measured levels, fecal coliform in the lagoon would probably be diluted sufficiently by the lagoon volume to drop below State standards. Levels of total coliform would still remain above standards. Reducing contaminant inputs would be the primary means to improve water quality.

4.2.e Vegetation

This alternative provides a very restricted opportunity for establishment of a wetland community. After contouring of the new lagoon area is completed, a suite of wetland species would be introduced based on soil sampling, gradient, and expected tidal and seasonal inundation levels. Following the gradient from the water's edge upland, a complex suite of suitable species would be planted, matching appropriate species with microhabitats in order to maximize diversity. The goal is to create a plant community that would become self-sustaining and perform the functions of a natural ecosystem. The species palette will be determined by reference to Malibu Lagoon, Carpinteria Marsh and other appropriate locations. Plants will consist of genetically appropriate stocks grown by a reputable nursery. Plots will be established so that long-term monitoring is possible. Finally, monthly monitoring will be required in order to document the establishment of the plants and respond to any problems that arise. Evaluation criteria will be based on adaptive management recommendations from Zedler (2001). Removal of non-native exotic invasives is envisioned, as well as revegetation of the vertical wall on the east bank.

4.2.f Biological Resources

With the introduction of more diverse native wetland plants and microhabitats, it is expected that some natural recruitment of benthic organisms, plankton, and fishes will occur. Recruitment and establishment opportunities will be limited by the size constraints. An adaptive management plan will be developed to direct monthly monitoring for all fauna, document population diversity and density changes, identify food chains, evaluate suitability for supporting juvenile fishes, monitor bird use, and address any problems identified.

Protection of the Tidewater Gobies during the construction process will be a high priority. Restricting excavation north of the bridge to the fall months will avoid peak reproductive season for the fish. Containment of the fish in small areas with nets may be necessary as well. Restoration will include re-establishment of suitable sediments and canopy cover over a larger area than presently exists. No impacts to Steelhead Trout are anticipated

4.2.g Recreational Opportunities

Recreational opportunities remain almost the same as for Alternative concept 1, with the possible addition of a boardwalk/nature trail and viewing platform at the lagoon/wetland area.

4.2.h Infrastructure Changes Required

Infrastructure at the lagoon is described for Alternative concept 1 and remains the same for Alternative concept 2. A minor change will be the relocation of the emergency access ramp/helipad further west to the edge of the new lagoon basin. This could increase response time for lifeguards during the winter months when the lagoon inlet is open and obstructs vehicle access along the beach.

4.2.i Long-Term Management Issues

Long-term maintenance includes removal of sediment, exotic vegetation and debris from the wetland, repair of the PCH bridge and any new nature trails. Periodic clearing or dredging may be required if it becomes filled with sand by waves overwashing the beach at high tides or from upstream deposition. Also, the culverts will require inspection and clearing after each winter at a minimum, and maybe after each particular storm at a maximum, to preserve their function. No other additional long-term maintenance will be required as compared to Alternative concept 1.

4.2.j Cost Estimates

Costs to construct, monitor and maintain Alternative concept 2 will be greater than Alternative concept 1 due to the creation of a larger lagoon requiring excavation and material disposal, and installation of culverts under PCH, revegetation and monitoring. First-order lagoon restoration costs based on assuming an excavation volume of 72,000 cubic yards and disposal by trucking offsite 25 miles, plus costs for the culverts under PCH are between $3 million and $5 million.

4.3 ALTERNATIVE CONCEPT 3 - LAGOON EXPANSION SOUTHWEST AND NORTHWEST OF PACIFIC COAST HIGHWAY

4.3.a Hydraulics/Hydrology

Alternative concept 3 proposes restoring the entire western portion of the historic lagoon. It is expected that final design will include excavation of a thalweg that is expected to return to natural conditions over time. Alternative concept 3 provides better habitat and water quality than Alternatives 1 and 2, owing to expansion of the restoration to 10.5 acres and the lagoon to 6 acres, providing significant filtration from native wetland vegetation and removal of several septic systems. A major problem with this alternative is that the vertical slope confining the eastern edge of the lagoon will remain. The PCH bridge would be lengthened from 80 feet to 340 feet. This restores the bridge to a length greater than that in 1924, which is necessary to pass the flood more effectively. Alternative concept 3 is shown in Figure 4-7.

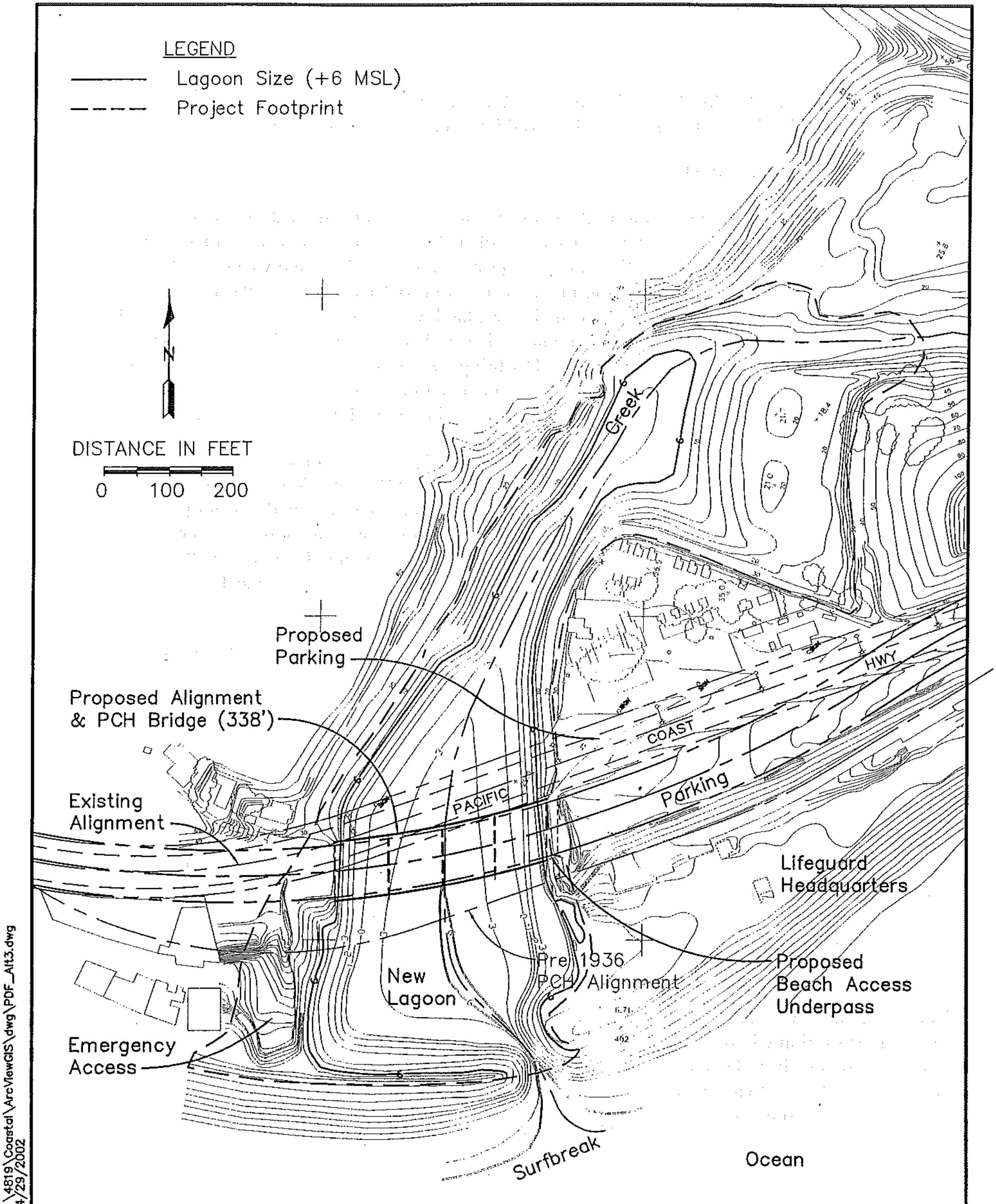
Severe flood flow velocities will reach approximately 8 feet per second and water surface elevations reach approximately 7 feet above MSL without the effects of debris damming under the bridge being considered. The floodway near PCH is significantly expanded from previous alternatives causing the flood elevation to drop significantly throughout the downstream reach of the creek. As with Alternative concepts 1 and 2, conditions would be worse with debris damming occurring, but less debris will be caught under the bridge due to the larger cross-section that allows passage of larger objects.

Under Alternative concept 3, flow velocities are within the tolerance of adult steelhead trout to migrate upstream during the peak flood event, which substantially increases the opportunity for migration. Flows will not quite occupy the entire floodplain. In addition the expanded lagoon will provide transitional areas suitable for migrating juvenile Steelhead Trout.

4.3.b Sediment Transport

Quantitative and qualitative analysis indicates that severe floods will not experience a backwater effect from the bridge and flows will pass through relatively unimpeded. Thus accelerated sedimentation upstream of the bridge will not occur and sediment will be conveyed to the delta, beach and sea for beneficial effects to the littoral zone. A period of creek bed elevation adjustment may occur upstream from the restored lagoon as the bed is scoured by flows. These sediments may move downstream and infill the lagoon until the equilibrium creek bed profile is reached over time.

Numerical model results for Alternative concept 3 are presented in Appendix C and indicate that sediment deposition will occur in the lagoon over time but at a relatively low rate. The predicted sedimentation rate is 428 cubic yards per year under average conditions. For the 6-acre lagoon area, this translates into an average annual rate of approximately 0.5 inches per year of sedimentation. Sediment gradation will include boulders, sand and silts, with the larger sediments (boulders) remaining in the floodplain longer and smaller sediments (sands and silts) being flushed to sea more frequently. Sedimentation would occur during lower to moderate flow



Topanga Creek Watershed And Lagoon Restoration Feasibility Study

LAGOON RESTORATION ALTERNATIVE CONCEPT 3

FIGURE 4-7

events. Severe floods would likely transport most sediment to the sea because the constriction to the flood under PCH bridge and consequent backwater effect would be removed.

4.3.c Lagoon/Ocean Interface Dynamics

The restoration design proposed for Alternative concept 3 is 10.5 acres of restoration, with a 6.0 acre lagoon possessing a volume of approximately 617,500 cubic feet. It will be larger than either of the previous alternatives, and almost the size of the historic lagoon. It will also possess a seasonally stable tidal inlet that will be closed during dry seasons and open during wet seasons. Once opened, it may remain open slightly longer than the existing inlet due to its larger lagoon volume. However, as with the other alternatives, tidal forcing does not appear to be the dominant factor for stability and it may still close quickly after runoff subsides. A temporarily enlarged inlet may form during severe floods, but the inlet will revert to its closed condition shortly thereafter.

The lagoon will be relatively deeper on average for Alternative 3 than for previous alternatives. While the existing lagoon is approximately 2.4 feet deep, the lagoon for Alternative concept 3 will be approximately 2.6 feet deep on average, leading to improved conditions of water quality. Effects to surfing from lagoon restoration should be minimal because lagoon flows will not significantly change in timing, discharge or location.

4.3.d Water Quality

The lagoon design proposed for Alternative concept 3 will be characterized by improved water quality compared to Alternative concepts 1 and 2. Assuming bacteria input concentrations to the lagoon remain the same over time, dilution when the inlet is open will be sufficient for concentrations to drop below State criteria for fecal coliform (Refer to Table 4-1). Restoration of native wetland vegetation is expected to provide significant filtration and nutrient reduction. This vegetation will also likely attract numerous birds. Recent studies at Bolsa Chica wetland reveal that while are birds are a contributing source of bacteria, the quantities are not significant enough to cause exceedance of State water quality criteria. (Moffitt &Nichol Engineers, 2001). Reducing contaminant inputs from septic systems and non-point source road runoff will be another benefit which will improve water quality.

Due to the excavation of the lagoon to MSL, water depth should remain sufficient to sustain reasonable levels of dissolved oxygen and minimize temperature fluctuations. Nutrient levels are expected to remain within acceptable parameters. Enlargement of the lagoon basin and associated wetland habitat should provide a substantial improvement of overall water quality. Closed freshwater coastal lagoons historically had little circulation, and the species adapted to this regime have declined with the loss of this specialized habitat. Thus restoration of this hydrologic condition could provide vital habitat.

4.3.e Vegetation

This alternative provides a greater opportunity for establishment of a diverse wetland community. After contouring of the new lagoon area is completed, a suite of wetland species would be introduced based on soil sampling, gradient, and expected tidal and seasonal inundation levels. A transition zone on the north side to the existing coastal sage scrub on the western slope will be needed. It may also be possible to reintroduce riparian trees like sycamores, alders, and California bay to provide additional habitat structure and restore some of the riparian edge community on the upstream edge of the lagoon as it transitions into the creek. Following the gradient from the water's edge upland, a complex suite of suitable species would be planted, matching appropriate species with microhabitats in order to maximize diversity. The goal is to create a plant community that would become self sustaining and perform the functions of a natural ecosystem. The species palette will be determined by reference to Malibu Lagoon, Carpinteria Marsh and other appropriate locations. Plants will consist of genetically appropriate stocks grown by a reputable nursery. Plots will be established so that long-term monitoring is possible. Finally, monthly monitoring will be required in order to document the establishment of the plants and respond to any problems that arise. Evaluation criteria will be based on adaptive management recommendations from Zedler (2001). Removal of exotic non-native invasives will also be completed, along with restoration of vegetation as possible on the vertical east bank.

4.3.f Biological Resources

The amount and quality of habitat will increase substantially with Alternative concept 3. With the introduction of more diverse native wetland plants and microhabitats, it is expected that more natural recruitment of benthic organisms, plankton, and fishes will occur. Habitat suitable to support Tidewater Gobies, and both adult and juvenile Steelhead Trout is expected to substantially increase. This alternative should restore the natural creek channel path and provide an even greater variety of possible habitat niches. An adaptive management plan will be developed to direct monthly monitoring for all fauna, document population diversity and density changes, identify food chains, evaluate suitability for supporting juvenile fishes, monitor bird use, and address any problems identified.

Protection of the Tidewater Gobies during the construction process will be a high priority. Restricting excavation north of the bridge to the fall months will avoid peak reproductive season for the fish. Containment of the fish in small areas with nets or in temporary holding tanks may be necessary as well. Restoration will include re-establishment of suitable sediments and canopy cover over a larger area than presently exists. No impacts to Steelhead Trout are expected.

4.3.g Recreational Opportunities

The recreational resources will be significantly increased with Alternative concept 3. Trails, viewing platforms, and bird watching will be integrated into an enhanced interpretive recreational experience. There will be no change to the surf break. The existing parking lot south of the highway will be relocated to the existing PCH footprint while the new highway alignment falls onto the existing parking lot footprint. The same area for parking will be provided so no loss of spaces should result. Access will have to be provided under PCH bridge.

4.3.h Infrastructure Changes Required

Infrastructure at the lagoon is described for the previous alternatives. The PCH bridge will be replaced with a longer bridge (380 feet) and the highway will be moved south onto the existing County beach parking lot footprint. Utility lines on the bridge will also have to be moved, although it may be possible to retain the water main in its existing location. Installation of state-of-the-art stormwater runoff and non-point source pollution devices is planned for both the bridge and the new roadway. A minor change will be the relocation of the emergency access ramp/helipad further west to the edge of the new lagoon basin. This could increase response time for lifeguards primarily during the winter months when the lagoon inlet is open and vehicle access along the beach is obstructed, although all weather access under the new PCH bridge would be provided.

4.3.i Long-Term Management Issues

Long-term maintenance may include periodic removal of sediment, exotic vegetation and debris from the wetland, stabilizing banks, repair of the PCH bridge and nature trails. The larger wetland of Alternative concept 3 will probably require more maintenance activity than smaller ones. Clearing or dredging may be required if it becomes filled with sand by waves overwashing the beach at high tides, or due to deposition from the upper watershed. The new PCH bridge will require more maintenance than the existing short bridge due to installation of the best management practices for improving water quality. A strategy for protecting the existing lifeguard headquarters when the inlet migrates downcoast will also be developed.

4.3.j Cost Estimates

Costs to construct, monitor and maintain Alternative concept 3 will be greater than the previous alternative concepts because it calls for removal of a significant volume of fill, installation of a new bridge and highway section, relocation of the parking lot, and installation of a new pedestrian/emergency vehicle access under the PCH bridge. In addition, improvements to trails, viewing platforms, and other interpretive facilities are anticipated. First-order lagoon restoration costs based on assuming an excavation volume of 153,500 cubic yards and disposal by trucking offsite 25 miles, plus costs for the 340-foot-long bridge are between $10 million and $20 million.

4.4 ALTERNATIVE CONCEPT 4 - LAGOON EXPANSION TO BOTH THE WEST AND EAST

4.4.a Hydraulics/Hydrology

The lagoon design proposed for Alternative concept 4 most closely replicates the historic lagoon configuration. It is anticipated that the final design will recreate a natural creek channel (deep thalweg) and associated lagoon area, which is expected to adjust over time. Alternative concept 4 performs better than previous alternatives because the restoration area is expanded to 15.5 acres to provide the maximum amount of habitat restoration possible given the physical constraints of the landscape. Alternative concept 4 is shown in Figure 4-8.

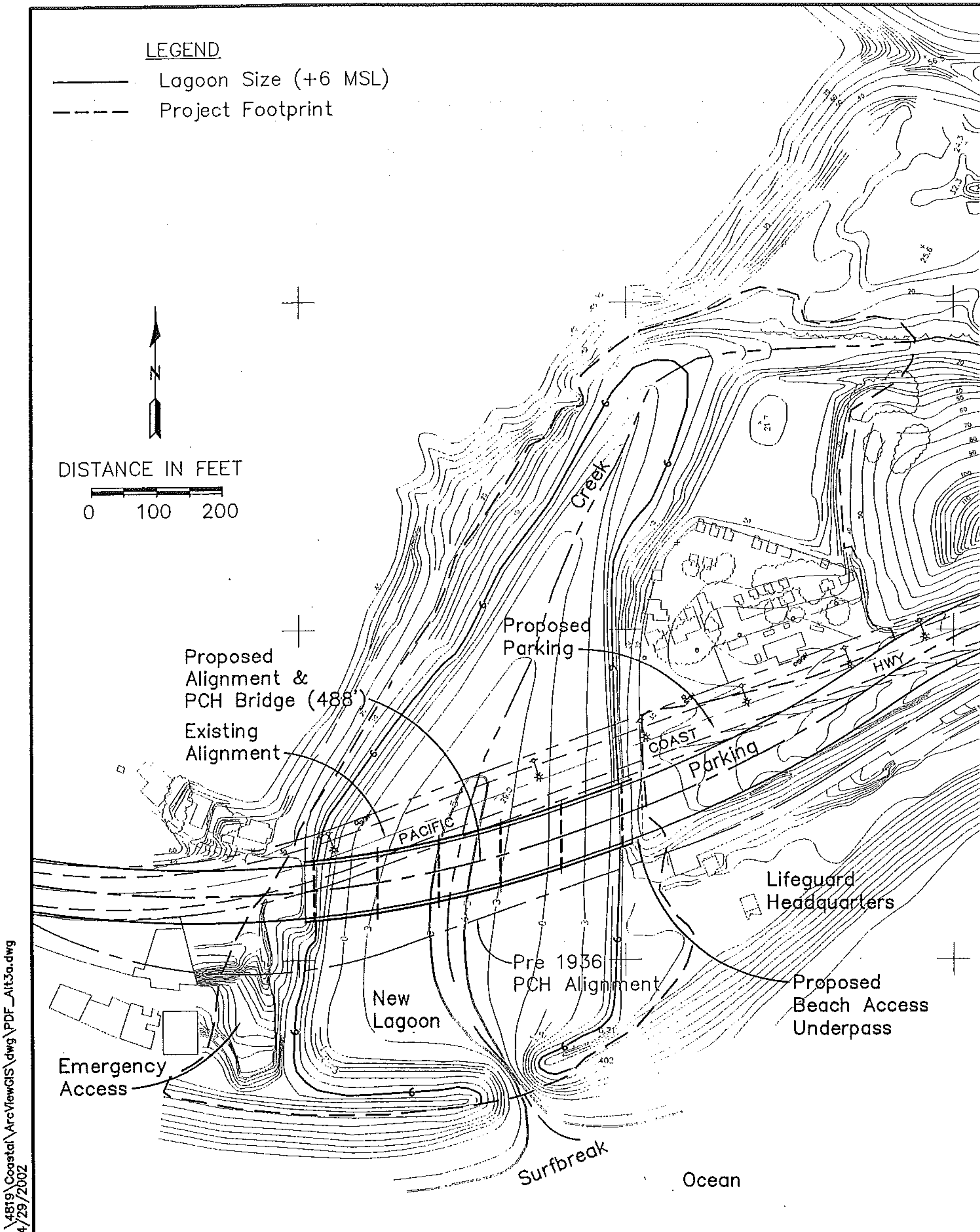
A main advantage of this alternative is that the lagoon slopes on both the east and west sides will be reconfigured and revegetated with native species. The PCH bridge would be lengthened to 490 feet in order to provide a span most closely related to pre-human disturbance. Like Alternative concept 3, the cross-section under the bridge expands to pass the flood more effectively. Severe flood flow velocities modeled reached approximately 5 feet per second and water surface elevations reach approximately 6 feet above MSL without the effects of debris damming under the bridge being considered. The expanded floodway of Alternative concept 4 results in an even lower water surface throughout the downstream creek area than the previous alternative. As with Alternative concepts 1-3, conditions would be worse with debris damming occurring, but the least amount of debris will be caught under the bridge due to the relatively large cross-section that would allow passage of large objects.

Under Alternative concept 4, flow velocities are within the tolerance of adult Steelhead Trout to migrate upstream during the peak of this flood event. Flows will not quite occupy the entire floodplain. This alternative provides the most optimal opportunities for both adult and juvenile Steelhead migration. Additionally this design provides ample areas suitable for juvenile trout as they transition from fresh to saltwater.

4.4.b Sediment Transport

Like Alternative concept 3, quantitative and qualitative analysis of Alternative concept 4 indicates that severe floods will not generate a backwater effect from the bridge and will pass through relatively unimpeded. Significantly less sedimentation should occur upstream of the bridge over the long-term and more sediment will be conveyed to the delta, beach and sea for the greatest level of benefit to the littoral zone of any alternative. A period of creek bed elevation adjustment may occur upstream from the restored lagoon as the bed is scoured by flows. These sediments may move downstream and infill the lagoon until the equilibrium creek bed profile is reached over time. Due to reduced flood flow velocities under PCH bridge from existing conditions, more fine particles may deposit in the lagoon, contributing to the development of suitable wetlands soils.

Numerical model results for Alternative concept 4 are presented in Appendix C and indicate that sediment deposition will occur in the lagoon over time but at a low rate. The predicted sedimentation rate is 771 cubic yards per year under average conditions. For the 8-acre lagoon area, this translates into an average annual rate of approximately 0.7 inches per year of sedimentation. Sediment gradation will include boulders, sand and silts, with the larger sediments (boulders) remaining in the floodplain longer and smaller sediments (sands and silts) being flushed to sea more frequently. Sedimentation would occur during lower to moderate flow events. As with Alternative concept 3, severe floods would likely transport most sediment to the sea because the constriction to the flood under PCH bridge and consequent backwater effect would be removed.



Topanga Creek Watershed And Lagoon Restoration Feasibility Study	LAGOON RESTORATION ALTERNATIVE CONCEPT 4	FIGURE 4-8

4.4.c Lagoon/Ocean Interface Dynamics

The lagoon for Alternative concept 4 is approximately 8.0 acres in area and possesses a lagoon volume of approximately 940,760 cubic feet. The restoration footprint will be larger than the previous alternatives (15.5 acres), which is the closest in size to the historic lagoon. It will possess a seasonally stable inlet, which will close during dry seasons and open during wet seasons. It may remain open slightly longer than the existing inlet, due to its larger lagoon volume, but it may still close quickly after runoff subsides as a result of wave forced deposition recreating the barrier beach. Like other alternatives, a temporarily enlarged inlet may form during severe floods, but the inlet will revert to its closed condition shortly thereafter.

The lagoon will be relatively deeper on average for Alternative 4 than for previous alternatives. While the existing lagoon is approximately 2.4 feet deep, the lagoon for Alternative concept 4 will be approximately 2.7 feet deep on average, leading to improved conditions of water quality. Effects to surfing from lagoon restoration should be minimal because lagoon flows will not significantly change in timing, discharge or location.

4.4.d Water Quality

The lagoon design proposed for Alternative concept 4 provides the greatest opportunity for improved water quality over previous alternatives. Assuming bacteria input concentrations to the lagoon remain the same over time, dilution while the inlet is open will be sufficient for concentrations to drop well below State criteria for fecal coliform (Refer to Table 4-1). Water quality should remain higher throughout the year for this alternative, since the restoration of the lagoon level to historic conditions will maintain depth and prevent dramatic fluctuation of temperature and dissolved oxygen. Restoration of native wetland vegetation is expected to provide significant filtration and nutrient reduction. Nutrient levels are exptected to remain well within suitable standards to support aquatic species. Recent studies at Bolsa Chica wetland reveal that while are birds are a contributing source of bacteria the quantities are not significant enough to cause exceedance of State criteria (Moffitt &Nichol Engineers, 2001). Reducing contaminant inputs from septic systems and non-point source road runoff will be another benefit to improved water quality.

4.4.e Vegetation

This alternative provides the optimal opportunity for establishment of the most diverse wetland community possible. After contouring of the new lagoon area is completed, a suite of wetland species would be introduced based on soil sampling, gradient, and expected tidal and seasonal inundation levels. A transition zone on the north side to the existing coastal sage scrub on the western slope will be needed. It may also be possible to reintroduce riparian trees like sycamores, alders, and California bay to provide additional habitat structure and restore some of the riparian edge community on the upstream edge of the lagoon as it transitions into the creek on both banks. Using the historical lagoon photos as a guideline, the east bank will also be revegetated with a succession of lowland to upland species. Exotic invasive species will be removed.

Following the gradient from the water's edge upland, a complex suite of suitable species would be planted, matching appropriate species with microhabitats in order to maximize diversity. The goal is to create a plant community that would become self-sustaining and perform the functions of a natural ecosystem. The species palette will be determined by reference to Malibu Lagoon, Carpinteria Marsh and other appropriate locations. Plants will consist of genetically appropriate stocks grown by a reputable nursery. Plots will be established so that long-term monitoring is possible. Finally, monthly monitoring will be required in order to document the establishment of the plants and respond to any problems that arise. Evaluation criteria will be based on adaptive management recommendations from Zedler (2001).

4.4.f Biological Resources

This alternative provides the greatest potential for restoring biological functions of the Topanga Lagoon. Due to the greater area of lagoon and wetland areas, the creek will be able to develop natural meanders, side channels and depositional bars that will significantly increase the habitat diversity available.

With the introduction of more diverse native wetland plants and microhabitats, it is expected that the most natural recruitment of benthic organisms, plankton, and fishes possible will occur. This alternative should restore the natural creek channel path and provide an even greater variety of possible habitat niches. An adaptive management plan will be developed to direct monthly monitoring for all fauna, document population diversity and density changes, identify food chains, evaluate suitability for supporting juvenile fishes, monitor bird use, and address any problems identified.

Protection of the Tidewater Gobies during the construction process will be a high priority. Restricting excavation north of the bridge to the fall months will avoid peak reproductive season for the fish. Containment of the fish in small areas with nets or in temporary holding tanks may be necessary as well. Restoration will include re-establishment of suitable sediments and canopy cover over a larger area than presently exists. No impacts to Steelhead Trout are expected.

4.4.g Recreational Opportunities

The recreational resources will be significantly increased with Alternative concept 4. Trails, viewing platforms, and bird watching will be integrated into an enhanced interpretive recreational experience. There will be no change to the surf break. The existing parking lot south of the highway will be relocated to the existing PCH footprint while the new highway alignment falls onto the existing parking lot footprint. The surface area available for parking will be reduced by almost 46% as a result. One possibility is to construct an underground parking structure to provide additional space. Access will have to be provided under the PCH bridge.

4.4.h Infrastructure Changes Required

Infrastructure at the lagoon is described for previous alternatives. The PCH bridge will be replaced with a much longer bridge (490 feet) and the highway will be moved south onto the existing County beach parking lot footprint. Utility lines on the bridge will also have to be moved although it should be possible to retain the water main in its existing location.

Installation of state-of-the-art stormwater runoff and non-point source pollution devices is planned for the bridge, the new roadway, and parking areas. A minor change will be the relocation of the emergency access ramp/helipad further west to the edge of the new lagoon basin. This could increase response time for lifeguards primarily during the winter months when the lagoon inlet is open and vehicle access along the beach is obstructed. The final design will need to include access for emergency vehicles to the upstream area, safe access to the beach, and protection of the exiting lifeguard facility.

4.4.i Long-Term Management Issues

Long-term maintenance will be necessary for Alternative concept 4. As for the previous alternatives, maintenance may include periodic removal of sediment, exotic vegetation and debris from the wetland, stabilizing banks, repair of the PCH bridge and nature trails. The wetland of Alternative concept 4 may require more maintenance activity than the other ones. Clearing or dredging may be required if it becomes filled with sand by waves overwashing the beach at high tides, or due to deposition from upstream. The new PCH bridge will require more maintenance than the existing shorter bridge.

4.4.j Cost Estimates

Costs to construct, monitor and maintain Alternative concept 4 will be the greatest of all alternatives. It includes removal of the largest volume of fill and discharge, installation of the longest bridge and highway section, relocation of the parking lot, and installation of a new pedestrian/emergency vehicle access under the PCH bridge. First-order lagoon restoration costs based on assuming an excavation volume of 215,000 cubic yards and disposal by trucking offsite 25 miles, plus costs for the 490-foot-long bridge are between $15 million and $25 million.

4.5 SUMMARY OF ALTERNATIVE CONCEPT ANALYSIS

As previously stated, alternative concepts for the lagoon were analyzed using a comprehensive numerical model and using analytical techniques. Each was analyzed for hydraulics and sediment transport using the MIKE-11 model, while water quality was analyzed using dilution analysis. Results are summarized below. Appendix C provides more detailed information of modeling and analysis. The information presented below is abbreviated information from the appendix. Table 4-1 summarizes the results.

4.5.a Hydrologic and Hydraulic Performance

Lagoon Alternative concepts 3 and 4 will require larger downstream openings than Alternative concepts 1 and 2. They will therefore more effectively convey flood flows and cause less adverse effects of upstream backwater and lagoon sedimentation. Upstream improvements will effectively reduce flow velocities and water surface elevations throughout the creek reaches above the lagoon. This will result in less flood damage to infrastructure, less ponding and water damage, and better conveyance of sediment downstream. Lagoon alternative concepts 1 and 2 will perpetuate the existing conditions.

Runoff from fire events for hydrology and hydraulics was also performed. Results show significant increases in runoff by up to 30% maximum.

4.5.b Sedimentation

Overall, reaches of the creek upstream of the stream gage are scouring while reaches of the creek between the stream gage and the ocean are experiencing deposition. With upstream improvements, the overall amount of sediment be reduced and it will move through the creek more effectively, reaching the downstream areas. Alternative concept 2 will experience the largest sediment deposition volume in the lagoon, and the sediment is mostly deposited in the area immediately upstream of the PCH bridge forming a bar. This is caused by the backwater effect caused by the constriction of the cross-section under the existing PCH bridge.

For Alternative concept 4, the average annual sedimentation rate at the lagoon is approximately 0.7 inches per year, which is spread out over the largest surface area. Alternative concept 3 has a lower sedimentation rate than any other alternative, but it will not be as spread out. Sediment deposited and temporarily stored in the lagoon under Alternative concepts 3 and 4 will likely be flushed out to the ocean during a 4-year or greater storm event. The cross-section under the PCH bridge is sufficiently large to prevent backwater and promote steady flood flow velocities throughout the lower reach of the creek. This will also promote restoration of the floodplain upstream of the lagoon to more natural levels.

Slightly more sediment will deposit in the lagoon of Alternative concept 4 as compared to 3 on average over time because it extends farther upstream from the sea, and is wider and deeper. Also for this Alternative, more habitat area will be created for fish and other sensitive species. The value of habitat creation will likely offset the impacts of sedimentation. Sedimentation may or may not require maintenance dredging as severe floods may flush the lagoon of any sediment that is deposited during low or moderate floods. Sediment that remains over time will likely be a range of all grain sizes and should provide the basis for establishment of soils suitable for colonization of desired wetland habitat.

Insufficient data exist of runoff from fire events to enable sediment transport modeling. Qualitatively however, sediment transport will increase more significantly than runoff to cause sedimentation in areas downstream of the milemarker 2.2 bridge for all alternatives. The relationship of runoff and sediment yield is exponential, in that an increase in runoff will cause an exponential increase in sediment yield. If a fire were to burn the entire watershed, runoff would increase by approximately 30 percent. The increase in sediment yield would be greater than 30 percent under this scenario.

In the absence of post-burn conditions, maintenance actions for Alternative concepts 3 and 4 should be minimal. Post-burn conditions would represent an anomaly and may require maintenance excavation or dredging. Controlled or prescribed burns of the watershed should be implemented to reduce the probability of this occurrence.

4.5.c Water Quality

Analysis of water quality has been done using analytical modeling (dilution calculations of bacteria levels) to predict future bacteria levels of alternatives. Alternatives 3 and 4 result in significant improvement to water quality compared to Alternatives 1 and 2 due to increased lagoon volume, enhanced filtration, and dilution of contaminants when the inlet is open. Bird use of the restored marsh is not anticipated to significantly impair water quality.

4.5.d Fish Habitat Restoration

Alternative concepts 3 and 4 are more conducive to restoration of fish habitat and passage than Alternative concepts 1 and 2. Concepts 3 and 4 provide greater lagoon and wetland habitat area for fish. They also result in hydraulic conditions during floods (lower flood flow velocities) allowing for fish passage over a longer period of time. Suitable transition conditions for juvenile trout will be generated in the larger lagoons.

4.5.e. Conclusions Based on Modeling

The superior lagoon alternative concept based on numerical and analytical modeling is Alternative concept 4 with an overall restoration footprint of 15.5 acres, including an 8-acre lagoon and a 490-foot-long bridge, with PCH relocated slightly to the south. This alternative most closely replicates the historic condition, provides the most effective flood conveyance leading to benefits related to fish passage, reduces sedimentation impacts, as well as damage to infrastructure and habitat from floods. The recreational opportunities are increased, with no change to the surf break.

The other alternative that clearly improves hydrologic and hydraulic conditions at the lagoon is Alternative concept 3 with a restoration footprint of 10.5 acres, a 6-acre lagoon, a 340-foot-long bridge and PCH relocated slightly to the south. This alternative will provide some of the same benefits as Alternative concept 4 related to flood control, though not to the extent of that alternative. It provides more effective flood conveyance than existing conditions and Alternative concept 2, leading to some benefits related to fish passage, and less sedimentation and less damage to habitat and infrastructure from floods. The problem with this alternative is the retention of the vertical east bank, which will reduce habitat restoration and potentially effect long-term deposition and circulation patterns within the lagoon/wetland area.

5.0 ALTERNATIVE REVIEW AND RANKING PROCESS

5.1 RANKING SCORECARD AND MODEL RESULTS

A preliminary scorecard for comparing the relative merits of Alternative concepts 1-4 was developed and presented to the TLAC for consideration in December 2001. Using the goals of the study as mileposts, each alternative was ranked according to how well it achieved the objectives identified (i.e., flood reduction, sediment reduction, water quality improvements, habitat improvements for endangered fishes, improved recreational opportunities). In addition, factors of cost, maintenance, and monitoring were also considered.

Results of the modeling and analysis are quantitative for hydrology, water quality, and identifying suitable parameters to support steelhead trout. Data was not sufficient to provide significant quantitative evaluation of sedimentation changes at this time. Improved recreational experience is a qualitative value judgement.

Input was solicited concerning: emergency access for the lifeguards, beach access and maintenance, maintaining and enhancing existing benefits identified by surfers and beach users, retaining the "funky beach flavor" of the existing landscape. Consideration of traffic management and integration of possible restoration actions with the States Parks planning process were also considered.

Based on modeling and analyses, Alternative concept 4 provides the most optimal lagoon restoration. It should result in a higher quality marsh and diverse wetland habitat which will support endangered fishes. It will convey floods and sediment to the sea more effectively. Water quality is expected to improve, especially when the inlet is open. Public recreational benefits will be provided by the new nature attraction of the improved lagoon, including expanded educational opportunities.

Larger-scale infrastructure changes are required for this alternative, and great costs will be incurred for construction, monitoring and maintenance compared to other alternatives. It will also be necessary to relocate several designated historic buildings. There will be a loss of approximately 46% of the parking spaces currently available, unless an underground parking structure or other solution is implemented.

Alternative concept 3 is the runner-up in performance to Alternative concept 4. It offers some of the benefits of a significantly improved environmental condition, but is severely constrained by the retention of the existing vertical slope on the east side. As with Alternative concept 4, a large ridge, highway realignment and relocation of designated historic buildings are necessary. It does have the benefit of retaining the existing amount of parking spaces.

Alternative concepts 1 and 2 would basically continue to support existing conditions of degraded habitat, poor water quality, and significant limiting factors for endangered fished.

5.2 TLAC REVIEW AND INPUT

The TLAC reviewed the Draft Feasibility Study and provided input to the project at the February 13, 2002 meeting. Moffatt and Nichol Engineers provided a presentation on the final study results, although the final sediment transport modeling had not yet been completed. Discussion focused on how to best represent the concerns of all the members of the TLAC in this summary. It was agreed that a two week review period was needed in order to allow agencies time to review the Draft Feasibility Study document carefully and provide further written comments. It was also agreed that the completed sediment modeling results would also be provided to the TLAC for their review and comment prior to finalization of the Study report.

Copies of this summary, the original comment letters and the sediment modeling results were sent to the TLAC for review on 10 April 2002. The comment period closed on 26 April 2002, when further comments were added to this summary.

In summary, the consensus appears to support implementation of the upstream streambank stabilization and restoration actions, as well as further exploration of a lagoon restoration design that will: 1) provide the maximum amount of lagoon restoration possible; 2) incorporate public safety concerns; 3) provide safe access and adequate parking; 4) incorporate historical structures and visitor services; 5) cost effective maintenance; and 6) protect the existing surf break.

Comment Letter remarks:

Comment letters supporting the results of the study and recommending the selection of Alternative concept 4 (largest possible wetland restoration) were received from the CA Department of Parks and Recreation, the Santa Monica Bay Restoration Project, the Los Angeles Regional Water Quality Control Board, the National Park Service, Heal the Bay and ichthyologist Dr. Camm Swift.

State Parks reiterated the need to integrate existing historic structures, as well as visitor services into the design. They have also agreed to participate in the planning and design process for developing a solution to the problem at the "Narrows".

The Los Angeles County Lifeguards wanted to be sure that the following issues were integrated into the process moving towards a final restoration design:

1. Access for emergency vehicles should be provided under Pacific Coast Highway for response to water and medical related emergencies on the north side

2. Incorporate safety measures to prevent the public direct access across Pacific Coast Highway from the parking area to the beach; and

3. Provide adequate protection of the existing lifeguard facility from possible encroachment when the lagoon outlet meanders in that direction.

Los Angeles County Department of Beaches and Harbors took no position on a preferred concept design alternative, but instead offered the following considerations for each possibility.

Alternative Concept 1:

1. Continue to improve upstream conditions, removing non-point source pollution in Topanga Creek to improve lagoon and ocean water quality.

Alternative Concept 2:

1. Provide alternative continuous access at the beach level (not using PCH) for Beaches and Harbors, and lifeguard vehicles and personnel for maintenance and rescue operations west of Topanga Creek.

2. Consider screening of the upstream opening of new culverts to prevent debris entrapment inside.

3. Provide a plan to reconfigure the lagoon outlet, when necessary to prevent eastward migration of waters that encroach on lifeguard facilities and operations, handicapped parking and picnic facilities, and beach sanitizing and contouring operations.

Alternative Concept 3:

1. Provide full or replacement public parking north of PCH on State Park land prior to any construction on the existing county parking lot. The number of spaces should be a minimum of 100.

2. Assure safe all-weather access for beach patrons across or under PCH, and avoiding direct public access across PCH at unauthorized locations.

3. Develop realigned PCH that is designed to minimize visual, noise and air quality impacts on beach-goers.

4. Provide a plan to reconfigure the lagoon outlet, when necessary to prevent eastward migration of waters that encroach on lifeguard facilities and operations, handicapped parking and picnic facilities, and beach sanitizing and contouring operations.

Alternative Concept 4:

1. Provide full or replacement public parking north of PCH on State Park land prior to any construction on the existing county parking lot. The number of spaces should be a minimum of 100.

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3. Develop realigned PCH that is designed to minimize visual, noise and air quality impacts on beach-goers.

4. Provide a plan to reconfigure the lagoon outlet, when necessary to prevent eastward migration of waters that encroach on lifeguard facilities and operations, handicapped parking and picnic facilities, and beach sanitizing and contouring operations.

Caltrans has agreed to participate in the next step of designing a solution to the chronic streambank stabilization problem at the "Narrows." Funding for that design process is pending.

Caltrans took no position on a preferred lagoon restoration alternative, stating that each is worthwhile and worthy of more detailed analysis. They requested that Alternative concept 2 be revisited to see if additional culverts could expand the lagoon size instead of replacing the existing small bridge. They noted that a Project Study was needed in order for the project to become eligible for the State Transportation Improvement Program list for future funding. This would be followed by Project Approval/ Environmental document and Project Development, followed by construction.

Los Angeles County Department of Public Works (LACDPW) provided comments on several aspects of the Feasibility Study report. In regards to the proposed upper watershed restoration actions, they are most concerned that an integrated analysis of the proposed solutions be included in the final design phase to ensure that no downstream problems would occur. They also requested that any environmental impacts associated with the construction and maintenance activities be identified.

Regarding lagoon restoration, LACDPW was concerned about possible impacts from settling of finer sediments should the lagoon be expanded. They recommend that a thorough evaluation of the impact of sedimentation on biological resources be conducted for each alternative. Given consideration to long-term maintenance activities and costs, LACDPW recommends Alternative concept 3 as the preferred proposal to provide habitat.

5.3 COMMUNITY INPUT

Community input has been solicited throughout the study period. Presentations were made to the Topanga Creek Watershed Committee in June, October, and December 2001. When the alternatives were presented at the December meeting, there was strong support from the community for the maximum lagoon restoration possible. A final presentation to the community regarding the recommendations of the TLAC was provided at the 21 March 2002 watershed committee meeting. See Appendix D for details.

5.4 FINAL RECOMMENDATIONS

For the upper and central watershed restoration proposals, the recommendation is to proceed with obtaining funding to continue necessary design and implementation work.

For the lagoon and wetland restoration, the consensus is to move forward with the largest restoration possible (Alternative concept 4), given the constraints of safety, access, parking, maintaining the surf break, providing visitor services, preserving historical resources, improving water quality and restoring habitat.

6.0 COORDINATION WITH STATE PARKS INTERIM PLANNING PROCESS

The Feasibility Study results will be considered by the State Department of Parks and Recreation for eventual inclusion in the General Plan Amendment for Topanga State Park, which will be completed by December 2003. The Lower Topanga Interim Management Plan will guide all planning efforts in the meantime. The ultimate design for the lagoon restoration will be guided by the following expressed management goals. State Parks will continue to participate in the cooperative lagoon and watershed restoration planning efforts. The following goals and implementation strategies have been outlined in the plan.

6.1 ENHANCE WILDLIFE HABITAT AND PLANT COMMUNITY VALUES

1. Remove manmade intrusions in the Natural Habitat Zone. Remove fences, structures and debris.

2. Roadways

   A. Work toward removing and revegetating roadways in the Natural Habitat Zone.

   B. No active removal at this time. Merely close to public vehicular use.

3. Work toward removing non-native, exotic species in the Natural Habitat Zone. (Mechanical removal is preferred.)

   A. Only focus on the most aggressive non-native plants: Arundo and Tree of Heaven, Cape Ivy.

   B. Focus on the above plus other less invasive species: English Ivy, Palms and Eucalyptus.

   C. Focus on all non-native species: the above plus other non-native ornamental plants.

4. State Department of Transportation Dumping

   A. Work with the State Department of Transportation to discontinue dumping on State Park property along Topanga Canyon Blvd, and removal of existing dumped material.

   B. In addition to the above, add slope restoration.

5. Continue to actively participate in and support planning efforts and studies that will result in restored natural processes and protect endangered species (including Steelhead Trout and Tidewater Goby). These planning efforts will, most significantly, include lagoon restoration and streambed restoration.

6.2 ENHANCE THE QUALITY OF THE PUBLIC'S ENVIRONMENTAL EXPERIENCE (AESTHETICS, VIEWS)

1. Remove manmade intrusions that detract from the visitors' environmental experience and access. Remove fences, structures and debris.

2. Roadways

   A. Work toward removing and revegetating roadways in the Natural Habitat Zone.

   B. No active removal at this time. Merely close to vehicular use.

3. Remove visual obstructions along Topanga Canyon Blvd. and other public use areas. (Structures, fences, debris). Restore with native plants.

4. Redesign the frontage area along PCH to be more attractive and better organized for the movement of people and vehicles.

6.3 PROVIDE SUPPORT FACILITIES THAT ENHANCE THE PUBLIC'S VISIT TO TOPANGA STATE PARK

1. Develop a small trailhead parking area (10 to 15 vehicles) with a few picnic tables at:

   A. The "Pit" area behind the motel site or,

   B. The Old Malibu Road area behind Wylie's or,

   C. Along PCH in front of the Topanga Ranch Motel.

2. Develop a loop trail through the lower portions of the Natural Habitat Zone with seasonal crossings of the creek.

3. Develop a trail leading to a viewpoint atop Sentinel Rock.

4. Maintain the existing Parker Mesa Overlook Trail and Santa Ynez Trail within the northeastern portion of the acquisition.

5. Allow continuation of commercial enterprises along PCH over the course of the two-year interim period covered by this plan. (Wylie's, Topanga Ranch Motel, Cholada, Something's Fishy, the Reel Inn, Topanga Ranch Market, Ginger Snips, Money House, The Oasis, Feed Bin.)

6.4 PROTECT THE PUBLIC AND THE SITE'S NATURAL AND CULTURAL RESOURCES FROM:

Hazardous Conditions (Safety, Ease of Access)

1. Remove vacant structures, fences, miscellaneous site debris and any hazardous material.

2. Remove sources of water quality impacts and address vegetative management issues, in compliance with regulatory agency mandates.

3. Utilize existing buildings and/or temporary modular facilities to accommodate up to 8 structures for state park operations use.

4. Implement appropriate signage.

5. Repair existing pedestrian routes.

6.5 PROVIDE EDUCATIONAL OPPORTUNITIES TO THE VISITING PUBLIC

1. Install interpretive panels.

2. Begin organization of volunteer docents.

3. If the current operator of the Topanga Ranch Motel chooses to relocate, utilize existing buildings for any of the following (not mutually exclusive):

   A. An Overnight Educational program (School Programs, Jr. Lifeguard, Youth Programs),

   B. Interpretive / Educational Center,

   C. Santa Monica Mts. Environmental Agencies (or Support Groups) offices and/or

   D. Park operations.

6.6 CONTINUE RESPONSIBLE STEWARDSHIP IN THE OPERATION OF TOPANGA STATE PARK

1. Eliminate all private residential use. (These Operational Costs detract from other public service. Private residential use is contrary to several components of the State Park Mission.)

6.7 PROTECT AND INTERPRET HISTORICAL AND ARCHAEOLOGICAL RESOURCES THAT ARE POTENTIALLY ELIGIBLE FOR THE NATIONAL REGISTER OF HISTORIC PLACES.

1. Manage eligible historic structures to assure longevity and integrity of historic features. (Topanga Ranch Motel, Wylie's and the Reel Inn)

2. Continue study for the presence and significance of archaeological sites. Alternatives considered but deemed not consistent with interim management goals:

   A. Maintain Private residential use.

B. Implement overnight camping or recreation vehicle use as suggested in 1977 general plan.

C. Create formal trailhead parking along Topanga Canyon Boulevard.

7.0 TOPANGA CREEK RESTORATION FEASIBILITY STUDY RECOMMENDATIONS

Recommendations are provided below based on engineering work completed for the project.

1. Implement upstream improvements along Topanga Creek to improve flood protection, habitat quality, maintain traffic circulation, improve public safety and reduce emergency costs. Improvements should be implemented at Lake Topanga, Topanga School Road, boulder dams, the Narrows, the landslides, the Rodeo Grounds and the lagoon/PCH bridge.

2. Implement a lagoon restoration to improve the environment, and provide better flood and sediment conveyance to the sea to benefit the coast.

   A. The superior lagoon alternative based on modeling and analyses is the 15.5-acre wetland, 8 acre lagoon, with a 490-foot-long bridge, and relocated highway to the south (Alternative concept 4). This concept alternative most closely replicates the historic condition, provides the maximum amount of habitat restoration, significantly increases recreational opportunities, and potentially provides the greatest improvements to water quality. It will provide an optimal aesthetic and educational experience for residents of the highly urbanized Los Angeles area. In addition this alternative will substantially increase the opportunity for successful recovery of endangered Steelhead Trout and Tidewater Gobies. This concept alternative costs more than the others to construct, monitor/maintain and causes impacts by relocating and reducing available parking. It will also require the relocation of historically significant buildings (Wylies Bait Shop and possibly one or two of the small units of the Topanga Ranch Motel). This concept alternative most closely supports the goals identified in the Lower Topanga State Park Interim Plan.

   B. The other concept alternative that clearly improves environmental conditions at the lagoon is a 10.5 acre wetland, 6-acre lagoon, with a 340-foot-long bridge and relocated highway to the south (Alternative concept 3). This concept alternative will provide many benefits, but the retention of the vertical bank on the east side will prevent optimal restoration of natural processes. This concept alternative does not optimize the opportunity to convey floods and sediments. It would not cost as much as Alternative concept 4, nor would it provide as much benefit.

3. Initiate permitting and environmental review of the preferred lagoon alternative concept and upstream improvements. If possible, secure permits and complete environmental review of all improvements as one Master Plan for the creek.

4. Initiate final engineering design for construction as permitting and environmental review are being concluded. The final engineering will incorporate permit conditions and mitigation measures identified as necessary during the permitting and environmental review stage.

5. Continue to pursue all possible funding opportunities to finance project planning, engineering and construction.

8.0 NEXT STEPS

8.1 ADAPTIVE MANAGEMENT

The completion of the Feasibility Study concludes the preliminary exploration of restoration opportunities in the Topanga Creek Watershed. At the request of the TLAC, Moffatt and Nichol Engineers has developed an outline for future efforts.

Given the fact that wetland and riparian restoration is a continually evolving science, it seems prudent to build into the process a strategy for adaptive management. Even with all the best data available, it is important to note that unintended consequences are possible. Incorporating a research plan into the design, implementation and monitoring phases of the restoration projects will provide valuable information regarding coastal and creek dynamics, and most importantly, establish a conceptual framework for adjusting the restoration program along the way. Thus, as unexpected developments arise, there will be a strategy for management, adjustment and eventual resolution of any problems that arise.

8.2 INTEGRATED PLANNING

Implementation of the project requires successive stages of permitting, environmental documentation, final engineering for construction, and actual construction. Each stage is briefly described below.

Permitting and environmental review under the California Environmental Quality Act (CEQA) should commence as soon as the preferred project is identified. As the CEQA document is certified, permits can be applied for and possibly secured. Permitting and environmental review will result in conditions and mitigation measures that can be incorporated into the final engineering design. Planning may require a minimum of twelve to eighteen months to complete.

Final engineering for preparation of construction documents should immediately follow the planning stage. Engineering will include preparation of final engineering plans, construction specifications and cost estimates. This information will be included in a bid package for contractors to submit construction bids to perform the work. Final engineering may require six to nine months to complete.

The project proponent will select the contractor based on the bids for construction. Construction can then be performed and may take up to several years to complete.

8.3 COORDINATION BETWEEN LANDOWNERS

In order to accomplish a lagoon restoration, it will be necessary for State Parks, Los Angeles County Beaches and Harbors and Caltrans to develop a shared vision for design and implementation. Full participation of Caltrans will be needed in order to actualize any bridge or road replacements. The responsibility for maintaining and operating Topanga Beach and a restored lagoon, as well as the associated parking areas will need to be discussed and a formal agreement reached between Los Angeles County Beaches and Harbors and State Parks.

8.4 CALTRANS

Implementation of the restoration actions proposed in this study rely upon the cooperation of Caltrans. As the responsible agency for both Pacific Coast Highway and Topanga Canyon Blvd., it will be necessary for District 7 to incorporate the proposed restorations into their Work Plan. It is also anticipated that implementation of some restoration actions will be accomplished using Caltrans grant funding. Preliminary discussions concerning these issues have been on-going during the course of the Feasibility Study.

8.5 SEDIMENT ANALYSIS AND DISPOSAL PLANS

Implementation of any restoration action at Topanga Lagoon will require the removal of fill materials placed on the site by Caltrans in 1934. It is necessary to examine this material and determine if it is suitable for use as beach replenishment material or qualifies for disposal in the nearshore environment. There is also a concern about possible hazardous contamination. A grant proposal was submitted in February 2002 to the Southern CA Wetlands Recovery Project to fund this work.

8.6 FUNDING NEEDED

The steps outlined all cost money. Funds for developing the engineered plans and environmental documents for the "Narrows" streambank restoration and the identified preferred lagoon restoration alternative has been obtained from the Santa Monica Bay Restoration Project ($298,000). Grant proposals are being developed to generate the necessary project study, environmental documentation and final engineering documents for restoring and stabilizing the three landslide locations in Lower Topanga, and to fund the actual lagoon construction.

Clearly there will also be a need to apply for Caltrans grant monies as well in order to ultimately implement the plans.

8.7 TASK SUMMARY

1. Initiate meetings between State Parks, Los Angeles County Beaches and Harbors and Caltrans to develop a shared vision for the future of the proposed restoration sites, agree upon tasks to be undertaken by each agency, and outline a time line for implementation.

2. Develop the Project Definition and Description which will include, but not be limited to, identification of design constraints to incorporate historical structures and visitor services, parking solutions, safe passage across Pacific Coast Highway, access for emergency services, characterize composition of fill material and identify disposal opportunities, identify ways to minimize impacts from road and bridge re-alignment, incorporate habitat designed for endangered fishes, and develop recreational services within the framework of the revised Topanga State Park General Plan Amendment. (6 months – 1 year)

3. Develop preliminary engineering plans to identify the dimensions and specifications for the proposed design. (6 months – 1 year)

4. Prepare the EIR/EIS document, prepare permit applications for USACE Section 10 and 404, CDFG Section 1601, LARWQCB Section 401, Los Angeles County Regional Planning and Flood Control, and Coastal Commission permits. (1-2 years)

5. Prepare Caltrans Project Report/Project Study Reports for all road related restorations proposed. Get projects listed on the District 7 Work Plan.(6 months)

6. Develop a research and monitoring plan for the restoration sites. (6 months)

7. Hire a Project/Permit Coordinator to oversee the process.

8. Prepare Final Engineering plans and construction bid documents. (6 months – 1 year)

9. Continue to apply for implementation funding at all stages.

10. Construction (1 year)

11. Monitoring and maintenance (on-going)

Steps 1-5 should begin as soon as possible in order to make best use of the current funding available. Subsequent steps should proceed as soon as funding is secured.

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APPENDICES FOR

FINAL REPORT

TOPANGA CREEK WATERSHED AND LAGOON RESTORATION

FEASIBILITY STUDY

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April 29, 2002

APPENDIX A

SUMMARY OF WATER QUALITY REPORT FOR THE TOPANGA CREEK WATERSHED

APPENDIX A:
Summary of Water Quality Report for the Topanga Creek Watershed 1999-2001

Funded by:
CA State Water Resources Control Board
Contract No. 09-070-250-0

California Coastal Conservancy
Southern CA Wetlands Recovery Project
Grant No. 00-062

Prepared by:
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A. Executive Summary

Standard water quality data was collected at five sites weekly and ten sites monthly from July 1999 through May 2001within the Topanga Creek Watershed, funded by a grant from the State Water Resources Control Board. A grant from the CA Coastal Conservancy funded additional monthly samples taken in Topanga Lagoon from November 2000 to January 2002. The goal of the sampling was to answer the following two important questions.

1. What is the relationship of upper watershed inputs to poor water quality at Topanga Beach?

Topanga Beach is listed by the LA Regional Water Quality Control Board as impaired for coliform bacteria (303d listing). A comparison of the total and fecal coliform, and E. coli levels between Site 6, the lowest sampling point in the watershed, and Topanga Beach and Lagoon are presented in Table 1. High bacteria counts at Topanga Beach do not appear to be a result of inputs from the upper watershed, above Site 6, 2 miles upstream from the beach. They do appear somewhat related to whether the lagoon entrance is open or closed. Further study is needed to identify sources of bacterial contamination in the lowest reach of the watershed, in the lagoon and at the beach. A grant proposal has been submitted to identify bacteria sources through DNA fingerprinting, and to begin viral assays to establish a correlation between bacteria levels and pathogenicity.

Although there were several sites in the upper watershed with consistently high bacteria levels, by the time the water moved through the uninhabited, steep, narrow canyon leading down to the bridge located 2 miles upstream from the ocean (Site 6), levels were generally well within primary contact limits at all but 3 sampling events (storm related).

The Topanga Creek Watershed Committee has held several workshops to educate property owners on ways to improve septic system function and responsibly discharge greywater. Continuing education and implementation of best management practices are ways the community is trying to cope with "hot spots".

2. What, if any, are the relationships between water quality and the following variables; septic systems, sensitive species distribution, implementation of Best Management Practices, and land use?

The eighteen square mile Topanga Creek Watershed is the third largest watershed draining into the Santa Monica Bay, and is the least altered, even though the creek, major roads, utilities and homes compete for space within the steep, narrow canyon. Recent sensitive species surveys found several resident adult Steelhead Trout, and increasing numbers of Western Pond Turtles, along with thriving populations of CA Newts, CA Tree Frogs, Western Toads, Pacific Tree Frogs, and numerous other aquatic species of concern. Over 750,000 visitors swim at Topanga Beach each year. Clearly water quality must be preserved in order to support both human activities and species of concern.

The Topanga Creek Watershed is home to over 12,000 residents of approximately 2,000 homes, all having on site septic systems. Although water is imported for domestic uses, there are no substantial agricultural or industrial sites within the watershed. There is no storm drain collection system, or other point source collection or dispersion infrastructure. Over 8,000 acres are dedicated public open space, therefore limiting the amount of impervious surfaces (less than 20%), which are concentrated around the pockets of development scattered on the remaining 2,500 acres of private lands. Thus the majority of water quality problems stem from non-point sources associated with residential, corralled animal, and small commercial facilities.

Nutrient levels were low and well within standards at all locations. This is a notable difference from other watersheds draining into the Santa Monica Bay, like Malibu Creek. The upper watershed has been listed by the Los Angeles Regional Water Quality Control Board as impaired for lead (303d list). Results of sampling for heavy metals on three separate occasions (first flush storm events, and at the end of the rainy season) are summarized in Table 2 (pg. 9). Concentration of heavy metals are effected by water hardness, and have varying criteria based on 4 day and 1 hour concentrations. Using the most stringent objective criteria, Topanga Creek had very low, to non-detectable levels of cadmium, copper, nickel, lead and zinc. The objective criteria for chromium is based on drinking water standards (50 ug/l) rather than freshwater aquatic standards. Again, levels were well below the objective limits.

Total suspended solids are of concern due to their potential impact on benthic aquatic organisms. Levels remained low at the majority of sites, except during storm events. This data will be incorporated into a watershed wide erosion and sediment delivery study which is in progress.

Summary

Overall, despite the potential for pollution problems, Topanga Creek water quality is in relatively good condition. The impacts have not yet exceeded the natural capacity of the creek to cleanse itself. The strong diversity of sensitive aquatic species, and the presence of so many endangered species, such as steelhead trout that have very limited tolerance for pollution indicates that Topanga Creek remains a vibrant, healthy system throughout much of the watershed.

Volunteers played a critical role in collecting data for this study, and the members of the Topanga Creek Stream Team deserve credit for their dedication. Not only were they enthusiastic stream data collectors, they became ambassadors to the community concerning the need to be good stewards of our creek. Their contributions were, and continue to be, outstanding.

Creek Clean Up events conducted during this study removed 12 tons of trash from Topanga Creek. A grant from the Urban Streams Restoration Program funded a helicopter to airlift out 20 wrecked cars and 17 loads of debris from the inaccessible section of the creek. These projects were supported by over 300 volunteers who donated over 3,400 hours of time, and more than $20,000 of in-kind services. For these efforts, the Topanga Creek Watershed Committee received the 2001 Waterbody Restoration Award from the Los Angeles Regional Water Quality Control Board.

MAP OF WATER QUALITY SAMPLING SITES
TOPANGA CREEK WATERSHED

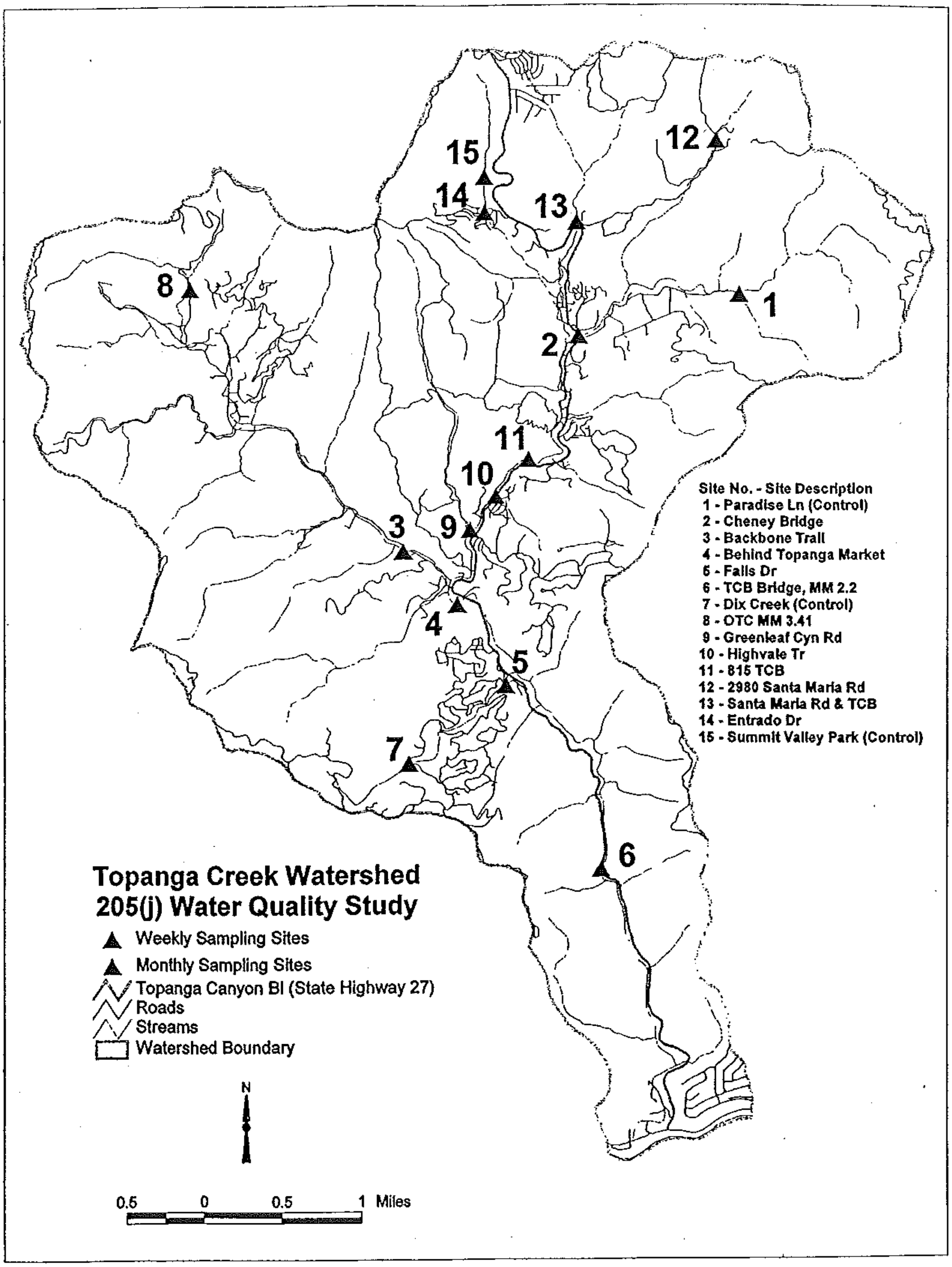


Table 1. Comparison of Bacteria Levels

Summary of Bacteria Levels at Topanga Beach, Lagoon and Site 6: TC Bridge MM2.2

Sampling	Bridge MM2.2			Topanga Lagoon			Topanga Beach		Lagoon/ocean		
Date	Tot. coliform	Fecal coliform	E. coli	Tot. coliform	Fecal coliform	E. coli	Dry	Wet	entrance	Tot. 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	nd				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	130	130	1100	240	240	F	C	open	55	26
12/18/00	500	8	8	240	240	240	F	ns	open	30	24
1/22/01	900	23	23	no data	nd	nd	A+	F	open	110	20
2/26/01	3300	3000	3000	16000	1100	1100	B	F	open	7800	6100
3/26/01	800	300	220	5000	500	800	C	F	open	300	72
4/16/01	300	30	50	500	50	30	C	F	open	20	2
5/21/01	1700	17	13	290,000	30	30	A+	ns	open	160	54
6/25/01	1700	900	900	5,000	4	4	C	ns	closed	8	3
7/30/01	170	4	2	2,100	2100	700	A	ns	closed	10	7
8/27/01	3000	23	na	1,700	700	na	A+	ns	closed	4	3
9/24/01	7	110	na	1400	300	na	A+	ns	closed	20	24
10/22/01	1400	240	na	17000	700	na	A	ns	closed		
11/26/01	9000	140000	na	1600	140000	na	A	F	open		
12/17/01			na			na	A+	F	open		

Notes:

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

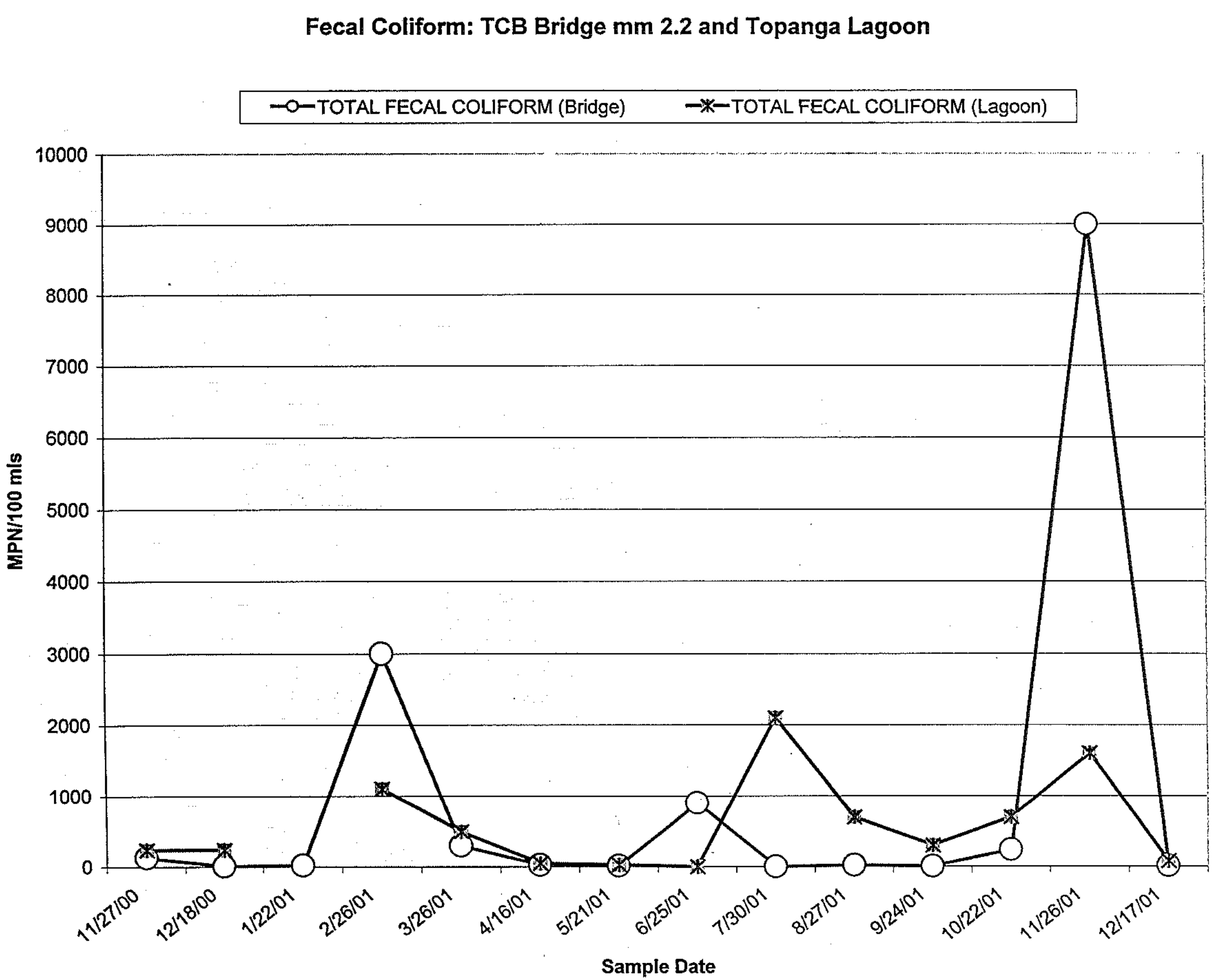
Data provided by

Heal the Bay

Beach Report Card

Collected weekly by

Hyperion


Fecal Coliform: TCB Bridge mm 2.2 and Topanga Lagoon
TOTAL FECAL COLIFORM (Bridge)
TOTAL FECAL COLIFORM (Lagoon)
MPN/100 mls
10000
9000
8000
7000
6000
5000
4000
3000
2000
1000
0
11/27/00
12/18/00
1/22/01
2/26/01
3/26/01
4/16/01
5/21/01
6/25/01
7/30/01
8/27/01
9/24/01
10/22/01
11/26/01
12/17/01
Sample Date

Locations	Jul-99	Aug-99	Sep-99	Oct-99	Nov-99	Dec-99	Jan-00	Feb-00	Mar-00	Apr-00	May-00	Jun-00
Weekly sites												
1. End of Paradise Lane	Excellent	no water	no water	no water	Good*	Good*	Good	Good*	Excellent	Excellent	Excellent	Good
2. Below Cheyney bridge- not sampled												
3. Old Topanga, Backbone Trail	Excellent	no water	no water	no water	no water	no water	Excellent	Excellent	Excellent	Excellent	Excellent	Good
4. Behind Topanga Market	Good*	Good *	Good *	Good *	Problem	Good*	Good*	Good*	Good*	Good*	Problem	Problem
5. Falls Drive, above culvert	Excellent	Excellent	Excellent	Good*	Problem	Good*	Excellent	Problem	Good*	Good*	Good*	Problem
Monthly sites												
6. Topanga Cyn. Blvd. MM2.2	Excellent	Excellent	Excellent	Excellent	Good*	Excellent	Excellent	Excellent	Excellent	Excellent	Excellent	Excellent
7. Fernwood Pacific Rd, Dix Creek	no water	no water	no water	no water	no water	no water	no water	Excellent	Excellent	Excellent	Excellent	no water
8. Old Topanga Cyn. MM 3.41	no water	no water	no water	no water	no water	no water	no water	Excellent	Excellent	Good*	Good*	Excellent
9. Greenleaf Rd, MM 0.97	no water	no water	no water	no water	Good*	no water	no water	no water	Good*	Excellent	Excellent	Excellent
10. Highvale Rd. culvert pool	Excellent	Excellent	Excellent	Excellent	Good*	Good*	Excellent	Excellent	Excellent	Excellent	Excellent	Good
11. 815 TC Blvd. below maintenance site	no water	no water	no water	no water	no water	no water	Excellent	Excellent	Excellent	Excellent	Excellent	Excellent
12. Santa Maria Rd, near oak at 2980	no water	no water	no water	no water	no water	no water	no water	Excellent	Excellent	Excellent	Good*	Good
13. Santa Maria Rd. and TC Blvd.	no water	no water	no water	no water	Good*	Excellent	Excellent	Excellent	Excellent	Excellent	Excellent	Excellent
14. Entrado Rd below culvert 0.14	Problem	Excellent	Problem	Good*	Problem	Problem	Good*	Problem	Good*	no data	Problem	Problem
15. Summit Valley Park	no water	no water	no water	no water	no water	no water	no water	Good*	Excellent	no data	no water	no water
16. Topanga Lagoon												
Criteria: Excellent - no problems												
Good - recurrent readings above limits for 1 parameter, other than total coliform												
Problematic - consistently exceeds limits for more than 1 parameter, or for fecal coliform/E. coli												
Topanga State Beach												
Heal the Bay Report Card Grade - dry	A+	A+	A+	A	A-F	D-F	A+	C	A+	B	A-F	A-B
Heal the Bay Report Card Grade -wet	ns	ns	ns	ns	C-A	ns	A+	F	F	F	F	ns
data collected by Hyperion weekly												
Control sites in bold												
* denotes bacteria counts above standards												
Potable drinking water= 0/100mL water												
Primary contact water= <200, <1000												
Secondary contact water= <1000, <5000												
AB411 standards used for beach closure												
Total coliform limit 10,000												
Fecal coliform limit 400												
E.coli limit 400												
Enterococcus limit 106												
Water considered unsafe if exceeds these limits or, the total:fecal ratio is less than 10 with a Total over 10,000												

Locations	Jul-00	Aug-00	Sep-00	Oct-00	Nov-00	Dec-00	2001 1-Jan	1-Feb	1-Mar	1-Apr	1-May
Weekly sites											
1. End of Paradise Lane	Excellent	no water	no water	Good*	Excellent	Good*	Good	Good	Excellent	Excellent	Good*
2. Below Cheyney bridge- not sampled				Good	Excellent	Good*	Good	Problem	Good	Excellent	Problem
3. Old Topanga, Backbone Trail	Excellent	no water	no water	Excellent	Excellent	Excellent	Excellent	Problem	Good	Problem	Good*
4. Behind Topanga Market	Good*	Good*	Good*	Good*	Good	Good	Good	Problem	Problem	Excellent	Problem
5. Falls Drive, above culvert	Good*	Good*	Excellent	Good	Good*	Problem	Problem	Problem	Good	Good*	Problem
Monthly sites											
6. Topanga Cyn. Blvd. MM2.2	Excellent	Excellent	Excellent	Excellent	Excellent	Excellent	Excellent	Problem	Good	Excellent	Good*
7. Fernwood Pacific Rd, Dix Creek	no water	no water	no water	no water	no water	no water	no water	Problem	Good	no water	Good*
8. Old Topanga Cyn. MM 3.41	no water	no water	no water	no water	no water	no water	Good*	Problem	Good	Excellent	Excellent
9. Greenleaf Rd, MM 0.97	no water	no water	no water	no water	Excellent	Good	Good	Problem	Excellent	Good*	Problem
10. Highvale Rd. culvert pool	Good	Good	Problem	Problem	Good	Excellent	Excellent	Problem	Problem	Problem	Good*
11. 815 TC Blvd. below maintenance site	no water	no water	no water	no water	Excellent	no water	Good	Problem	Excellent	Problem	Excellent
12. Santa Maria Rd, near oak at 2980	no water	no water	no water	no water	no water	no water	no water	Problem	Problem	Problem	Good*
13. Santa Maria Rd. and TC Blvd.	no water	no water	no water	no water	Excellent	Excellent	Problem	Problem	Excellent	Good*	Good*
14. Entrado Rd below culvert 0.14	Good*	Good*	Good*	Good*	Problem	Problem	Problem	Problem	Problem	Good*	Problem
15. Summit Valley Park	no water	no water	no water	no water	no water	no water	no water	Problem	Good	Excellent	no water
16. Topanga Lagoon					Problem	Problem	no data	Problem	Problem	Excellent	Good*
Criteria: Excellent - no problems											
Good - recurrent readings above limits for 1 parameter, other than total coliform											
Problematic - consistently exceeds limits for more than 1 parameter, or for fecal coliform/E. coli											
Topanga State Beach											
Heal the Bay Report Card Grade - dry	A+	A+	A+	A	A-F	D-F	A-F	B-C	A-C	C	A+
Heal the Bay Report Card Grade -wet	ns	ns	ns	F	C	C	F	F	F	F	ns
data collected by Hyperion weekly											
Control sites in bold											
* denotes bacteria counts above standards											
Potable drinking water= 0/100mL water											
Primary contact water= <200, <1000											
Secondary contact water= <1000, <5000											
AB411 standards used for beach closure											
Total coliform limit 10,000											
Fecal coliform limit 400											
E.coli limit 400											
Enterococcus limit 106											
Water considered unsafe if exceeds these limits or, the total:fecal ratio is less than 10 with a Total over 10,000											

Summary of Heavy Metals Data during storm events for Topanga Creek

* = control site

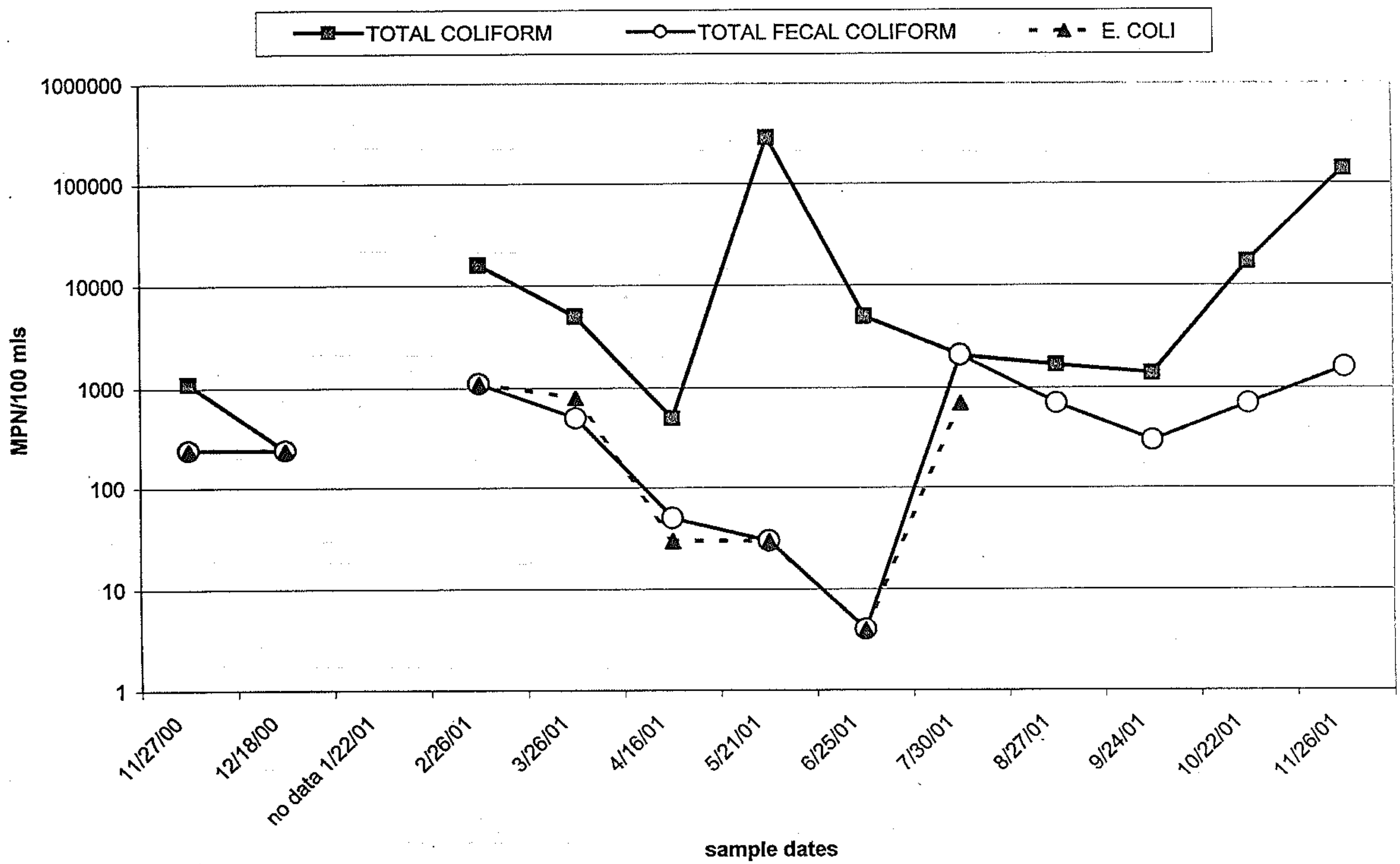
all data are in units of ug/l

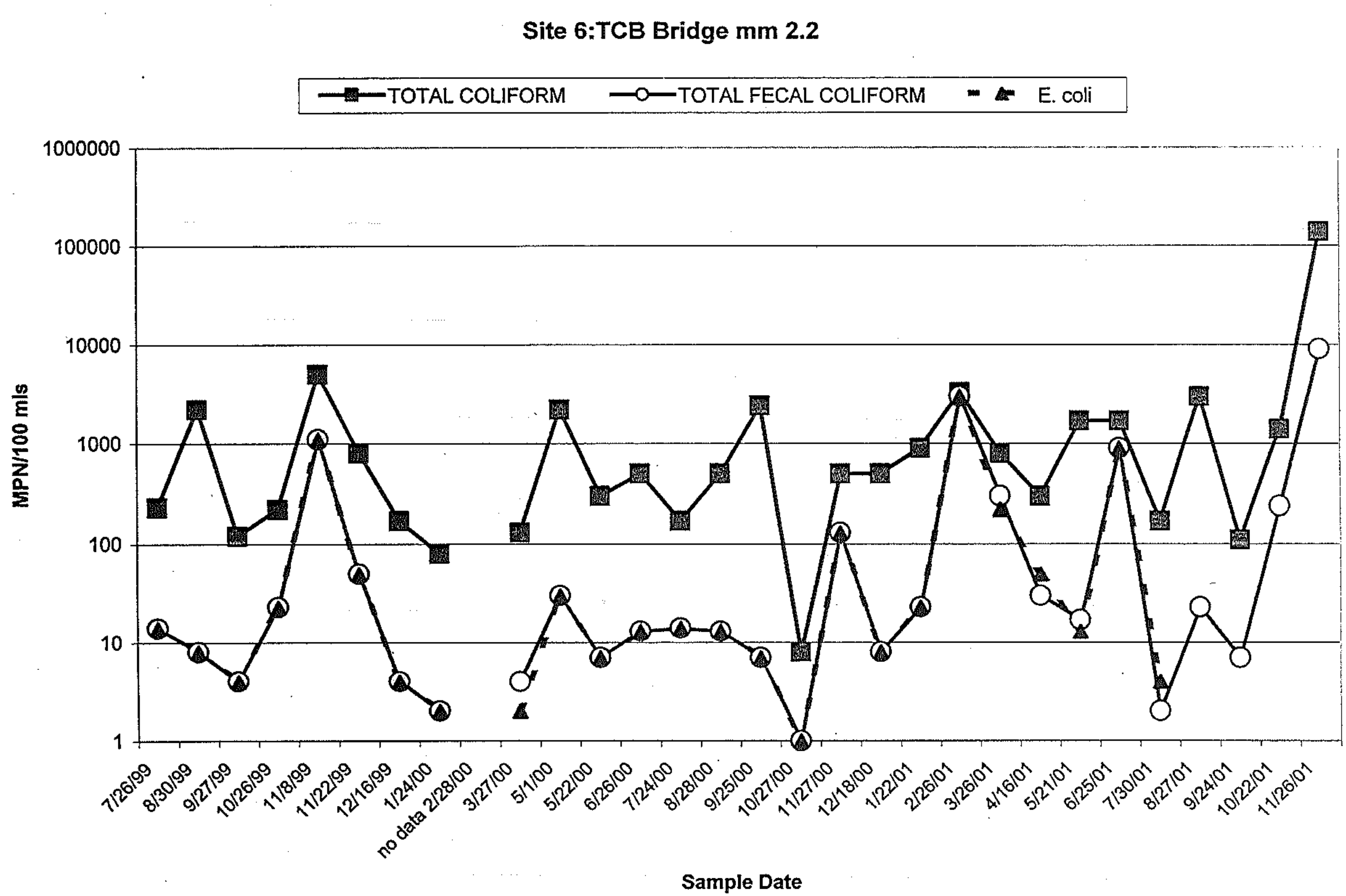
Not all sites had water at each storm event.

ND = below detectable limit

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		

Site 16:Topanga Lagoon




Site 6:TCB Bridge mm 2.2
TOTAL COLIFORM
TOTAL FECAL COLIFORM
E. coli
1000000
100000
10000
1000
100
10
1
MPN/100 mls
7/26/99
8/30/99
9/27/99
10/26/99
11/8/99
11/22/99
12/16/99
1/24/00
no data 2/28/00
3/27/00
5/1/00
5/22/00
6/26/00
7/24/00
8/28/00
9/25/00
10/27/00
11/27/00
12/18/00
1/22/01
2/26/01
3/26/01
4/16/01
5/21/01
6/25/01
7/30/01
8/27/01
9/24/01
10/22/01
11/26/01
Sample Date

APPENDIX B

SUMMARY OF EROSION AND SEDIMENT DELIVERY REPORT FOR THE TOPANGA CREEK WATERSHED

Topanga Creek Watershed

Erosion and Sediment Delivery, 2000-2001

Antony R. Orme, Amalie Jo Orme and Kimberly A. Saunders

Executive Summary

This study discusses the nature and magnitude of erosion and sediment yield in the Topanga Creek watershed, southern California, during the 2000-2001 water year and makes recommendations for the future management of the system. Constrained mostly to public land and to one water year, and limited by available resources, the study nevertheless presents a large amount of new information regarding the physical system, pertinent to future management and restoration efforts within the watershed.

Topanga Creek watershed covers about 50 km^2 of the central Santa Monica Mountains, and breaches the active anticlinal axis of these mountains in an antecedent stream that reaches Santa Monica Bay in a small fan delta. The upper basin is relatively open although streams become increasingly incised downstream. The lower basin is narrow and deeply incised by lower Topanga Creek. The watershed is underlain by late Cretaceous through Miocene bedrock, coarsely clastic in the south, becoming finer toward the north, which began emerging from the ocean in late Miocene time. Over the past 125 ka, the watershed has continued to rise at a mean rate of 0.30 m ka^{-1} in response to seismic and aseismic forcing.

Hydroclimatic forcing of the geomorphic system reflects the Mediterranean-type climate regime - warm wet winters typified by episodic rainfall/runoff events, mass movement, and unpredictability; warmer dry summers typified by dry ravel. Vegetation filters the effect of hydroclimatic impacts on hillslope and stream processes. Chaparral and coastal sage vegetation covers 75% of the watershed, woodland and woodland-savanna a further 10%. Burrowing mammals make large amounts of soil available for erosion. Fire also affects erosion by consuming vegetation, most recently in the fire of autumn 1993. Human disruption of the watershed is considerable - from single family homes, roads and trails, and imported water. Human impacts have changed the playing field for erosion and sediment delivery.

In terms of methodology, erosion and sediment yield were investigated in three spatial systems - hillslopes, roads, stream channels, and river mouth - and also observed along major roads. The spatial systems form an erosional-depositional cascade in which sediment eroded from hillslopes may move to tributaries, thence to the mainstream, and eventually to the sea. However, there are ample opportunities for storage within the

cascade. Very rarely does hillslope sediment reach a tributary stream in one event, except where debris flows occur, while storage within stream channels and the estuary postpones delivery to the sea. Sampling schemes were designed to capture as much information as possible about these systems.

On hillslopes, which represent 99% of the basin and thus have by far the highest erosion potential, erosion and sediment yields were sampled using 40 erosion sites in 6 locations. These sites were stratified by slope declivity, slope aspect, vegetation, and substrate. Sediment captured by downslope troughs was collected between 10 and 19 times throughout the year, bracketing rainfall/runoff events, and then dried, examined, and weighed. This gave a mean daily sediment yield in g m^{-2} d^{-1}, and by extrapolation a value for comparative denudation analysis. The resulting data revealed considerable noise. In general, highest erosion rates (4-14 g m^{-2} d^{-1}) occurred during and shortly after rainfall/runoff events on steep, north- and west-facing slopes underlain by coarse clastic sediment only partially protected by chaparral and coastal sage recovering from fires over the past 15 years. This is partly predictable but the inability of chaparral and associated plants to protect slopes several years after a fire is surprising. Lowest erosion rates (0.03-0.3 g m^{-2} d^{-1}) occurred throughout the year on low, south- and east-facing slopes on fine clastic substrate and covered by grassland and oak savanna. Such sites afford excellent canopy protection and soil cohesion against rainsplash erosion and overland flow under low intensity rainfall/runoff events. However, this result is misleading because grassland sites, notably those covered by dense shallow root mats of alien grasses, become unstable at higher rainfall intensities, leading to debris flows. Rainfall intensities during the 2000-2001 water year only neared the threshold intensity required to trigger debris flows for four hours - in the later evening of 10 January, 2001, and little happened beyond small debris flows along the northern interfluve. Oak woodland sites generated higher yields because, with a more continuous canopy, grassland disappears and oak litter only partially protects bare soil.

No fire consumed watershed vegetation during the study period, so there could be no direct assessment of the effects of fire on erosion and sediment yield. However, the higher yielding sites were those where chaparral/coastal sage vegetation had burned most recently, notably in the Old Topanga fire of November 1993. Although other factors influenced these high yields, this confirms that the more intense fires lead to increased erosion under post-fire conditions. The upper Garapito basin, spared fire for 40 years and containing a dense vegetal canopy and abundant fuel, should be managed with great care, especially because its creek is an effective sediment delivery system.

Debris flows as a distinct category of hillslope processes, can be predicted for winters with more frequent, intense, and persistent rains, especially on steep slopes unprotected by vegetation, covered by alien grasses, underlain by mudstone and claystone which may then reach their yield limits. Debris flows are important because they quickly yield abundant sediment to stream channels, thereby transforming normal floods into non-Newtonian (Bingham) flows with potentially devastating consequences. Deep-seated landslides and rotational slumps were not a significant factor during the 2000-2001 water year but many pre-existing landslides, notably adjacent to streams in the central basin, remain near the threshold for slope failure. Their hydrologies and vegetation cover, together with human imprints from septic tanks and road drainage, should be managed with care.

Variable erosion rates imply that longer-term denudation within the watershed will also vary. Extrapolating sediment yield into annual mass wastage indicates surface denudation ranging from a low of 0.004 m ka^{-1} to a high of 1.88 m ka^{-1}. Rates exceeding 0.30 m ka^{-1} exceed the mean rate of tectonic uplift. *In extremis*, the highest rates would reduce the basin to sea level in <150 ka, or little more than a glacial-interglacial cycle. Whereas this is unlikely to occur, denudation rates in excess of 0.30 m ka^{-1}, notably on 30° slopes, on coarse clastic substrate, and under recently burned chaparral, pose a major challenge for watershed management. The erosion potential of the watershed is defined in terms of eight morpholithogical units, each characterized by relatively distinct erosion and mass movement signatures, and by sediment yield within a predictable range of calibers.

Roads were investigated because of the perception that road berms yield abundant sediment to streams during rainfall/runoff events. It proved impossible to instrument these berms but paved roads were observed repeatedly during the study period. Along Topanga Canyon Boulevard and Old Topanga Road, which together have a margin length of over 42 km, small berms comprise 29% of total margin, medium berms 8%, large berms 3%, cut banks 46%, and the remainder is open frontage. There are also 80 official culverts along these roads.

Road berms were subject to frequent reworking by highway authorities and private property owners before, during, and after rain events. During rain events they were also prone to surface erosion and their outer rims to occasional failure. However, the root causes of perceived berm problems lie in road construction and maintenance. Within the Topanga Creek watershed, road construction usually involves the need, first, to cut into hillslopes and fill the outside slope in order to provide a sufficiently wide right-of-way and, second, to provide adequate drainage for the impermeable road surface, including the provision of side ditches, culverts and downspouts. Both during and after heavy rains, cut banks along most roads yield surface flows, seepage waters, mud and coarser debris. Cut banks may also fail in landslides and rotational slumps. These cut banks are the primary source of sediment reaching road surfaces. Thus, for reasons of safety and trafficability, such debris is removed expeditiously by the highway authorities to outside berms and, where abundant, either trucked from the problem site or dumped into nearby stream channels.

Further, certain stretches of road, especially in the narrow lower canyon, have been constructed beneath high unstable cliffs on the inner side, and perilously close to creek banks on the outer side, the latter often requiring protection by riprap and other devices. Such protection in turn deflects stream energy and generates problems nearby.

Elsewhere, often on public lands far removed from paved roads, many fire roads and recreational trails are yielding to accelerated erosion, gullied by inadequate drainage and poorly placed culverts, eroded by hikers, bikers and hooves, and poorly maintained, if at all.

Such erosion and sediment yield problems, whether they be along paved roads or hiking trails, are seemingly the price paid for access, recreation, and fire control. If the watershed had neither residents, nor visitors, nor commuters, nor any need for fire protection, there would be no need for roads and trails. Existing roads could be put to bed. More realistically, given the human clamor for roads, every attention should be given to best management practices, from paved roads to trails. This should begin with careful maintenance of cut banks and landslide reaches by highway authorities and property owners alike. The number of culverts could also be increased to shorten reach length contributing drainage to individual culverts. Cut banks rather than berms are the principal source of debris. Small berms are commonplace and relatively harmless, large problem berms are a small percentage of the total and could be modified or removed. However, as long as the Topanga Creek watershed caters for people, road problems are unlikely to disappear.

Erosion and sediment delivery in stream channels were investigated by recognizing 23 reaches at 9 locations for initial observation and then selecting 18 of these for repeat survey during the water year. Of these 18 reaches, 8 were along the mainstem of Topanga Creek, the remainder on Santa Maria (1), Garapito (3), Greenleaf (1), Red Rock (2), and Old Topanga (3) creeks. The hydraulic geometry of these reaches was computed for successive survey intervals and a value of net scour or fill computed for each interval. Incidental kinematic variables and suspended load were measured, and bedload sampled, when time and conditions permitted. Discharge data from the Topanga gauging station, near the Route 27 road bridge 3 km from the ocean, were also considered.

Following the 70-day autumn dry spell ending 7 January, channel reaches were subject to frequent changes during winter 2001, during and after larger hydrograph peaks. As a result of mid-January flows, the largest of the water year, the upper reaches showed net scour, the middle reaches net deposition, and the lower reaches net scour. Later, in February, the pattern became more complex as discrete slugs of sediment were remobilized and then redeposited farther downstream. By mid-March, scour had again returned to much of the system, which then desiccated and stabilized. No channel reaches showed persistent fill and only one reach showed persistent scour, namely the reach immediately downstream of the Topanga Creek confluence with Old Topanga Creek. Channels were re-examined for bank failures and change during spring and summer 2001, but little change was observed.

Observed patterns of scour and fill are explained by the greater delivery of water and sediment to streams from hillslopes and channel banks in the upper basin, followed by deposition in the reduced stream gradients of the middle basin above the Topanga-Old Topanga confluence, and then scour farther downstream. Furthermore, the pulsing nature of sediment delivery and the stochastic storage patterns observed within the middle basin ensured that measured suspended sediment data were not readily equated with reality. Such are the gradients of lower Topanga Creek and its tributaries that sediment reaching Topanga village, and especially the head of the main canyon near Fernwood, moves through to the estuary runout zone with little to impede it.

Garapito and Santa Maria creeks emerged as major contributors of suspended and bedload sediment during the study period, especially upstream from their confluence. Several coarse clastic depositional lobes were found in lower Garapito Creek and in the mainstem of middle Topanga Creek. These lobes were probably related to friction-dominated debris flows with a strong sediment-support matrix, or to transitional liquefied flows in which sediment was partially supported by escaping pore fluids until dewatering occurred. There is thus a probable hazard from Bingham-type flows, as well as from Newtonian viscous flows, in these reaches. Santa Maria Creek yielded mostly fine clastic sediment. The Old Topanga Creek system, including Red Rock Creek, was a far less active erosion and sediment delivery system during the study period, probably because flows were less and channels were better stabilized by riparian woodland and engineering structures. However, a large quantity of loose hillslope sediment remains stored within this system and will likely be mobilized in future high magnitude storm events.

Over the longer term, the Topanga Creek watershed appears to be experiencing a change in stream regime. Along many reaches, floodplains are being incised and channel banks appear less stable, for example in Upper Topanga, Garapito, and Santa Maria creeks. Whereas these changes could be attributed to climatic change crossing hydrodynamic thresholds, there is no compelling evidence to support this. More likely, the impact of discharged imported water, concentrated road runoff, vegetation conversion, and other land-use changes have combined to disrupt the system inherited from earlier times. Morphological evidence suggests that this change in regime began about 30 or 40 years ago.

The river mouth, between the Pacific Coast Highway Bridge and Santa Monica Bay, was the focus of repeat surveys during the 2000-2001 water year. These surveys captured the essential morphodynamics of the two phase system, and related observed changes to hydrodynamic forcing by fluvial discharge, wave climate, and changing ocean levels. In essence, the river mouth is protected from high wave energy by its sheltered location in Santa Monica Bay, by the effect of the fan delta on wave refraction, and by limited tidal range. Thus for most of the year, the river mouth exists as a modestly wave-dominated barrier-lagoon system. Under these circumstances, the barrier remains intact and the lagoon gains water from low stream discharge, wave overwash and influent tidal seepage, and loses it by effluent seepage and evaporation. With positive budgets, the lagoon may rise to a threshold whereby it spills seaward but the overall integrity of the barrier is not jeopardized. While the barrier is closed, however, the lagoon generally atrophies from suspended and dissolved fluvial sediment inputs, wave overwash, aeolian sand, human interference, and eutrophication.

In contrast, during high streamflow events, Topanga Creek breaches and removes the barrier along a 60-80-m wide front. For a few hours, depending on the magnitude of the discharge, the constraining highway bridge generates a fully turbulent jet with great erosive capacity. Thereafter, the sediment flushed seaward at this time soon transforms the river mouth into a friction-dominated estuary characterized by a complex of middle-ground bars which progressively restrict the outflowing recessional discharge.

Finally, the following recommendations are made regarding the erosion and sediment delivery system of the Topanga Creek watershed.

1. Hillslopes should be managed to minimize accelerated erosion, sediment yield and mass movement, particularly with respect to vegetation cover, fire policy, and steep erodible slopes near stability thresholds.

2. Roads and trails should be managed with respect to reducing cut-bank and berm erosion, drainage needs, and restoration of gullied trails.

3. Stream channels should be managed as natural systems, implying as far as possible the removal of extraneous debris and inappropriate structures, provision for healthy riparian vegetation and effective erosion control, and special concern for stream segments prone to persistent erosion.

4. The river mouth should be managed for recreational safety and appropriate surf break. Beach erosion cannot be resolved based on Topanga Creek sediment inputs alone.

5. Lagoon restoration is feasible but the physical constraints on restoration, particularly the nature of water and sediment budgets in a restored system and the need for adequate circulation, should be incorporated into restoration goals.

6. Studies of watershed erosion and sediment yield should continue, aided by improved instrumentation and technical infrastructure. In this way, the momentum developed in this study can be maintained and the Topanga Creek watershed can come to serve as a model for small basin analysis.

APPENDIX C

SUMMARY OF COMPREHENSIVE NUMERICAL MODELING RESULTS

APPENDIX C:

SUMMARY OF COMPREHENSIVE NUMERICAL MODELING RESULTS

FOR

TOPANGA CREEK WATERSHED AND LAGOON RESTORATION

FEASIBILITY STUDY

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April 29, 2002

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FIGURES

TABLES

1.0 INTRODUCTION

This Appendix presents results of comprehensive modeling. The overall study objective is to identify problems within the watershed adversely affecting the lagoon and creek environment, to design concept alternative solutions, and test the alternatives using modeling. Numerical modeling was performed for existing and future conditions of hydrology, hydraulics and sediment transport. Water quality was quantified analytically.

Numerical modeling of creek and lagoon hydrology, hydraulics and sediment transport is complete and can be applied to quantify the performance of the alternatives for creek and lagoon flows. Due to results of review of available data and data constraints, numerical modeling of water quality was replaced with analytical modeling (dilution calculations of bacteria levels) to predict future bacteria levels of the alternatives. That effort is complete and can be used to assess the performance of each alternative relative to one another and to state water quality standards.

Data limitations of modeling included stream discharge records, suspended sediment concentrations and sediment grain size. The stream discharge records were incomplete for years prior to water year 1997. From 1997 to the present, short-interval stream discharge records exist for the gage downstream at the bridge at milemarker 2.2. These data were used for the modeling. Also limiting were data of sediment concentrations during flows. It was assumed at the onset of this study that the Topanga Creek Erosion and Sediment Delivery Study would provide data sufficient to predict sediment yield from the watershed. Those data were not available within the time frame expected, so suspended sediment data taken by the Resource Conservation District of the Santa Monica Mountains were used to establish the relationship between flows and sediment transport. Finally, sediment grain size data were limited to one sample taken from the confluence and to visual estimation of the gradation of the stream reach to characterize existing bed conditions for modeling.

Although limiting, these data were sufficient to quantify hydraulic and sediment transport processes of the watershed at the first order. The results are useful for planning and analysis of the performance of alternatives relative to each other and to existing conditions.

2.0 SCOPE OF WORK

The following tasks comprised the engineering scope of work.

1. Attend site visit;
2. Attend modeling parameters meeting;
3. Collect and review existing data;
4. Identify opportunities and constraints;
5. Model existing conditions;
6. Analyze three alternative lagoon configurations;
7. Quantify runoff relative to land use and brushfire events;
8. Evaluate man-induced constraints on the creek/lagoon system;
9. Provide digital data for an ArcView GIS system;
10. Integrate associated studies;
11. Identify a phased approach to implementation;
12. Present results and
13. Prepare draft and final reports.

The main body of the Feasibility Study report presents results of tasks 1, 3, 4, 5, 6, 8, 10, 11, 12 and 13. This appendix presents more detail of progress on tasks 2, 3, 5 and 6. Task 9 is in the final stages of completion.

3.0 MODEL SELECTION AND DESCRIPTION

3.1 MODEL SELECTION

The MIKE model was selected for application to this task because it can perform comprehensive modeling of the entire watershed system. The MIKE model "suite" includes programs to model hydrology, hydraulics, sediment transport and water quality in an integrated fashion. It also models a dynamic-state stream system, defined as a stream with a varying upstream inflow discharge, a constantly varying downstream tidal elevation at the ocean, and ebbing and flooding tides through the mouth. Finally, MIKE provides an integrated interface to GIS. For these reasons, MIKE is considered superior to other available models for this project.

3.2 MODEL DESCRIPTION

The MIKE-11 modeling suite, which includes MIKE-11-RR (Rainfall Runoff), MIKE-11-HD (Hydrodynamic model), MIKE-11-ST (Sediment Transport), and MIKE-11-GST (Graded Sediment Transport), was selected for modeling of the hydrology, hydraulics and sediment transport at Topanga Lagoon, Topanga Creek and Topanga Watershed. The MIKE-11 model has an integrated modular structure with all modules required for this project. The modular structure offers great flexibility as:

- Each module can be operated separately;
- Data transfer between modules is automatic;
- Coupling of physical processes (e.g. river morphology, sediment re-suspension, and water quality) are facilitated; and
- Updating or expansion of existing installations with renewed or additional modules is simple.

In addition, MIKE-11-HD (the hydrodynamic model) as detailed in the following section is able to simulate flow conditions ranging from steep river flows to tidally influenced estuaries. Also, the MIKE-11-RR module can predict continuous hydrography over time.

3.2.1 MIKE-11 Model Overview

MIKE-11 is a professional engineering software package for the simulation of flows, water quality and sediment transport in estuaries, rivers, irrigation systems, channels and other water bodies. It is a dynamic, one-dimensional modeling tool for the detailed design, management and operation of both simple and complex river and channel systems. Because of flexibility and speed, MIKE-11 provides a complete and effective design environment for engineering, water resources, water quality management and planning applications.

MIKE-11 was more suited to comprehensive stream modeling than piece-meal use of models such as HEC-2 and HECRAS, Better Assessment Science Integrating Point and Nonpoint Sources (BASINS), Agriculture Nonpoint Source Model (AnnAGNPS), Stormwater Management Model (SWMM), Hydrologic Simulation Program Fortran (HSPF), and/or the Storage, Treatment, Overflow, Runoff Model (STORM) developed by others. Use of several separate models presents problems of data and program compatibility, and can increase the modeling effort and decrease the accuracy of results.

3.2.2 Hydrodynamic Module (HD)

The HD module of MIKE contains an implicit, finite difference computation of unsteady flows in rivers and estuaries. The formulations can be applied to branched and looped networks and quasi two-dimensional flow simulation on flood plains. The computational scheme is applicable to vertically homogeneous flow conditions ranging from steep river flows to tidally influenced estuaries. Both subcritical and supercritical flow can be described by means of a numerical scheme, which adapts according to the local flow conditions.

The complete non-linear equations of open channel flow (Saint-Venant) can be solved numerically between all grid points at specified time intervals for given boundary conditions. In addition to this fully dynamic description, a choice of other flow descriptions is available, such as:

- High-order, fully dynamic;
- Diffusive wave;
- Kinematic wave; and
- Quasi-steady state.

Within the standard HD module advanced computational formulations enable flow over a variety of structures to be simulated.

3.2.3 Rainfall-Runoff Module (RR-NAM)

In addition to the provision of boundary conditions at model boundaries, the description of rainfall and associated runoff is often a key element in setting up a MIKE-11 simulation. The rainfall-runoff (RR) module contains three different models that can be used to estimate catchment runoff. The NAM model was used in this project study

NAM is a lumped parameter, conceptual rainfall-runoff model simulating overland flow, interflow and baseflow as a function of the moisture content in each of the following four mutually interrelated storages:

- Snow storage;
- Surface storage;
- Root zone storage; and
- Groundwater storage.

In addition, NAM allows treatment of man-made interventions in the hydrological cycle such as irrigation and groundwater pumping.

3.2.4 Sediment Transport Modules (ST and GST)

The non-cohesive sediment transport module (ST) can be used to study the sediment transport and morphological conditions in rivers. The features include:

- Five models for the calculation of sediment transport capacity: Engelund-Hansen, Ackers-White, Engelund-Fredsøe, van Rijn and Smart Jeaggi;

- Sediment description by an average particle size and standard deviation of the grain size distribution;
- Morphological (with feedback via sediment continuity and bed resistance) models; and
- Output of sediment transport rates, bed level changes, resistance numbers and dune dimensions.

The MIKE-11-GST is an add-on module for the simulation of graded sediment transport, in which the bed material is represented by two layers: an active layer overlying an inactive, passive layer. Each layer is divided into an equal number of fractions specified by the user. A mean grain size for each fraction and the percentage distribution for both the active and the passive layers must be specified. The fraction mean grain sizes are global but the initial percentage size distributions may be specified globally or locally. It is possible to specify a lower limit for the active layer depth and an initial depth for the passive layer. The effects of shielding can also be included in the simulation.

4.0 MODEL DEVELOPMENT

Universal Transverse Mercator (UTM) zone-11 coordinates, Mean Sea Level (MSL) vertical datum and metric units were used in the MIKE-11 modeling. The modeling results were presented in standard units.

The MIKE-11 model has an integrated modular structure, the hydrodynamic and hydrological models are coupled and modeled simultaneously. The runoff generated by the MIKE-11-RR model in each individual sub-watershed is merged into the creek network either at the outlet of the sub-watershed or in the reach where the creek intersects the sub-watershed. After the flow merges into the creek, the flow is routed downstream through the stream network by the hydrodynamic model MIKE-11-HD. With the HD and RR coupled model, the time of concentration from sub-watershed to the stream gage can be more accurately estimated. This is especially important for steep creeks like Topanga Creek. The peak flow rate will be overestimated if the flow rates calculated by the Rational Method for each sub-watershed are simply superimposed upon one another.

4.1 MODELING AREA

4.1.1 Hydrologic and Hydraulic Modeling Area

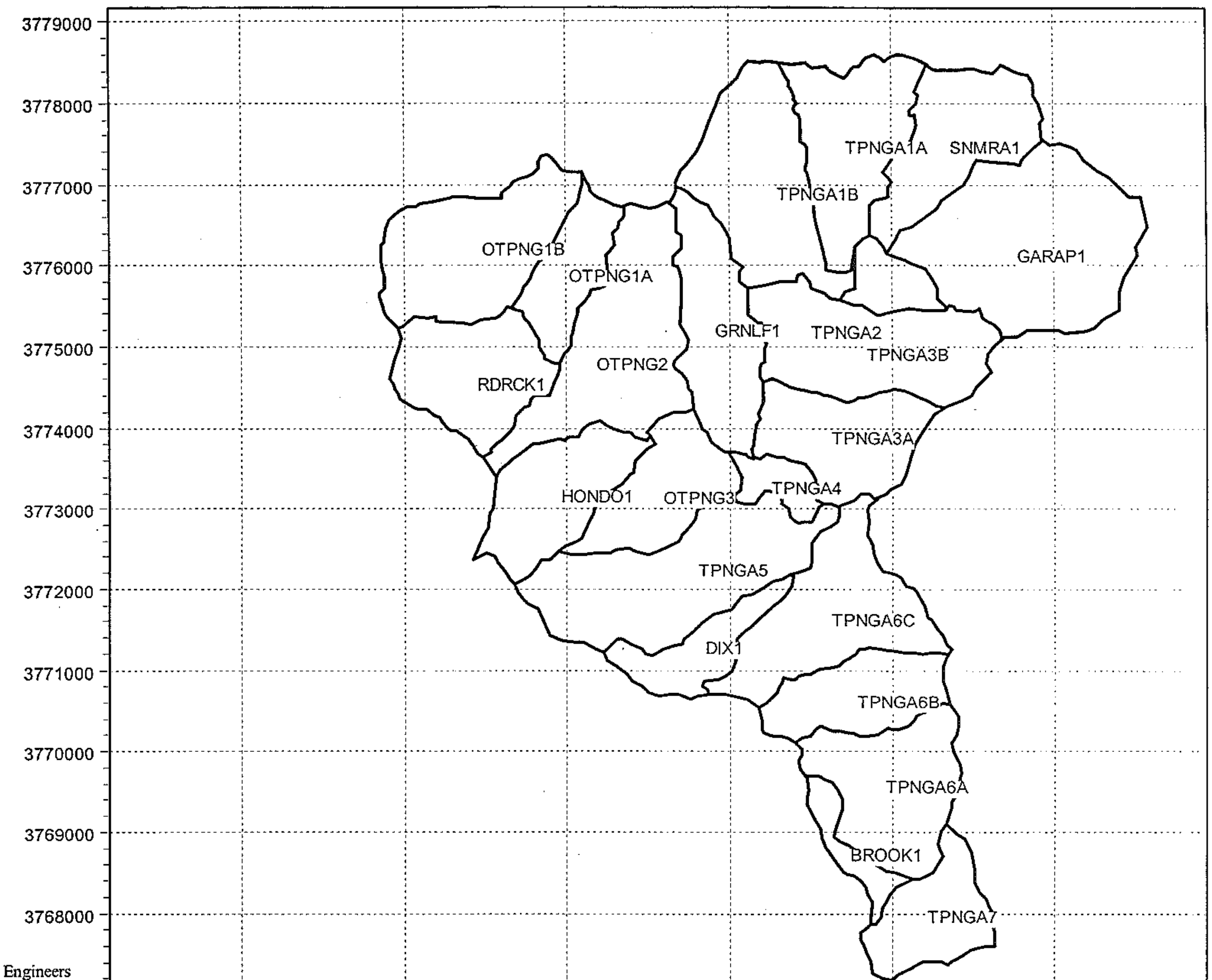
The modeling area includes the entire Topanga Creek watershed, major creeks and the lagoon. The entire watershed is delineated into 22 sub-watersheds as shown in Figure C-1. The major creek networks together with sub-watersheds are shown in Figure C-2. The topography of creek networks was characterized by 124 cross-sections as shown in Table C-1. The total number of cross-sections is limited by the time required for digitizing the topographical data and model running time.

The model calculates the discharge in each cross-section of each individual sub-watersheds. The water level and depth is calculated between cross-sections, and the flow velocity is calculated at both the cross-sections locations and also between the cross-sections.

Table C-1 Creek Cross-Sections

Creek Reach	Number of Cross Sections
Lagoon	8
PCH Bridge to Stream Gage	30
Stream Gage to Confluence	24
Old Topanga Creek	19
Topanga Creek above Confluence	32
Garapito Creek	11
Total	**124**

The cross-sectional data used in the model setup were provided by various agencies. The Los



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Draft, February 2002
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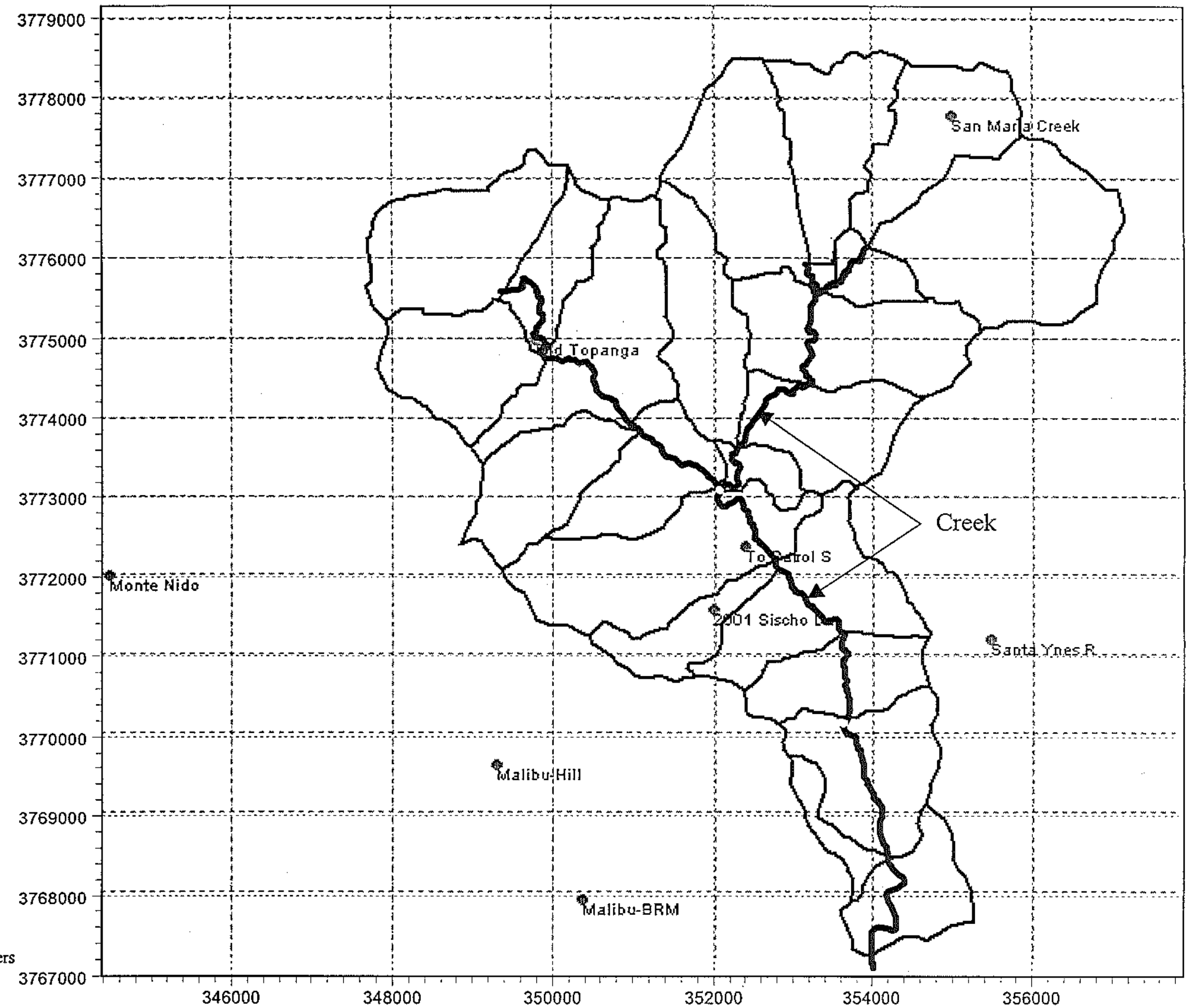
Topanga Lagoon & Topanga Creek Watershed Restoration Feasibility Study	WATERSHED DELINEATION MAP	Figure C-1



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Topanga Lagoon & Topanga Creek Watershed Restoration Feasibility Study

HYDROLOGIC AND HYDRAULIC MODEL SETUP

Figure C-2

Angeles County Department of Public Works (LACDPW, 2001) provided the topographical maps for Topanga Creek, Lagoon and Old Topanga Canyon (OTC) creek with the RCDSMM also providing data for OTC. The RCDSMM (RCD) provided lagoon underwater mapping and cross-sectional data collected during the habitat mapping study for Topanga Creek from north of PCH nearly to the main confluence. Professor Orme of UCLA provided lagoon topographic mapping and cross-sectional data at four locations on creeks. The topographical data inventory is shown in Table C-2.

Table C-2 Topographic Data Inventory

Data	Purpose	Source	Form	Dates
Topanga Beach Topography	Model setup and lagoon alternative development	LACDPW	Hardcopy	1985 survey
Topanga Lagoon Topography	Model setup and lagoon alternative development	UCLA	Hardcopy	December 2000 survey
Topanga Lagoon Bathymetry	Model setup and lagoon alternative development	RCDSMM	Hardcopy	September 2001 survey
Topanga and Old Topanga Creek Topography	Model setup and design of upstream improvements	LACDPW	Hardcopy[1]	1984 and 2000 surveys[2]
Topanga Creek wet Cross-Sections	Model setup and topographic verification	RCDSMM	Hardcopy	Winter 2000[3]
	Model setup	RCDSMM	Hardcopy	July 2001[4]

1. Topographic data between north of PCH and upstream of the stream gage were converted to digital by California Department of Parks and Recreation and Moffatt & Nichol Engineers.
2. A small portion of the Topanga creek near the Lake Topanga was surveyed in 2000, and the digital topography was provided.
3. Four sections: stream gage, main confluence, Lake Topanga and Garapito bridge.
4. From north of PCH to 19,000 ft upstream.

The modeling area for lagoon alternative comparison extends from (and includes) the lagoon to the stream gage at milemarker 2.2 such that the recorded flow rate at the stream gage can be used as the model input.

4.1.2 Sedimentation Modeling Area

The sedimentation modeling area extends from (and includes) the lagoon to the confluence of mainstem Topanga Creek and Old Topanga Creek. The sediment transport rate and bed elevation changes are calculated in each cross-section. From north of PCH to the main confluence, 16 additional cross-sections were interpreted from the cross-sectional data listed in Table C-1 to factor in the variations of the bed material grain sizes from section to section.

4.2 MODEL BOUNDARY CONDITIONS

4.2.1 Hydrology and Hydraulics

The main model input data are precipitation data recorded in the watershed and its vicinity, potential evapotranspiration rates of the watershed, water levels (tides while the inlet is open) in the lagoon and at the stream gage. The precipitation data used are detailed in Section 5.1.1. The monthly mean potential evapotranspiration rate in the watershed was downloaded from the web site of the California Irrigation Management Information System (CIMIS, 2001) at Santa Monica Station (#99), which is the closest station to the watershed. The water levels at the ocean boundary were downloaded from the web site of the Center for Operational Oceanographic Products and Services (CO-OPS, 2001) of the National Ocean Service at Santa Monica prediction station (#9410840). Stream flows recorded in the Topanga stream gage by the LACDPW were used as model upstream boundary input in simulating the lagoon alternatives and the performance of upstream improvements. The stream flows recorded by the LACDPW and the water depth measured at various locations by the RCDSMM were used as the model calibration data.

4.2.2 Sedimentation

The sedimentation modeling requires sediment transport rate input at all open boundaries where there is inflow. The MIKE-11-RR model calculates local sub-watershed inflows in Topanga Creek downstream of the main confluence and directly inputs results into the HD model. However, sediment erosion from the lower watershed between the lagoon and the main confluence is not considered in the sedimentation modeling since sediment is mainly contributed to the creek from erosion in the upper watershed per the Topanga Creek Erosion and Sediment Delivery Study (Orme, et al. 2002). The estimation, as well as the check of the sediment transport rate at the model upstream boundary (the main confluence), is detailed in the following paragraphs.

Sediment Transport Rate Estimation: The measured sediment transport rate or sediment delivery rate at the main confluence is not available. The total suspended solids (TSS) measured by the RCDSMM for their water quality study and the estimated flow rate at the confluence were used in estimating the sediment transport rate. The estimation procedures are as follows:

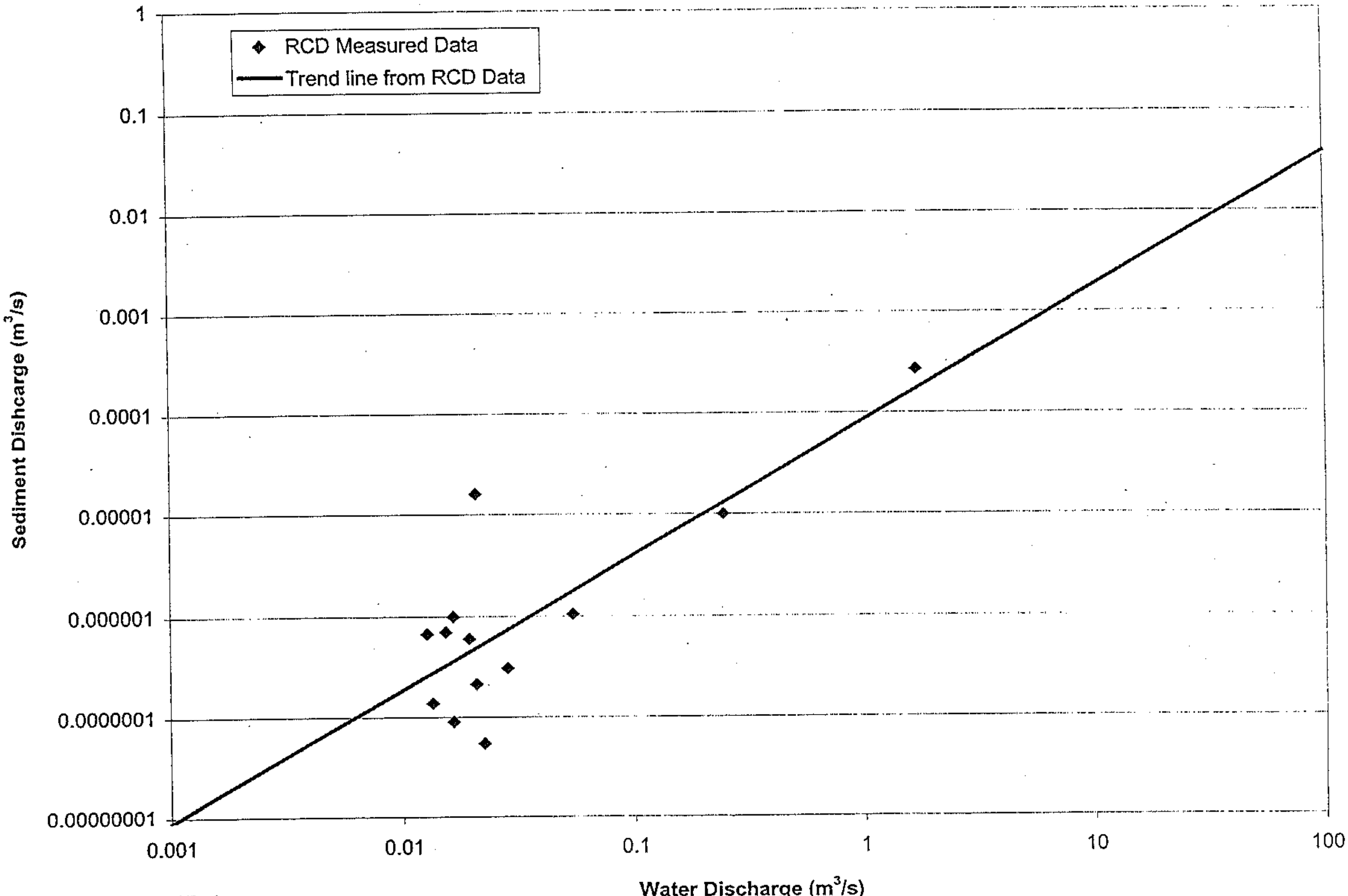
a) Estimate the flow rates at the time when the TSS samples were taken. The mean ratio of the flow rate at the stream gage versus that at the main confluence is 1.15 based on data predicted by MIKE-11-HD model. The ratio of the watershed area upstream of the stream gage versus that upstream of the main confluence is 1.27. The average of these two ratios is 1.21 and was used in estimating the flow rate at the confluence.

b) Construct a power law relationship ($Q_s=aQ^b$) between the sediment transport rate Q_s and the flow rate Q by using regression methods. Figure C-3 shows the fit between the developed curve and the data.

c) Calculate Q at the confluence by dividing the flow rate recorded at the stream gage by the ratio estimated in step a) above.

d) Then, calculate the sediment transport rate Q_s at the confluence by using the relationship developed in step b) above.

Check of Estimated Sediment Transport Rate: The hillside erosion data collected by the Topanga Creek Erosion and Sediment Transport Study was used as a check. The average sediment yield rate due to the hillside sediment erosion under a 4-year storm event between two consecutive data collection periods was calculated from data provided in the Topanga Creek Erosion and Sediment Transport Study. The pre-storm and post-storm data were collected on January 5, 2001 and January 12, 2001, respectively. The total sediment yield of the entire watershed over the seven-day period was then estimated from these data.



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Draft, February 2002
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Topanga Lagoon & Topanga Creek Watershed Restoration Feasibility Study

DATA FIT OF PREDICTED SEDIMENT TRANSPORT RATE VERSUS THAT MEASURED AT THE MAIN CONFLUENCE

Figure C-3

Alternatively, the total sediment transport volume at the main confluence over the same seven-day period was calculated from the sediment transport rate Q_s calculated based on method detailed above in step d. It was found that the sediment transport volume estimated from the TSS at the main confluence is about 16.5 percent of the total hillside sediment erosion estimated from the Erosion and Sediment Delivery study. This is very close to Dr. Orme's estimation of the portion of hillside erosion that is contributed to the creek in a personal phone conversation (March, 2002). He estimated that no more than 10 to 15 percent of the hillside eroded material would likely reach the creek in the 2001 water year. This check indicates that the sediment transport rates estimated with the method presented in the above paragraph is realistic considering limitations of the data and assumptions.

4.3 MODEL INITIAL CONDITIONS

4.3.1 Hydrology and Hydraulics

Initial conditions for hydrologic modeling include the maximum water content in storage in the surface and root zone, runoff coefficients and time constants for routing the interflow, overland flow and baseflow. These data were initially determined from the soil type and its infiltration rate, vegetation coverage, impervious development, watershed slopes and sizes, and baseflow data. They are then adjusted during the model calibration to match the measured flow rates recorded in the stream gage.

The Manning's roughness coefficients, n, in the hydraulic modeling were first selected based on the site inspection, literature review and past working experiences, and then refined during the model calibration process. Two main literature sources used were the textbook of Open Channel Hydraulics (Chow, 1959) and the Surface-Water Field Techniques (USGS, 2001). Per these sources, roughness coefficients ranging from 0.06 to 0.07 were used in this study, which is very typical for mountain streams with cobbles and large boulders in the bottom.

4.3.2 Sedimentation

In addition to the initial data required for RR and HD modeling, the bed material grain size data are required for sedimentation modeling. The bed material grain size data in the lagoon and Topanga creek from north of PCH to 19,028 ft (5,800 m) upstream from PCH were provided by the RCDSMM. Moffatt & Nichol Engineers collected a grab sample at the main confluence. As the sediment grain size varies from silt/clay to boulders, it is not be accurate to simply use the mean grain size in the modeling. Therefore, the MIKE-11-GST model was used and five fractions with mean grain sizes of 0.00001, 0.0004, 0.033, 0.16, and 0.5m were modeled.

The Smart-Jaeggi's sediment transport model was selected as it calculates the transport of coarse sediments in steep creeks. Parameters in the transport model were adjusted during the model calibration processes.

5.0 MODELING PROCEDURE

The modeling approach for hydrology and hydraulics was to replicate existing runoff conditions for the hydrologic model, and water surface elevations for the hydraulic model. The approach was to model the performance of alternatives for average flow conditions, high flows and low flows. Average conditions were represented by one continuous four and one-half-year period based on actual data from October 1, 1996 to March 7, 2001. High flow conditions were represented by one continuous five-year period created as a synthetic hydrograph from 1980 to 1984, including floods in 1980 (83-year storm) and 1983. To represent fire effects, a two-year period from 1976-1978 was to be run to replicate a pre-developed condition with post-fire influence. Low flows were included for each five-year period.

Runoff data for the period of 1976-1978 were determined to be insufficient in detail (frequency) to determine fire effects so this was performed using a different method present in the subsequent section of this report.

The focus of the effort was to assess the performance of the lagoon alternatives under high flow events to ascertain potential flooding damage and sedimentation problems, and of improvements proposed upstream of the lagoon. Low flows were of interest to determine potential water quality conditions. Average flow conditions served as the calibration data as well as the normal condition.

5.1 HYDROLOGY AND HYDRAULICS

Procedures for modeling included data collection and review; calibration and verification; and modeling of alternative concepts. Each is described below.

5.1.1 Data Collection and Review

The following types of data were collected and reviewed for an understanding of conditions and for determining their suitability for modeling:

- Topography and bathymetry;
- Structures;
- Precipitation;
- Flow rates;
- Water depth measurements;
- Tides;
- Water quality measurements;
- Sediment;
- Evaporation;
- Soil;
- Vegetation coverage; and

- Fire history.

In data review, data limitations were identified as constraints. The data limitations are described below.

Precipitation: There are two functional rain gages in the watershed and three functional rain gages in its vicinity as shown in Table C-3 and Figure C-2. The Thiessen method was used to calculate the mean precipitation for each sub-watershed. This method calculates the mean precipitation based on the invert of the distance-weighted average. Therefore, the mean precipitation mainly depends on the gages within the watershed. Unfortunately, there are no operating rain gages in the Santa Maria Creek area. Also, this watershed is small and steep and the time of concentration is very short, therefore, short time interval precipitation data is critical to accurately predict the peak runoff. However, the short interval data are only recorded by the automatic gage at the Topanga Patrol Station. As shown in Table C-3, Topanga Patrol station is the only automatic gage operating in the watershed.

In addition, it is important to note that during the model calibration period of water year 1997 to 2001, the Topanga Patrol Station malfunctioned for some time periods in November and December of 1996. Also, the gage at the Santa Ynez Reservoir malfunctioned in November through December of 1997, and in April of 1998. These periods are identified by comparing the precipitation recorded at this gage with other gages in the vicinity. The malfunctions did not present a significant constraint to the modeling, as they were for short periods in the relatively longer modeling period.

Table C-3 Precipitation Data Inventory

Gage Name	Agency and Station Numbers	Gage Type (Data Interval)	Location	Status
Topanga Patrol Station	LACDPW #6	Automatic (every 5 minutes)	Watershed	Operating
Old Topanga Canyon	LACDPW #1050F	Standard (Daily)	Watershed	Operating
Santa Ynez Reservoir	LACDPW #1194	Standard (Daily)	In vicinity	Operating
Malibu Big Rock Mesa	LACDPW #1239	Automatic (every 5 minutes)	In vicinity	Operating
Malibu Hills	California Dept. of Forestry (CDF)	Hourly	In vicinity	Operating
Santa Maria Creek	LACDPW #1023	Daily	Watershed	Stopped in 1988

Runoff: Stream Gage F54F located at milemarker 2.2 on Topanga Creek is an automatic gage operated by the LACDPW. Short interval data together with daily data were provided the LACDPW from October, 1996 to March, 2001. Comparison of the recorded discharges with precipitation data recorded in the watershed indicated that the stream gage malfunctioned from April possibly through October of 1998.

It was determined that sufficient data were available for hydrologic and hydraulic modeling, but limitations in the data required modifications to assumptions.

5.1.2 Model Calibration and Verification

For the hydrological model, the calibration goal was to match the recorded flow rate in the stream gage. Calibration was done for a four and one-half-year continuous simulation. The first six months is the model "warm-up" period, in which results are not relied upon as the model calculations are converging on the appropriated solutions and vary in accuracy. The remaining four year modeling period was for the model calibration and verification.

The predicted and measured flow rates are compared at the stream gage and show relatively good agreement as shown in Figure C-4. The emphasis is on high accuracy prediction for peak flow events rather than on low flows for the hydrologic calibration. Also, it is focused on the performance of the entire watershed, not individual sub-watersheds since the runoff from individual sub-watersheds is not available. For hydraulic calibration and verification, water depths predicted and measured at various locations were also compared and show relatively good agreement as shown in Figures C-5 through C-8. These visual correlations were considered sufficient to conclude that the hydrology and hydraulic model can be used with confidence to model alternatives and make relative comparisons of their performance.

The calibrated runoff coefficients vary from 0.7 to 0.8. The variation is based on the soil type and the proportion of impervious surface for each individual sub-watershed since the flow data are not sufficient to calibrate these numerical coefficients for each individual sub-watershed.

5.1.3 Impacts of Brush Fire to Runoff

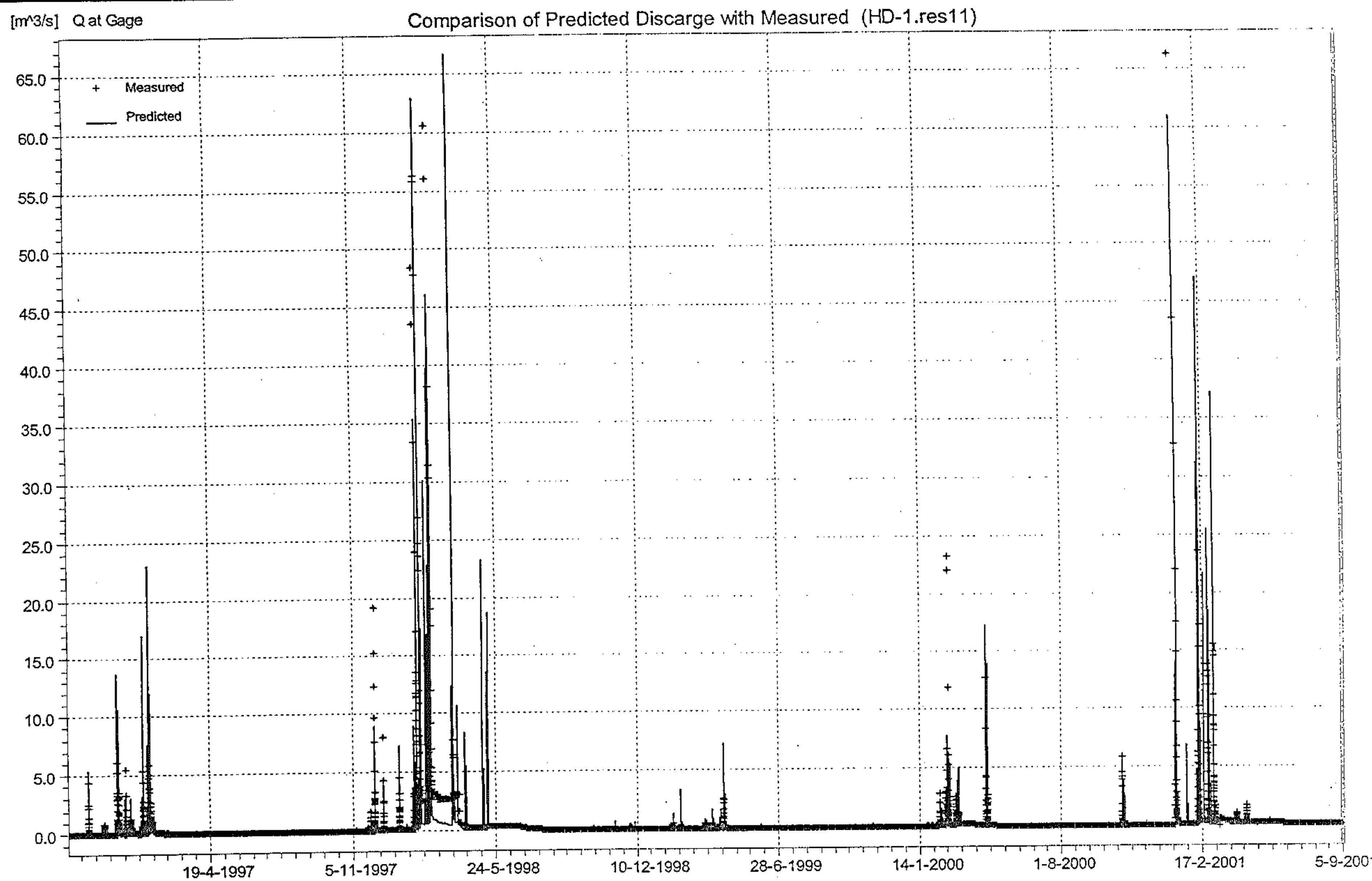
The fire history was analyzed to determine impacts of fires on runoff. Two fire events (1977 and 1993) were identified for the potential fire impact calibration, unfortunately no detailed flow data are available for the 1977 fire and the stream gage was not operating in 1993. Therefore, the fire impact to the runoff was based on a literature review and the LA County Hydrology Manual (LACDPW, 1991).

In order to evaluate the brush fire impact under a 4-year event (the largest storm event with detailed rainfall and stream record data available), the calibrated runoff coefficients increased by about 20 percent from a range of 0.7 to 0.8, to 0.86 to 0.96. Three-fire scenarios were modeled: scenario one is burning of the entire OTC creek watershed; scenario two is burning of the entire upper Topanga Creek watershed (upstream of the main confluence); and scenario three is burning of the entire watershed (upstream of the stream gage).

The modeling results are shown in Figure C-9, and the percentage increase of the peak flow rate is summarized in Table C-4. The peak flow rate could increase as much as nearly 30% if the entire watershed were burned. This indicates that the fire will steepen the existing hydrograph even further.

Table C-4 Brush Fire Impact To Runoff

Scenarios	OTC Watershed Burned	Up Topanga Creek Watershed Burned	Entire Watershed Burned
Percent Increase of Peak Flow Rate (%)	13	19	29

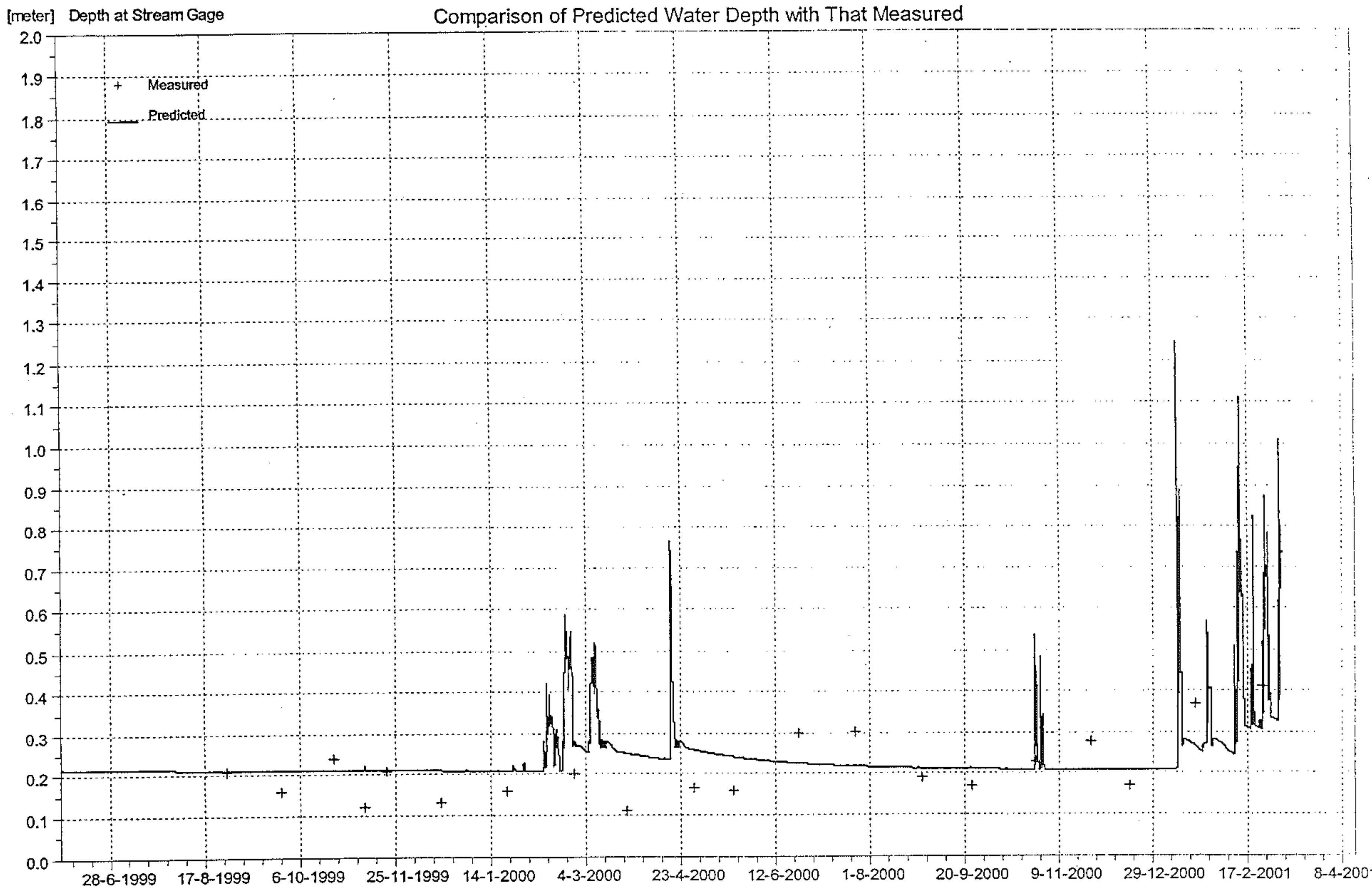


Prepared by: Moffatt & Nichol Engineers
Draft, February 2002
k:/4819/coastal/report\Appendix-C.ppt

Topanga Lagoon & Topanga Creek Watershed Restoration Feasibility Study

MODEL CALIBRATION TO STREAM DISCHARGE

Figure C-4



Prepared by: Moffatt & Nichol Engineers
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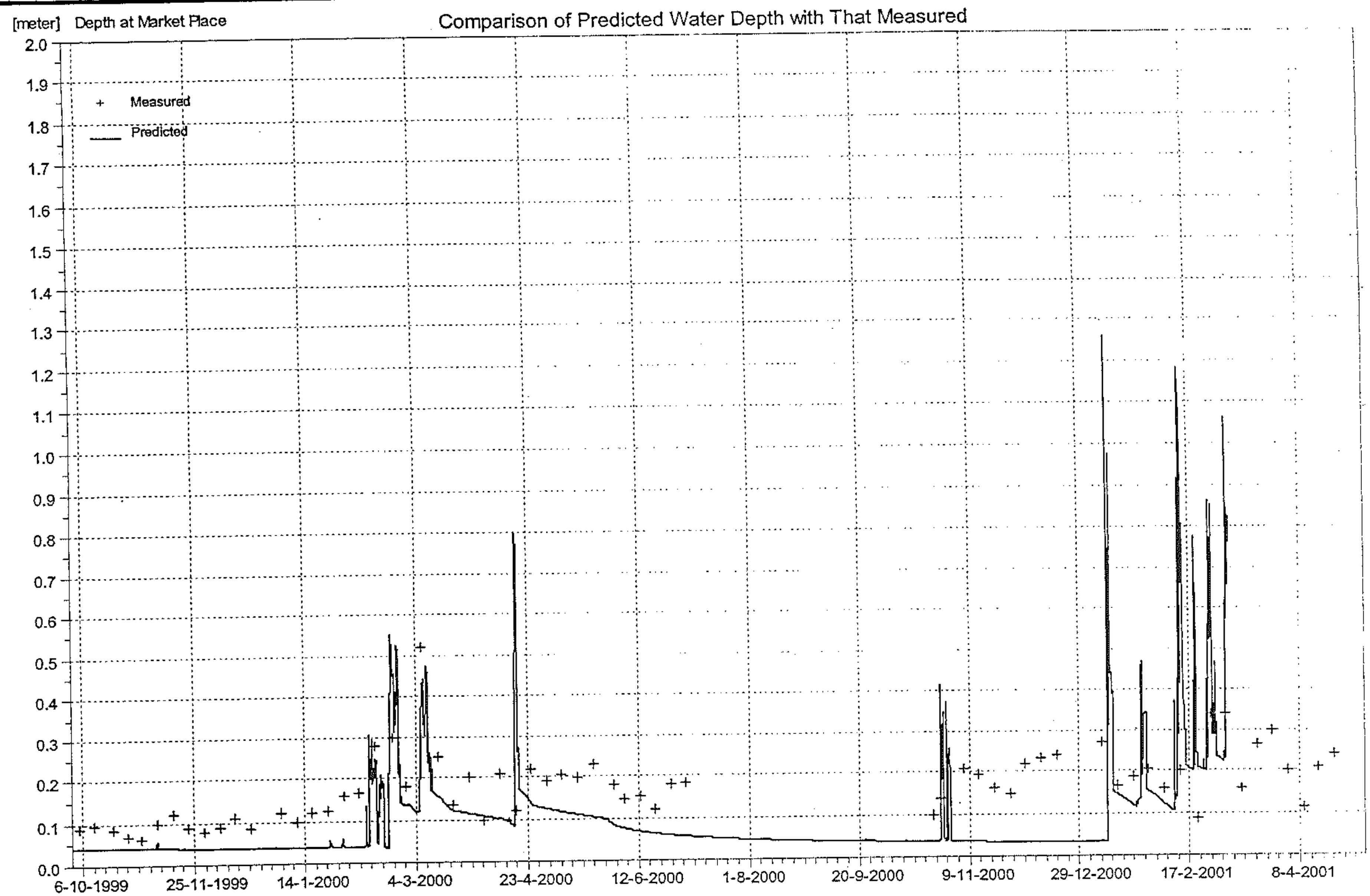
k:/4819/coastal/report\Appendix-C.ppt

Topanga Lagoon & Topanga Creek Watershed Restoration Feasibility Study	MODEL CALIBRATION TO WATER DEPTH Stream Gage	Figure C-5



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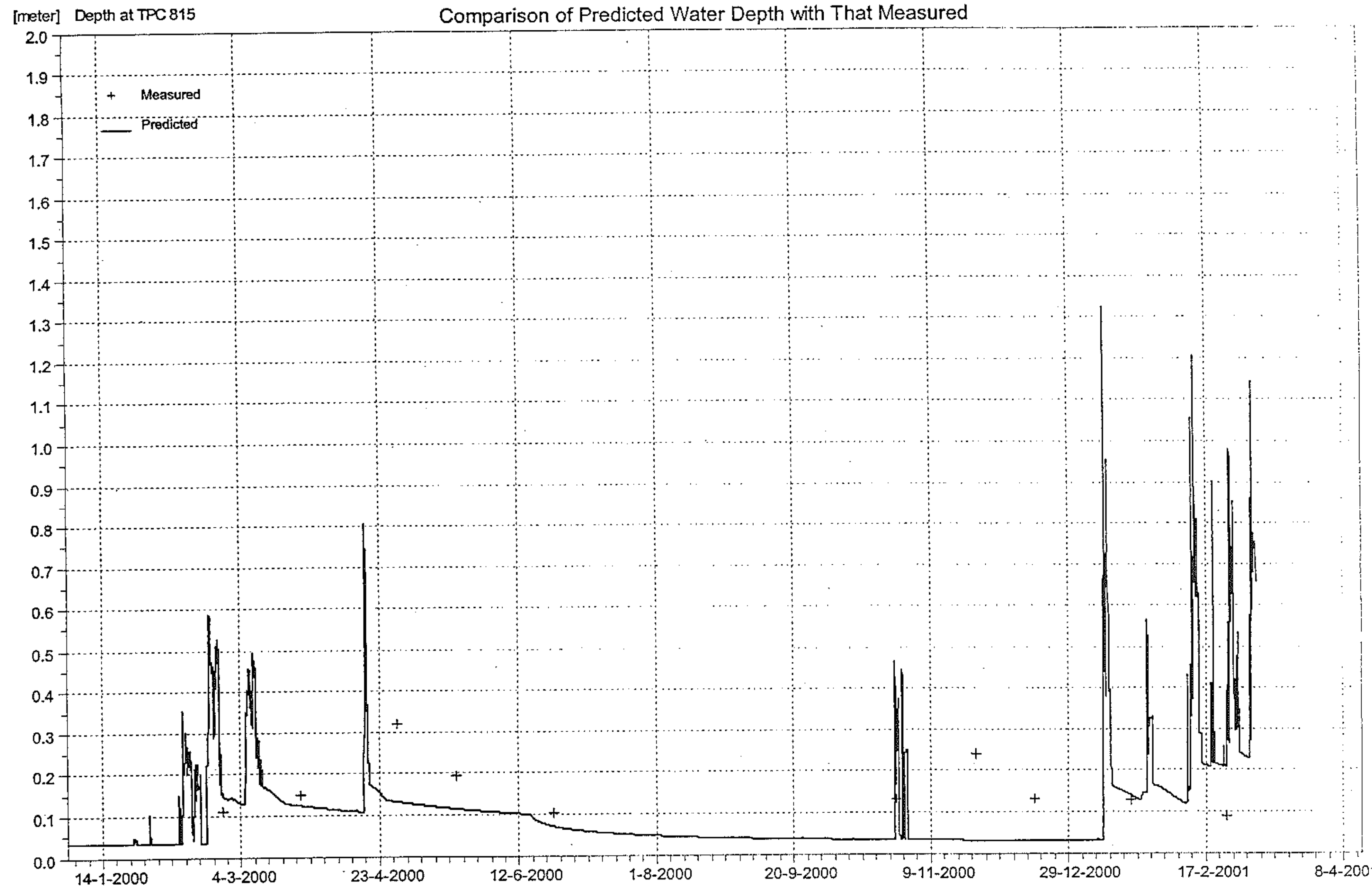
Draft, February 2002
k:/4819/coastal/report\Appendix-C.ppt

Topanga Lagoon & Topanga Creek Watershed Restoration Feasibility Study

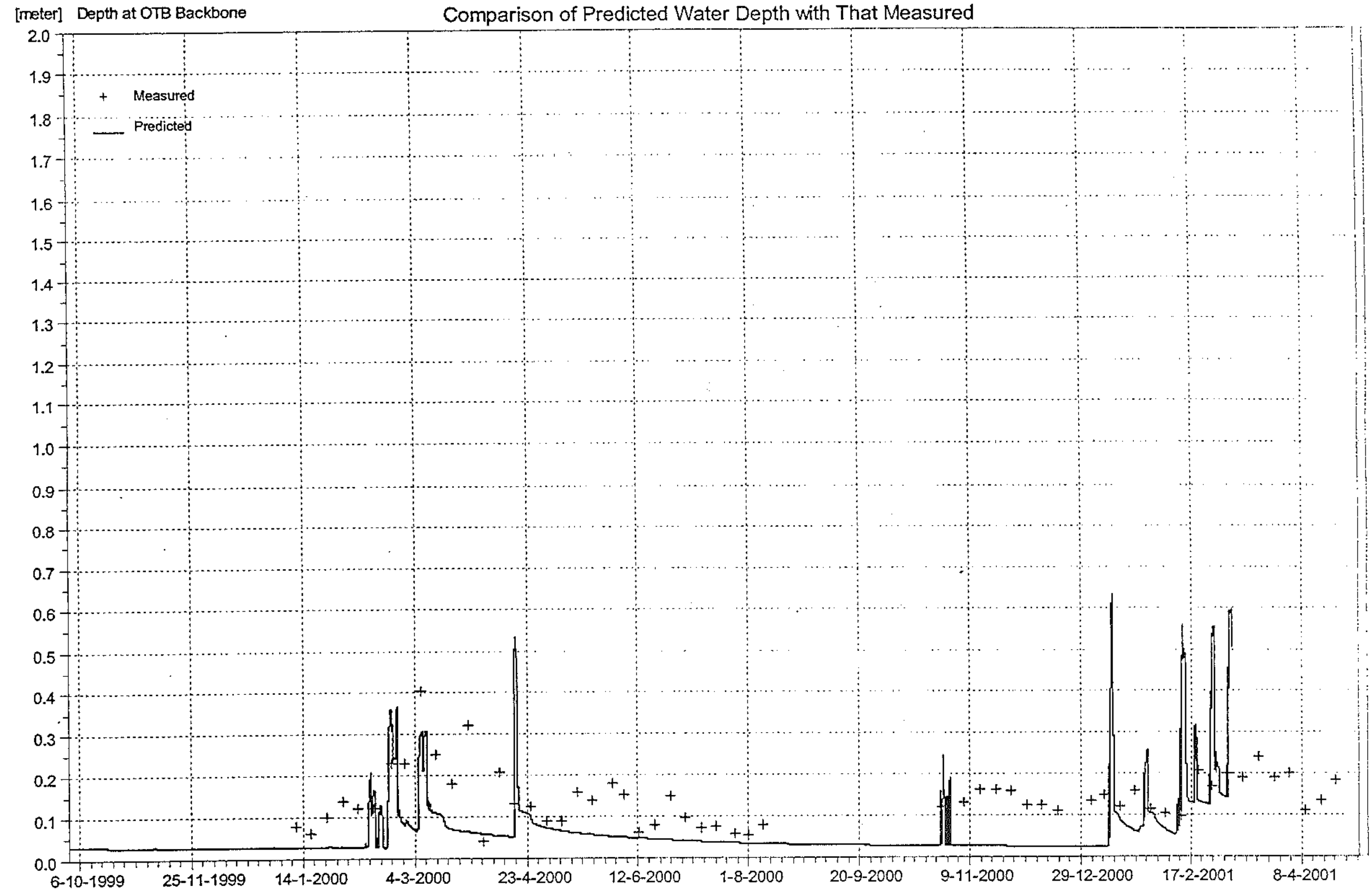
MODEL CALIBRATION TO WATER DEPTH
Market Place

Figure C-6



Prepared by: Moffatt & Nichol Engineers
Draft, February 2002
k:/4819/coastal/report\Appendix-C.ppt

Topanga Lagoon & Topanga Creek Watershed Restoration Feasibility Study	MODEL CALIBRATION TO WATER DEPTH Topanga Canyon 815	Figure C-7



Prepared by: Moffatt & Nichol Engineers
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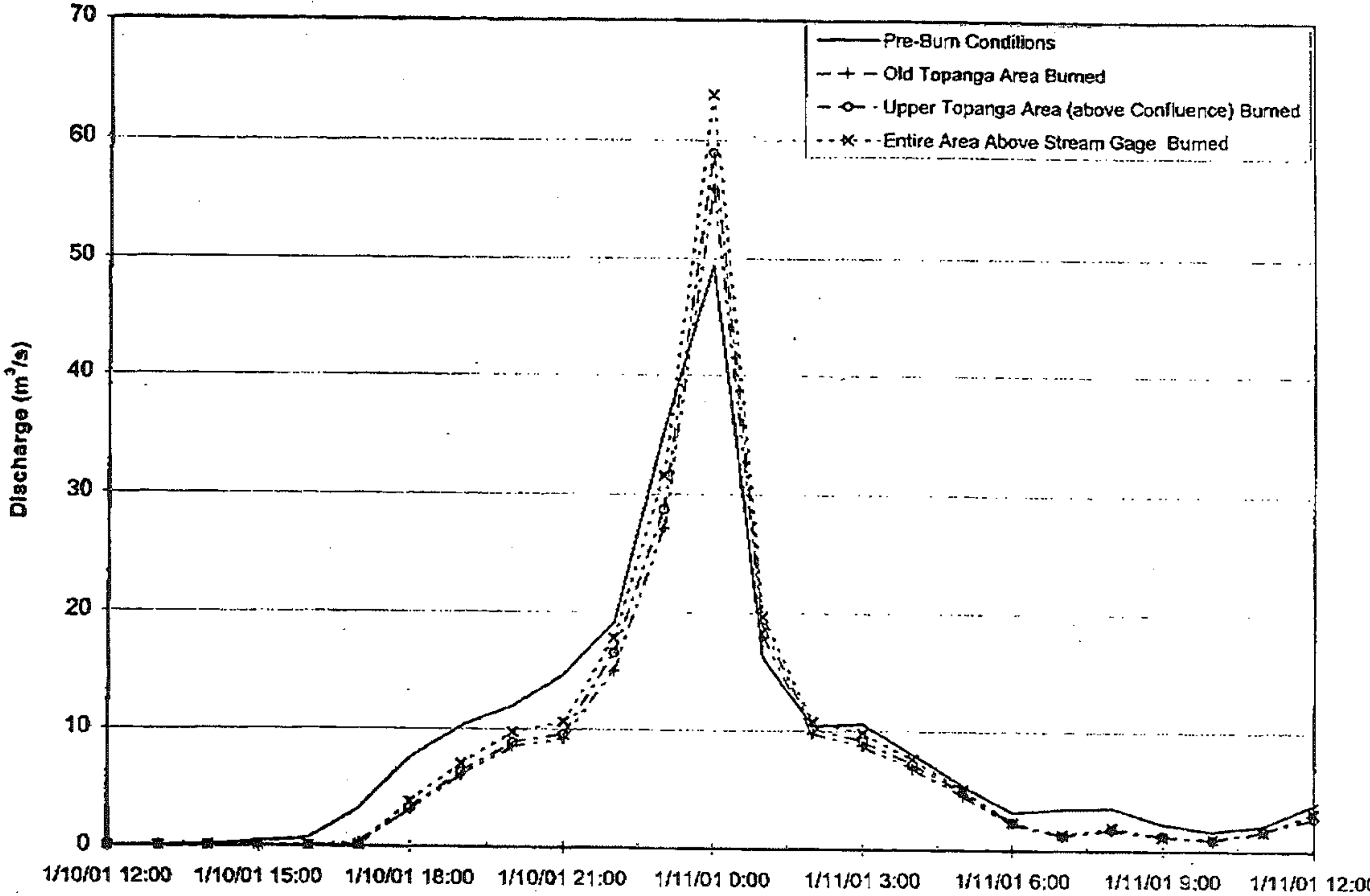
Topanga Lagoon & Topanga Creek Watershed Restoration Feasibility Study

MODEL CALIBRATION TO WATER DEPTH
Old Topanga Bridge Backbone

Figure C-8



Prepared by: Moffatt & Nichol Engineers
Draft, February 2002
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Topanga Lagoon & Topanga Creek Watershed Restoration Feasibility Study	PREDICTED POST-BURN RUNOFF COMPARED TO THAT UNDER PRE-BURN CONDITIONS	Figure C-9

The impact of fire on sediment delivery will be even more pronounced as the relationship between the sediment transport rate and the peak flow rate is not liner, but exponential. As shown in Section 4.2.2, they possess a power law relationship. It is not possible to model sediment yield and transport under fire conditions with the existing data constraints, but surely sediment transport after fires will increase significantly over existing conditions causing increased temporary and short-term sediment deposition in downstream reaches and the lagoon under relatively small storms. Larger storms should transport the majority of sediment out to sea. Long-term conditions will result in the sediment being remobilized and transported to the ocean.

5.1.4 Alternative Modeling and Results

Modeling Alternatives for Hydrology and Hydraulics - Modeling periods included:

- Water year 1997 to 2001 (results are summarized for four storm events: January 10, 2001, February 23, 1998, February 23, 2000 and April 11, 1999) and
- Water year water 1977 to 1984 (combining the two periods of 1977 through 1984 makes the modeling more efficient).

For this latter period, only daily rain data are available rather than short-interval data and the resolution is not sufficient to predict the peak storm discharges from the hydrologic model. As a result, an iterative method was used to match the peak discharge recorded in the 1980 and 1983 storms by adjusting the precipitation. The precipitation pattern of a recent large storm (January 11, 2001, which is a 4-year return period event) where detailed rainfall data were available, was used in the iterative modeling. The precipitation data and peak discharge data were correlated for the January 2001 storm, and the correlation was applied to the 1980 and 1983 storms to generate artificial precipitation data that would yield the recorded peak flood discharge.

Lagoon alternatives were modeled using the measured data from the stream gage at milemarker 2.2 on the creek. Improvements upstream of the stream gage were modeled using the model predicted discharge for the specified periods.

Results of hydrologic and hydraulic modeling indicate that lagoon alternatives perform vastly different during storms. Table C-5 shows model output for each alternative and each upstream improvement site, by cross-section and storm. The performance of an alternative relates to its ability to pass the flood and convey sediment to the sea under storms, and to remain environmentally suitable habitat during prolonged low flow conditions. Conditions conducive to fish passage and migration, such as an open lagoon mouth and flow velocities within a certain range, are dictated by storm flows. Also, flooding, sedimentation and damage to habitat and infrastructure of alternatives can occur during storm events. Alternative concept 4 performs best hydrologically and hydraulically based on modeling. It will convey floods to the sea more effectively. Alternative concept 3 also performs better than either Alternative concepts 1 or 2, as it also conveys flows effectively owing to the large mouth section.

Alternative concepts 1 and 2 would basically continue to support existing conditions of poor flood conveyance and resulting adverse effects of flooding to infrastructure, habitat and fish migration.

TABLE C-5 HYDRAULIC MODELING RESULTS

Water Level and Velocity at North of PCH (Section 0)

Storm Events	Peak Flow (m^3/s)	Return Period (yr)	Existing		Alternative2		Alternative 3		Alternative 4	
			Velocity (m/s)	Water Level (m, MSL)	*Velocity (m/s)*	Water Level (m, MSL)	*Velocity (m/s)*	Water Level (m, MSL)	*Velocity (m/s)*	Water Level (m, MSL)
02/16/80	391	83	***5.17***	3.33	***3.91***	3.52	***2.33***	1.98	***1.48***	1.84
01/27/83	289	20	***3.61***	2.76	***2.84***	2.85	***1.53***	1.70	***0.98***	1.60
01/10/01	80	4	***1.63***	1.90	***1.63***	1.56	***0.97***	0.74	***0.56***	0.71
02/23/98	70	3.3	***1.57***	1.75	***1.62***	1.41	***1.04***	0.56	***0.58***	0.51
02/23/00	30	2	***0.96***	1.04	***1.11***	0.78	***0.53***	0.35	***0.29***	0.27
04/11/99	3	1	***0.23***	0.40	***0.18***	0.40	***0.07***	0.40	***0.03***	0.40

Storm Events	Peak Flow (cfs)	Return Period (yr)	Existing		Alternative 2		Alternative 3		Alternative 4	
			Velocity (fps)	Water Level (ft, MSL)	*Velocity (fps)*	Water Level (ft, MSL)	*Velocity (fps)*	Water Level (ft, MSL)	*Velocity (fps)*	Water Level (ft, MSL)
02/16/80	13800	83	***16.96***	10.93	***12.83***	11.55	***7.64***	6.50	***4.86***	6.04
01/27/83	10200	20	***11.84***	9.06	***9.32***	9.35	***5.02***	5.58	***3.22***	5.25
01/10/01	2820	4	***5.35***	6.23	***5.35***	5.12	***3.18***	2.43	***1.84***	2.33
02/23/98	2470	3.3	***5.15***	5.74	***5.31***	4.63	***3.41***	1.84	***1.90***	1.67
02/23/00	1050	2	***3.15***	3.41	***3.64***	2.56	***1.74***	1.15	***0.95***	0.89
04/11/99	93	1	***0.75***	1.31	***0.59***	1.31	***0.23***	1.31	***0.10***	1.31

TABLE C-5 HYDRAULIC MODELING RESULTS

Water Level and Velocity at Chainage 38.41 m from North of PCH

Storm Events	Peak Flow (m^3/s)	Return Period (yr)	Existing		Alternative2		Alternative 3		Alternative 4	
			Velocity (m/s)	Water Level (m, MSL)	*Velocity (m/s)*	Water Level (m, MSL)	*Velocity (m/s)*	Water Level (m, MSL)	*Velocity (m/s)*	Water Level (m, MSL)
02/16/80	391	83	***3.3***	4.2	***3.3***	4.1	***2.8***	2.4	***2.4***	2.0
01/27/83	289	20	***2.4***	3.3	***2.5***	3.2	***2.1***	1.9	***1.7***	1.7
01/10/01	80	4	***1.3***	2.1	***1.5***	1.8	***1.4***	1.0	***1.1***	0.8
02/23/98	70	3.3	***1.3***	1.9	***1.5***	1.7	***1.4***	0.9	***1.2***	0.6
02/23/00	30	2	***0.9***	1.2	***1.0***	1.0	***0.9***	0.6	***0.6***	0.4
04/11/99	3	1	***0.4***	0.4	***0.4***	0.4	***0.3***	0.4	***0.1***	0.4

(126 ft from North of PCH)

Storm Events	Peak Flow (cfs)	Return Period (yr)	Existing		Alternative2		Alternative 3		Alternative 4	
			Velocity (fps)	Water Level (ft, MSL)	*Velocity (fps)*	Water Level (ft, MSL)	*Velocity (fps)*	Water Level (ft, MSL)	*Velocity (fps)*	Water Level (ft, MSL)
02/16/80	13800	83	***10.7***	13.6	***10.8***	13.5	***9.3***	7.8	***7.8***	6.5
01/27/83	10200	20	***7.9***	10.9	***8.2***	10.6	***6.8***	6.3	***5.5***	5.4
01/10/01	2820	4	***4.3***	6.9	***4.9***	6.0	***4.4***	3.3	***3.6***	2.5
02/23/98	2470	3.3	***4.1***	6.3	***4.8***	5.5	***4.5***	3.0	***3.8***	1.9
02/23/00	1050	2	***2.9***	3.8	***3.3***	3.4	***2.9***	1.9	***2.1***	1.4
04/11/99	93	1	***1.3***	1.3	***1.3***	1.3	***1.1***	1.3	***0.3***	1.3

TABLE C-5 HYDRAULIC MODELING RESULTS

Water Level and Velocity at 126.5 m Measured from North of PCH

Storm Events	Peak Flow (m^3/s)	Return Period (yr)	Existing		Alternative2		Alternative 3		Alternative 4	
			Velocity (m/s)	Water Level (m, MSL)	*Velocity (m/s)*	Water Level (m, MSL)	*Velocity (m/s)*	Water Level (m, MSL)	*Velocity (m/s)*	Water Level (m, MSL)
02/16/80	391	83	***3.5***	5.6	***2.8***	5.1	***3.9***	4.3	***2.8***	3.2
01/27/83	289	20	***3.0***	4.8	***2.4***	4.1	***3.2***	3.7	***2.2***	2.6
01/10/01	80	4	***2.3***	3.8	***1.7***	2.8	***2.4***	2.8	***1.4***	1.8
02/23/98	70	3.3	***1.7***	3.7	***1.7***	2.7	***2.4***	2.7	***1.4***	1.7
02/23/00	30	2	***1.4***	3.2	***1.3***	2.2	***1.8***	2.2	***1.0***	1.3
04/11/99	3	1	***0.6***	2.4	***0.7***	1.6	***0.6***	1.5	***0.6***	1.0

(415 ft from North of PCH)

Storm Events	Peak Flow (cfs)	Return Period (yr)	Existing		Alternative2		Alternative 3		Alternative 4	
			Velocity (fps)	Water Level (ft, MSL)	*Velocity (fps)*	Water Level (ft, MSL)	*Velocity (fps)*	Water Level (ft, MSL)	*Velocity (fps)*	Water Level (ft, MSL)
02/16/80	13800	83	***11.5***	18.2	***9.3***	16.8	***12.8***	14.0	***9.2***	10.4
01/27/83	10200	20	***10.0***	15.6	***7.7***	13.5	***10.5***	12.2	***7.1***	8.6
01/10/01	2820	4	***7.4***	12.5	***5.6***	9.1	***7.8***	9.0	***4.5***	5.8
02/23/98	2470	3.3	***5.4***	12.3	***5.4***	8.8	***7.7***	8.8	***4.5***	5.6
02/23/00	1050	2	***4.7***	10.6	***4.4***	7.2	***5.8***	7.1	***3.3***	4.3
04/11/99	93	1	***1.9***	7.8	***2.3***	5.1	***2.1***	4.8	***1.9***	3.1

TABLE C-5 HYDRAULIC MODELING RESULTS

Water Level and Velocity at Rodeo Grounds Concrete Levee

(902.48 m from North of PCH)

Storm Events	Peak Flow (cfs)	Return Period (yr)	Existing		Proposed	
			Velocity (m/s)	Water Level (m, MSL)	*Velocity (m/s)*	Water Level (m, MSL)
02/16/80	391	83	***2.2***	12.6	***2.1***	12.4
01/27/83	289	20	***2.0***	12.1	***1.9***	11.9
01/10/01	80	4	***1.5***	11.4	***1.4***	11.2
02/23/98	70	3.3	***1.5***	11.3	***1.3***	11.1
02/23/00	30	2	***1.1***	11.0	***0.9***	10.8
04/11/99	3	1	***0.4***	10.5	***0.4***	10.4

(2961 ft from North of PCH)

Storm Events	Peak Flow (cfs)	Return Period (yr)	Existing		Proposed	
			Velocity (fps)	Water Level (ft, MSL)	*Velocity (fps)*	Water Level (ft, MSL)
02/16/80	13800	83	***7.2***	41.3	***6.8***	40.8
01/27/83	10200	20	***6.6***	39.8	***6.4***	39.2
01/10/01	2820	4	***5.0***	37.3	***4.5***	36.6
02/23/98	2470	3.3	***4.8***	37.1	***4.3***	36.4
02/23/00	1050	2	***3.6***	35.9	***3.1***	35.3
04/11/99	93	1	***1.4***	34.5	***1.3***	34.2

TABLE C-5 HYDRAULIC MODELING RESULTS

Water Level and Velocity at Landslide Locations

Distance Measured from North of PCH (m)			2543				3365.9			
			Existing		Proposed		Existing		Proposed	
Storm Events	Peak Flow (cfs)	Return Period (yr)	*Velocity (m/s)*	Water Level (m, MSL)	*Velocity (m/s)*	Water Level (m, MSL)	Velocity (m/s)	Water Level (m, MSL)	Velocity (m/s)	*Water Level (m, MSL)*
02/16/80	391	83	***4.5***	59.5	*4.2*	59.0	*6.3*	79.0	6.0	*78.4*
01/27/83	289	20	***3.6***	58.7	*3.4*	58.3	*5.2*	78.2	5.0	*77.6*
01/10/01	80	4	***2.0***	57.3	*2.0*	56.9	*3.7*	76.9	3.3	*76.4*
02/23/98	70	3.3	***1.9***	57.1	*1.9*	56.8	*3.5*	76.7	3.1	*76.3*
02/23/00	30	2	***1.2***	56.5	*1.3*	56.3	*2.7*	76.1	2.2	*75.8*
04/11/99	3	1	***0.5***	55.7	*0.5*	55.6	*1.1*	75.3	0.8	*75.0*

Distance Measured from North of PCH (ft)			8343				11043			
			Existing		Proposed		Existing		Proposed	
Storm Events	Peak Flow (cfs)	Return Period (yr)	*Velocity (fps)*	Water Level (ft, MSL)	*Velocity (fps)*	Water Level (ft, MSL)	*Velocity (fps)*	Water Level (ft, MSL)	*Velocity (fps)*	Water Level (ft, MSL)
02/16/80	13800	83	***14.8***	195.3	*13.8*	193.7	*20.6*	259.3	19.8	*257.2*
01/27/83	10200	20	***11.7***	192.6	*11.2*	191.2	*17.0*	256.5	16.3	*254.5*
01/10/01	2820	4	***6.6***	187.8	*6.4*	186.7	*12.0*	252.1	10.9	*250.7*
02/23/98	2470	3.3	***6.2***	187.4	*6.2*	186.2	*11.6*	251.7	10.2	*250.3*
02/23/00	1050	2	***4.0***	185.4	*4.1*	184.7	*8.7*	249.6	7.1	*248.6*
04/11/99	93	1	***1.6***	182.8	*1.7*	182.5	*3.4*	246.9	2.7	*246.2*

TABLE C-5 HYDRAULIC MODELING RESULTS

Water Level and Velocity at the "Narrows"

Distance Measured from Stream Gage (m)			251				280				486			
			Existing		Proposed		Existing		Proposed		Existing		Proposed	
Storm Events	Peak Flow (m^3/s)	Return Period (yr)	*Velocity (m/s)*	Water Level (m, MSL)	*Velocity (m/s)*	Water Level (m, MSL)	*Velocity (m/s)*	Water Level (m, MSL)	*Velocity (m/s)*	Water Level (m, MSL)	*Velocity (m/s)*	Water Level (m, MSL)	*Velocity (m/s)*	Water Level (m, MSL)
02/16/80	391	83	***6.0***	91.2	***3.4***	90.3	***7.2***	92.2	***4.1***	90.6	***7.4***	99.6	***7.0***	100.7
01/27/83	289	20	***5.3***	90.0	***3.0***	89.8	***6.7***	90.9	***3.8***	90.1	***6.7***	98.4	***6.4***	100.3
01/10/01	80	*4*	***2.9***	88.5	***1.8***	88.1	***3.9***	89.2	***2.7***	88.6	***3.9***	97.1	***4.1***	99.1
02/23/98	70	3.3	***2.6***	88.3	***1.2***	87.9	***3.5***	89.0	***2.2***	88.4	***3.6***	96.9	***3.3***	99.0
04/11/99	3	*1*	***1.2***	86.9	***0.8***	87.1	***1.8***	87.6	***1.4***	87.7	***2.3***	95.9	***2.7***	98.2

Distance Measured from Stream Gage (ft)			823				919				1594			
			Existing		Proposed		Existing		Proposed		Existing		Proposed	
Storm Events	Peak Flow (cfs)	Return Period (yr)	*Velocity (fps)*	Water Level (ft, MSL)	*Velocity (fps)*	Water Level (ft, MSL)	*Velocity (fps)*	Water Level (ft, MSL)	*Velocity (fps)*	Water Level (ft, MSL)	*Velocity (fps)*	Water Level (ft, MSL)	*Velocity (fps)*	Water Level (ft, MSL)
02/16/80	13800	83	***19.6***	299.3	***11.1***	296.2	***23.8***	302.4	***13.5***	297.2	***24.4***	326.8	***23.0***	330.3
01/27/83	10200	20	***17.4***	295.2	***9.8***	294.7	***21.8***	298.1	***12.3***	295.7	***21.9***	322.8	***21.0***	329.1
01/10/01	2820	*4*	***9.4***	290.4	***5.8***	289.0	***12.6***	292.7	***8.9***	290.5	***12.8***	318.5	***13.5***	325.1
02/23/98	2470	3.3	***8.5***	289.7	***3.9***	288.4	***11.5***	291.9	***7.2***	290.1	***11.9***	317.9	***10.9***	324.7
04/11/99	93	*1*	***3.8***	285.0	***2.5***	285.9	***5.7***	287.3	***4.6***	287.7	***7.5***	314.5	***9.0***	322.3

TABLE C-5 HYDRAULIC MODELING RESULTS

Water Level and Velocity at Old School Road

Distance Measured from Confluence (m)			184				315			
			Existing		Proposed		Existing		Proposed	
Storm Events	Peak Flow (m^3/s)	Return Period (yr)	*Velocity (m/s)*	Water Level (m, MSL)	*Velocity (m/s)*	Water Level (m, MSL)	*Velocity (m/s)*	Water Level (m, MSL)	*Velocity (m/s)*	Water Level (m, MSL)
02/16/80	391	83	4.6	231.3	4.6	231.0	3.8	233.1	3.5	233.0
01/27/83	289	20	4.3	230.5	4.2	230.6	3.3	232.2	3.0	232.5
01/10/01	80	4	2.6	229.3	2.3	228.9	1.6	230.9	1.5	230.6
02/23/98	70	3.3	2.4	229.2	1.6	228.7	1.5	230.6	1.0	230.4
04/11/99	3	1	1.2	228.7	1.1	228.1	1.6	229.7	0.7	229.7

Distance Measured from Confluence (ft)			604				1033			
			Existing		Proposed		Existing		Proposed	
Storm Events	Peak Flow (cfs)	Return Period (yr)	*Velocity (fps)*	Water Level (ft, MSL)	*Velocity (fps)*	Water Level (ft, MSL)	*Velocity (fps)*	Water Level (ft, MSL)	*Velocity (fps)*	Water Level (ft, MSL)
02/16/80	13800	83	15.2	758.9	15.0	757.9	12.6	764.9	11.3	764.4
01/27/83	10200	20	13.9	756.1	13.7	756.7	10.8	761.9	9.9	762.9
01/10/01	2820	4	8.5	752.4	7.4	750.9	5.2	757.5	5.1	756.4
02/23/98	2470	3.3	7.7	751.8	5.1	750.3	4.9	756.6	3.3	755.8
04/11/99	93	1	3.8	750.3	3.6	748.2	5.2	753.7	2.2	753.5

TABLE C-5 HYDRAULIC MODELING RESULTS

Water Level and Velocity at "Lake Topanga"

Distance Measured from Confluence (m)			1579				1663				1800			
			Existing		Proposed		Existing		Proposed		Existing		Proposed	
Storm Events	Peak Flow (m^3/s)	Return Period (yr)	*Velocity (m/s)*	Water Level (m, MSL)	*Velocity (m/s)*	Water Level (m, MSL)	*Velocity (m/s)*	Water Level (m, MSL)	*Velocity (m/s)*	Water Level (m, MSL)	*Velocity (m/s)*	Water Level (m, MSL)	*Velocity (m/s)*	Water Level (m, MSL)
02/16/80	391	83	4.27	252.2	2.8	249.7	2.2	253.3	2.1	250.6	2.6	254.5	3.6	254.0
01/27/83	289	20	4.17	251.5	2.6	249.2	1.9	252.7	2.0	250.3	2.4	254.2	3.4	253.7
01/10/01	80	4	2.96	250.5	1.8	247.2	1.2	251.7	1.8	248.9	1.5	252.9	2.3	252.6
02/23/98	70	3.3	2.83	250.4	1.4	247.0	1.1	251.5	1.5	248.8	1.5	252.7	2.0	252.5
04/11/99	3	1	1.46	249.5	0.9	246.0	0.6	250.6	1.0	248.2	0.9	252.0	1.2	251.9

Distance Measured from Confluence (ft)			5180				5456				5905			
			Existing		Proposed		Existing		Proposed		Existing		Proposed	
Storm Events	Peak Flow (cfs)	Return Period (yr)	*Velocity (fps)*	Water Level (ft, MSL)	*Velocity (fps)*	Water Level (ft, MSL)	*Velocity (fps)*	Water Level (ft, MSL)	*Velocity (fps)*	Water Level (ft, MSL)	*Velocity (fps)*	Water Level (ft, MSL)	*Velocity (fps)*	Water Level (ft, MSL)
02/16/80	13800	83	14.0	827.5	9.0	819.1	7.1	831.1	6.9	822.3	8.5	834.9	11.8	833.3
01/27/83	10200	20	13.7	825.3	8.5	817.5	6.3	828.9	6.6	821.0	7.8	833.9	11.0	832.4
01/10/01	2820	4	9.7	821.9	6.0	811.0	4.1	825.6	5.8	816.4	4.9	829.6	7.7	828.7
02/23/98	2470	3.3	9.3	821.5	4.7	810.3	3.6	825.1	5.0	816.1	4.8	829.1	6.6	828.4
04/11/99	93	1	4.8	818.5	3.1	807.2	2.1	822.2	3.4	814.3	2.9	826.7	4.1	826.3

5.2 WATER QUALITY DILUTION ANALYSES

Numerical modeling was initially considered for the water quality study but was replaced with analytical modeling after all available data were reviewed and analyzed. Numerical modeling requires the sources of water quality constituents and continuous data from these sources as input and these data are not available. Also, the contamination problem appears to only exist at the lagoon and not upstream, so upstream sources are not the cause. Therefore, numerical modeling is not the appropriate tool for the analysis. Rather, an analytical dilution study is more useful to quantify variations in pollutant concentrations at the lagoon from localized sources and was therefore conducted under the assumed condition of an open inlet.

The analytical study was based primarily on parameters of tidal prism and measured bacteria concentrations. Die-off of bacteria was not considered in the analysis. This assumption is not realistic, but was employed to be conservative, and also due to the rapid flushing of the lagoon due to its small size thus causing contaminants to reach the sea almost immediately and bacteria die-off to be less influential on results. It was also assumed that the number of bacteria supplied to the lagoon is the same under the different alternatives.

The mean tidal prism between MHHW and MLLW was calculated to represent the average tidal flushing condition. The measured maximum bacteria concentrations in the lagoon were used in the analyses. The results, considered against state AB411 standards for beach closures, are summarized in Table C-6. These results were considered to be sufficient for alternative comparison for this level of study.

Table C-6 Summary Of Bacteria Dilution Analyses

Alternatives	Tidal Prism (cubic feet)	Fecal Coliform (MPN)	Total Coliform (MPN)
Existing Condition	77,000	2,100	290,000
Alternative concept 2	322,000	500	69,000
Alternative concept 3	617,000	260	36,000
Alternative concept 4	941,000	170	24,000
AB411 Standards for Beach Closure	*Not Applicable*	*400*	*10,000*

Alternative concepts 3 and 4 would result in acceptable water quality with regards to fecal coliform, while all alternatives would still fall short of total coliform standards. This is the case because the scenario analyzed is the worst-case ever recorded at the lagoon, so the input concentration of bacteria is extremely high. Alternative concepts 3 and 4 would have met state water quality standards under analysis of any other lagoon measured contamination scenario. Thus, Alternative concepts 3 and 4 show marked improvement in water quality over Alternative concepts 1 and 2.

Bird use of marshes has been discussed by many recently as a potential cause of contamination. While this may be the case for certain unique sites like Talbert Marsh in Orange County, significant study has occurred for other sites that indicates it may not pose a significant water quality threat to newly restored wetlands (Moffitt &Nichol Engineers, 2001). Typical bird use at marshes leads to increased contaminant supply, but dilution of the bacteria can be sufficient to reduce concentrations. The restored lagoon at Topanga for Alternative concepts 3 and 4 should possess sufficient water volume to dilute bird feces and minimize the impact to water quality.

5.3 SEDIMENT MODELING PROCEDURES

Procedures for modeling included data collection and review, model set-up, calibration and verification, and alternative modeling. Each is described below.

5.3.1 Data Collection and Review

The following data were collected in order to setup and calibrate the sedimentation model as well as to conduct the alternative runs:

- Bed material grain sizes and their percentages;
- Sediment transport rate at the model boundary; and
- Sediment transport rate at the stream gage.

Bed material grain sizes and their percentage distribution were used in model setup as detailed in Section 4.2.2. The estimation of sediment transport rates at the model upstream boundary was detailed in Section 4.3.2.

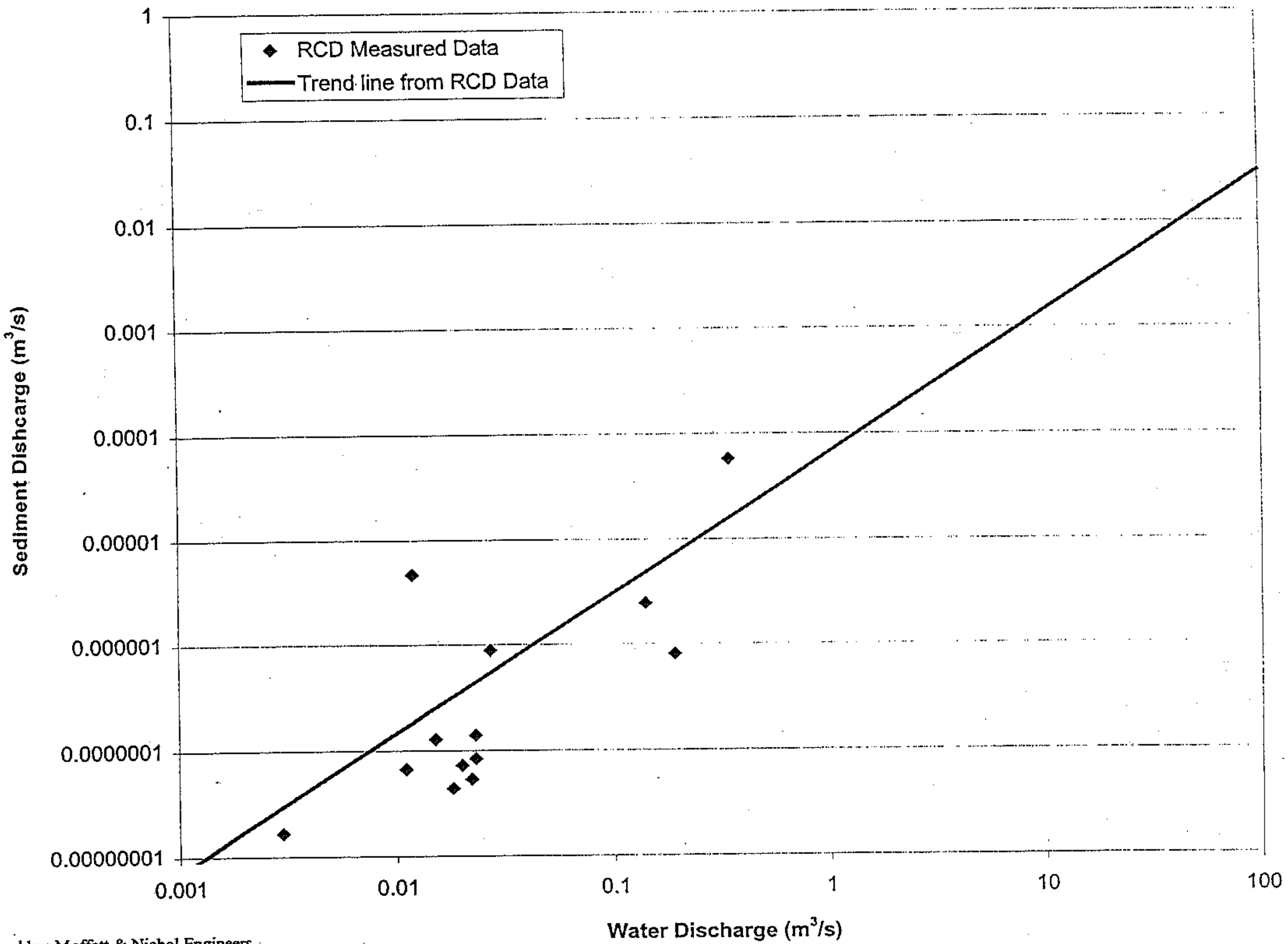
The sediment transport rates at the stream gage were estimated with the recorded flow rate and TSS collected by RCDSMM, and was used in model calibration. The estimation procedure is similar to that described in Section 4.2.2. Figure C-10 shows the fit between the sediment transport rate and flow rate. As previously mentioned, the relationship is based on the regression analyses method.

In data review, data limitations were identified as constraints. First, the TSS data collected were mainly under the low flow conditions. Only two samples were taken during which a flow rate higher than 10 cfs, and the highest flow rate is only 85 cfs. These data were extrapolated to a 4-year event within the four and one-half-year modeling period. Sediment is mainly transported under high flow conditions, but such sediment delivery rate data are not available for numerical modeling so this method was not used. Also, the grain size of the TSS was not available, so the sand size was assumed. In addition, the sediment model is limited by the limitations identified in the hydrologic and hydraulic sections of this report, since the sediment modeling is coupled with the hydraulic modeling.

5.3.2 Model Calibration and Verification

For the sedimentation model, the only data available for calibration is the TSS collected at the stream gage by the RCDSMM. The calibration goal was to match the estimated sediment transport rate and the total sediment transport volume over the calibration period in the stream gage. The calibration was done for a four and one-half-year continuous simulation. The first six months is the model "warm-up" period. The remaining four year modeling period was for model calibration and verification.

The calibration parameters were the critical shear stress and coefficients in the Smart-Jaeggi's sediment transport equation, which is the most appropriate equation for this project site with coarse grains and steep slopes. The critical shear stress needs to be calibrated because of the



Prepared by: Moffatt & Nichol Engineers
Draft, February 2002
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Topanga Lagoon & Topanga Creek Watershed Restoration Feasibility Study

DATA FIT OF PREDICTED SEDIMENT TRANSPORT RATE VERSUS THAT MEASURED AT THE STREAM GAGE

Figure C-10

steep slope where grains have a slope-induced height advantage and the critical shear stress is less than it would be for a flat bed.

Figure C-11 shows the predicted sediment transport rate at the stream gage versus the sediment transport rates estimated from the measured TSS data at the stream gage. The estimation method is the same as that used in estimating the sediment transport at the main confluence for model input as described in Section 4.2.2 of this report. As shown in the Figure, the model predicted the sediment transport pattern very well, but slightly underestimated the peak sediment transport rate and overestimated the low flow sediment transport rate. The predicted total sediment transport volume at the stream gage over the four and one-half-year period by the model is 6,970 cubic yards and that estimated from the TSS sampling data is 5,170 cubic yards. These results were sufficient to conclude that the sediment transport model can be used with confidence to model alternatives and make relative comparisons of their performance.

5.3.3 Alternative Modeling and Results

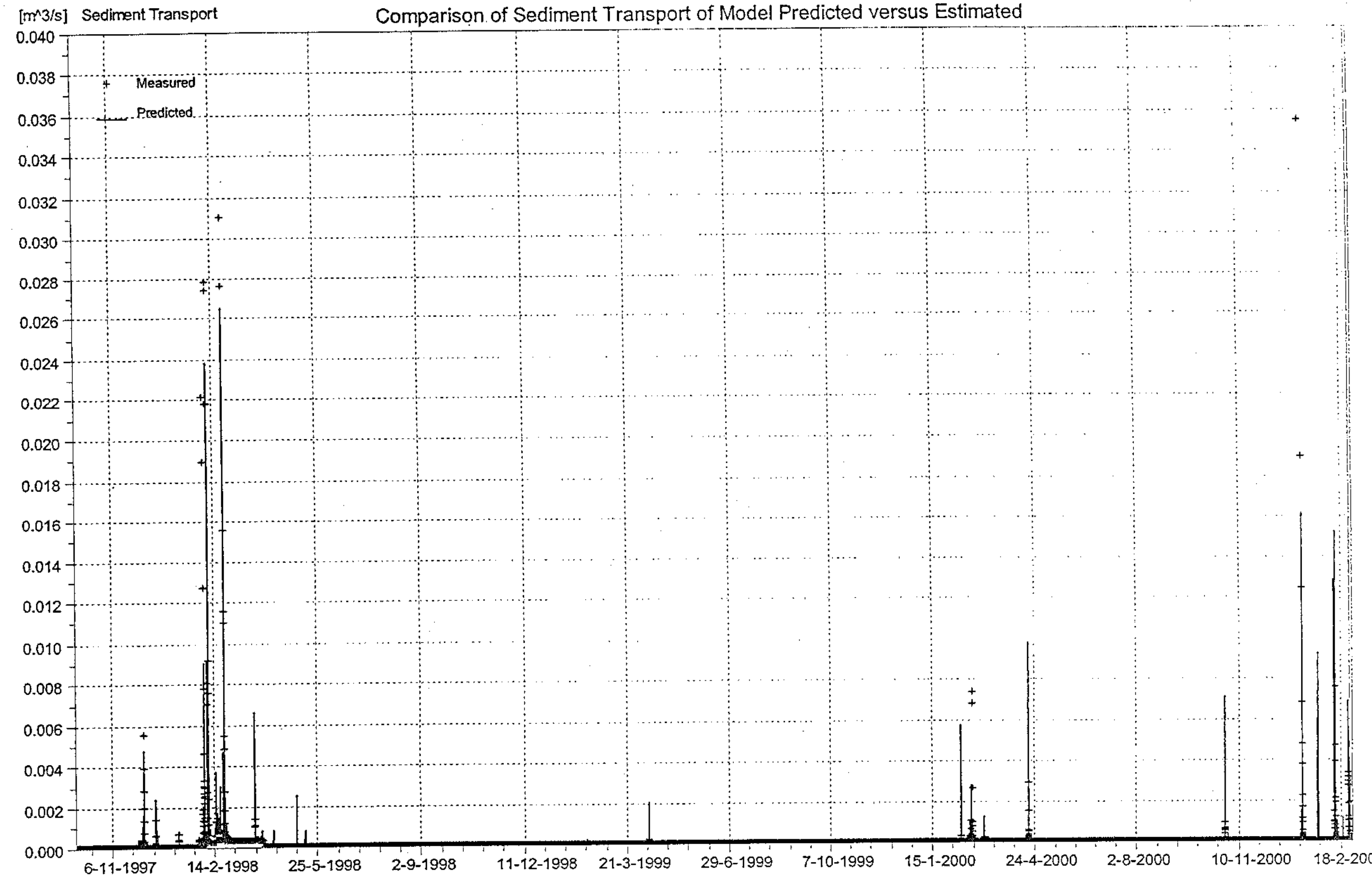
The modeling period for alternatives is from the beginning of water year 1997 to March 2001. The results were summarized from the beginning of water year 1998 to March 2001. The first six months is the model warm-up period, and there was no rain after the first six months or before October 1, 1997. Table C-7 summarizes the total sediment accretion and erosion volumes in the lagoon and different stream reaches over the four years of the modeling period for all four alternatives.

Table C-7 Total Sediment Accretion And Erosion Volumes From a Four-Year Simulation (Cubic Yards)

Alternative	Upstream Inflow	Confluence to Upstream End of Habitat Survey	Upstream End of Habitat Survey - Stream Gage	Stream Gage - Upstream End of Lagoon	Lagoon
Existing Condition	3,765[1]	-1,836[2]	-1,369	4,823	434
Alternative concept 2	3,765	-5,419	-2,299	5,308	4,915
Alternative concept 3	3,765	-5,419	-2,368	7,309	1,711
Alternative concept 4	3,765	-5,419	-2,912	7,697	3,086

Note: 1. A positive number indicates the sediment accretion.
2. A negative number indicates the sediment erosion.

Overall, creek reaches upstream of the stream gage are under a scour mode and river reaches between the stream gage and the lagoon, as well as the lagoon, are under a depositional mode. The upstream boundary of the lagoon in Topanga Creek was defined as the spring high tide inundation line (4.2 feet MSL). With upstream improvements, sediment moves through the creek and reaches the downstream locations. Alternative concept 2 has the largest sediment deposition volume in the lagoon area, and the sediment is mostly deposited in the area immediately upstream of the PCH Bridge and forms a bar. This is due to the backwater effect caused by the existing PCH Bridge. For Alternative concept 4, the volume of sediment deposited in the lagoon is smaller, and if annualized would equate to approximately 0.7 inches per year. Alternative 3 results in a sedimentation rate that is 0.5 inches per year on average. Contrary to existing



Prepared by: Moffatt & Nichol Engineers
Final, April 2002
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Topanga Lagoon & Topanga Creek Watershed Restoration Feasibility Study

MODEL CALIBRATION TO SEDIMENT TRANSPORT RATE

Figure C-11

conditions, any sediment deposited in the lagoon after restoration may be flushed out to the ocean under a larger storm event due to the larger cross-section under PCH, and thus is expected to reside only temporarily. In the absence of post-burn conditions, maintenance actions for Alternative concepts 3 and 4 should be minimal. Post-burn conditions would represent an anomaly and may require maintenance excavation or dredging. Controlled or prescribed burns of the watershed should be implemented to reduce the probability of this occurrence.

Modeling of existing conditions assumes no upstream improvements. The model was unable to simulate existing lagoon conditions with upstream improvements due to instability caused by the severe constriction under the PCH bridge. Results for Alternative concept 1 are assumed to be similar and likely worse in lagoon sedimentation than those for Alternative concept 2.

6.0 CONCLUSIONS AND RECOMMENDATIONS

Numerical modeling of hydrology, hydraulics and sediment transport was performed for existing conditions and lagoon alternatives, and for upstream improvements for specified modeling periods and conditions. Lagoon Alternative concepts 3 and 4 will possess larger downstream openings and will more effectively convey flood flows and cause less adverse effects of upstream backwater and lagoon sedimentation. Upstream improvements will effectively reduce flow velocities and water surface elevations as desired. This will result in less flood damage to infrastructure, less ponding and water damage, and estimated better conveyance of sediment downstream. Lagoon Alternative concepts 1 and 2 will perpetuate existing conditions.

Analysis of runoff from fire events for hydrology and hydraulics was also performed, however, insufficient data exist to enable sediment transport modeling. Results show significant increases in runoff. Qualitatively, sediment transport will also increase significantly to cause sedimentation in areas downstream of the milemarker 2.2 bridge. This condition should be temporary with the sediment being carried farther downstream, and eventually to sea during relatively large storms.

Analysis of water quality has been done using analytical modeling (dilution calculations of bacteria levels) to predict future bacteria levels of alternatives. Alternative concepts 3 and 4 result in significant improvement to water quality compared to Alternative concepts 1 and 2 due to increased lagoon volume and dilution of contaminants. Bird use of the restored marsh is not anticipated to significantly impair water quality.

Recommendations are provided below.

1. Implement upstream improvements along Topanga Creek to improve flood protection, habitat quality, and maintain traffic circulation. Improvements should be implemented at Lake Topanga, Topanga School Road, the Narrows, the landslides, the Rodeo Grounds and the Lagoon/PCH Bridge.

2. Implement a lagoon restoration alternative to improve the environment and provide better flood conveyance to the sea to benefit the coast.

    A. The superior lagoon alternative based on numerical and analytical modeling is the 15.5 acre restoration with an 8-acre lagoon, a 490-foot-long bridge, and highway relocated slightly to the south (Alternative concept 4). This alternative concept most closely replicates the historic condition, provides the maximum amount of habitat restoration, significantly increase recreational opportunities, and potentially provides the greatest improvement to water quality. It also provides the most effective flood conveyance leading to benefits related to fish passage, reduced sedimentation, and less damage to infrastructure and habitat from floods. It will provide an optimal aesthetic and educational experience for residents of the highly urbanized Los Angeles region. In addition, this alternative will substantially increase the opportunity for successful recovery of endangered Steelhead Trout and Tidewater Gobies. This concept costs more than the others to construct, monitor/maintain, and causes impacts by relocating and reducing available parking. It will also require the relocation of historically significant buildings (Wylie's Bait Shop and possibly one or two of the small units of the

Topanga Ranch Motel). This concept most closely supports the golas identified in the Lower Topanga State Park Interim Plan.

B. The other alternative that clearly improves hydrologic and hydraulic conditions at the lagoon is Alternative concept 3, with a 10.5 acre restoration footprint, a 6-acre lagoon, a 340-foot-long bridge and highway relocated slightly to the south. This alternative will provide many benefits, but the retention of the vertical bank on the east side will prevent optimal restoration of natural processes. It provides nearly the same benefits as Alternative 4 related to flood control, though not to the extent of that alternative. It provides more effective flood conveyance than existing conditions and Alternative concept 2, leading to benefits related to fish passage, and less sedimentation and less damage to habitat and infrastructure from floods.

3. Numerical modeling suggests that short-interval automatic rain precipitation data gages in the area of Old Topanga Creek and Santa Maria Creek are essential to accurately predict the watershed peak runoff and should be installed to assess future conditions.

4. Identify the preferred lagoon alternative and initiate permitting and environmental review of that alternative and upstream improvements. If possible, secure permits and complete environmental review of all improvements as one Master Plan for the creek.

5. Closely follow or slightly overlap the planning stage with final engineering design for construction to incorporate permit conditions and mitigation measures in the plans.

6. Continue to pursue all possible funding opportunities to finance project planning, engineering and construction.

7.0 REFERENCES

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APPENDIX D

AGENDAS AND MINUTES FROM TOPANGA CREEK WATERSHED COMMITTEE MEETING PRESENTATIONS IN JUNE, OCTOBER AND DECEMBER 2001

TOPANGA CREEK WATERSHED COMMITTEE

AGENDA

Saturday, 16 June 2001
10 am -12 pm

Meeting Place: **Topanga Elementary School Auditorium**
141 Topanga Canyon Blvd. Topanga CA 90290
At the top of Topanga School Road

1. Introductions and announcements

2. Topanga Lagoon and Watershed Restoration Feasibility Study
   What do we know thus far? Preliminary possibilities and constraints report
   Presentation by: Team from Moffatt and Nichols Engineers, and the RCDSMM

3. Report on the revisions of the recommendations for the Draft Topanga Creek Watershed Management Plan

4. Kerry Lane road maintenance issues and possibilities

5. Next Watershed Committee meeting: Saturday, Thursday, 26 July 2001
   at Top O Topanga from 6-8 pm.

   Invasive Plant sub-committee meeting: Monday, 25 June 2001 1-2:30pm
   at the RCDSMM office

Topanga Creek Watershed Committee

Minutes for Saturday, 16 June 2001

Participants: See attached list

1. Introductions and Announcements

Tricia Watts reported that she has scheduled a Hazardous Waste Round Up on 3 November, 2001 at Topanga Elementary School.
She has set out a Wish List, hoping for sponsorship/donations for curricula materials.
Additional copies of water quality issue handouts available if needed.
Tricia gave update on status of curriculum development with local schools.
Roger Pugliese noted that the TASC newsletter was coming out, and that meetings with Sprint regarding wireless issues were continuing.
Hearing for Wireless projects 28 June at Regional Planning Commission, 320 W. Temple St. Need to send letters or attend if you have concerns.
Susan Nissman announced that the LA County Board of Supervisors will be establishing a Memorandum of Understanding to create a Weed Management Area for the County to deal with invasive plants.

2. Topanga Lagoon and Watershed Restoration Feasibility Study
Rosi provided an overview of the project, explaining how all the current studies fit together, and noted that restoration alternatives will be presented in Dec 2001 for community review. She then introduced Kevin Reagan, data manager and GIS Wizard, who explained why data management using GIS provides greater ability to analyze and use the information, comparing changes over time. He explained the sources of the maps and how they have been tied to geographic landmarks, so they reflect real images. Rosi then reviewed some basic changes to the landscape revealed by the maps:

PCH Bridge span: 1924 = 66 m/ 216' 1940 = 25 m/ 82' 1997 = 25 m/ 82'
1876 mudflat/creek and marsh = 63,598 sq. meters= 15.7 acres
1876 mudflat/creek = 24,783 sq. m = 6.12 acres
1928 lagoon/marsh = 21,271 sq. meters = 5.25 acres
1997 lagoon/creek = 7,848 sq. meters = 1.93 acres
1997 dirt parking lot south side of PCH = 7,548 sq. m = 1.86 acres
1997 fill area west of creek, north side of PCH = 8,715 sq. m = 2.15 acres

Chris Webb and Weixa Jin of Moffatt and Nichols Engineers then gave a power point presentation explaining their role in the project, how the hydrologic and hydraulic analysis is being conducted, and identified possibilities and constraints to restoration actions at the lagoon, as well as several other locations along Topanga Creek. See enclosed summary for more details.

3. Report on the revisions of the recommendations for the Draft Topanga Creek Watershed Management Study

Rosi gave an overview on the history and evolution of the management study since it began with the Floodplain Citizen's Advisory Committee headed by Rabyn Blake in 1989. Remarkable to see how much has been accomplished since the document was released in April 1996. Now time to take it to the next stage. Need a sub-committee of folks to help revise the entire document to fill in gaps and develop guidelines for implementation of Best Management Practices. Time line is short if we wish to have ready for integration into the Local Coastal Plan revision this fall.

Revised recommendations were handed out, and will be mailed to all who participated in the Sept and March workshops for review. Need to add sections that are weak, and determine how best to revise the entire document to incorporate additional information.

4. Kerry Lane issues moved to July agenda when Dept. of Public Works can participate.

Woody Hastings, member of Kerry Lane Protection Project gave a review of why neighbors were concerned with a County proposal to pave the road to reduce erosion. He noted that the County was working with the community to develop a more site specific set of solutions for erosion problems that did not encourage development of parcels off the road by providing paved access. Susan Nissman added that the County is trying to work with the community, but has a responsibility to keep the road passable. Road Maintenance representatives will be attending the July meeting to share their revised proposals.

Next meeting: Thursday, 26 July 2001 6-8pm at Top O Topanga Mobile Homes Estates.

Next Invasives Subcommittee meeting: Monday 25 June, 12:30pm at the RCD office.

TOPANGA CREEK
WATERSHED COMMITTEE

STATE OF THE WATERSHED
AGENDA
Saturday, 20 October 2001
10 AM - NOON

Meeting Place: Topanga Elementary School Auditorium
141 Topanga Canyon Blvd. Topanga CA 90290 At the top of Topanga School Road

6. WELCOME From Assemblywoman Fran Pavely

7. Presentations from Topanga Creek Watershed Community Groups and Agencies such as: Arson Watch, TASC, Topanga Community Club, Firesafe Committee, VOICE, LA County representatives, State Parks, Traffic Committee, Trout Unlimited, S.C.A.T., Caltrans, TC Town Council, Chamber of Commerce, Creekside Homeowners Assoc, Top O Topanga, LA Regional Water Quality Control Board, Santa Monica Mountains Conservancy, Historical Society, Heal the Bay, Lower Topanga Community, CHIC, T-CEP, TEP, Surfrider

8. Report on the revisions of the recommendations for the Draft Topanga Creek Watershed Management Plan

9. Update on watershed research projects. What have we learned?
   Topanga Lagoon and Watershed Restoration Feasibility Study

NOON – 2PM Bring a bag lunch!

WHAT IS YOUR VISION FOR THE NEW STATE PARK AT LOWER TOPANGA?

Join us for a chance to map out your dream park restoration and help inform the State Parks planning process.

If you wish to receive meeting agendas and minutes via email, please send us your email address to info@rcdsmm.org

Subj: October 2001 TCWC Minutes (please forward to Natasha Lomas)
Date: Tuesday, January 8, 2002 10:50:43 AM
From: patricia.watts2@verizon.net
To: OAKSRUS@aol.com

October 20th, 2001
Topanga Creek Watershed Committee Meeting Minutes

Participants: See Attached list
Called to order at 10:15 AM
Topanga Elementary School Auditorium

1. Welcome - California Assemblywoman Fran Pavley

Fran Pavley welcomed participants and guests to the State of the Watershed Meeting. She thanked the people of Topanga for their

concern and participation in working to maintain a healthy Topanga

Watershed and read the mission statement for the Watershed Committee.

Pavley brought with her a hot off the press "green map" of the Santa Monica and Ballona Watershed, which she offered as a model educational

tool, one that we in Topanga might consider. This map locates and promotes

sustainable watershed features, both natural and manmade.

Pavley also reported on a Park Bond - 2.6 Billion Dollar Park Bond Measure that will be on the March Ballot, and which will allocate 300 Million

for Water Quality and 200 Million for Coastal Conservation/ Acquisition of Land.

The rest will go to State Parks and the Santa Monica Mountains Conservancy.

2. Presentations - Topanga Creek Watershed Community Groups and Agencies

Arson Watch, Alan Emerson 455-4244
They have six new members and are still looking for more new people. Alan noted that there have been a few small fires so far this summer that

were started by kids playing with fireworks.

Topanga Coalition for Emergency Preparedness (TCEP), Fred Freer 455-3000
They have acquired funding and are leasing a space near the Topanga Christian Science Center to set up an emergency operation headquarters.

One of the residents asked about cell phone access during fires. Fred mentioned

that cell phone stations require electricity to operate so the only way that you can

have efficient access during an emergency would be a satellite phone which is very expensive but dependable.

Topanga Citizen's Firesafe Committee, David Totheroh 455-2600
It was reported that the Firesafe Committee would be focusing future efforts more on education. They are created a calendar with helpful tips on

brush clearance and runoff, by the month! One resident was concerned that

people were cutting down Manzanita trees to comply with brush clearance.

Historical Society, Scott King 455-1969
Scott brought handouts with a list of current projects that the Historical Society will address in the coming year. He noted that "The

Topanga Story" book was almost sold out and that they were looking into running a reprint. They will also be publishing a new brochure. A first of two-meeting series on the history of art in Topanga was recently held and the second meeting will take place in January featuring Megan Rice.

Topanga Community Club, Lola Babalon 455-1980
The Topanga Community Woman's Club is now known as the Topanga

Community Club after fifty years. There is also now a subcommittee known

as CHIC, the Community House Improvement Committee, which is operating

under the auspice of the Topanga Community Club to do a feasibility study of

the needs of the community and the facilities that will meet these needs within

the limitations of the site.

Community House Improvement Committee (CHIC), Jack McNeil 455-1980
This committee formed in September of 2000 consists of 15-20 members
from the community. The goal is to create a master plan for the Community

House property. They will be applying for Grants and doing fundraisers to

pay for the improvements. They are looking to build a 6,000 - 10,000 sq.ft. building on the 12 acre site, in addition to the existing building which was built in the1950s. There are also plans for a circle driveway

so that buses can drop off middle school and high school students for the

Topanga Youth Services after school programs. There will also be a connector trail built to access the State Park.

Topanga Canyon Town Council, Vic Richards 455-3000
Topanga Access Stickers will be available in January 2002 for ten dollars to be placed in your car window for access to the canyon during

emergencies. Town Council is responsible for creating the Traffic Committee.

Topanga Mail and Message, Mary Bloom 455-1437
Mary presented a "Welcome to Topanga" packet which they sell for $6 to real estate agents for new residents to Topanga which includes the "Living

Lightly in the Watershed" brochure created by the TCWC and a "Companion

Animals in the Canyon" guide. They also include a "Evacuating Topanga" book

published by TCEP last year.

Viewridge Owners Involved in the Community and Environment
VOICE, Herb Peterman 818-888-0209
Herb talked about plans to build more trails to access the State Parks and Conservancy properties from Viewridge. There are also plans for a trail

at Summit Point over to Mulholland. Herb assured the residents that these trails

follow closely the "Smart Plan" established by the National Park Service and

uphold sensitivity to over fragmentation of wildlands.

Top O' Topanga, Michael Shore (VP Homeowners Association)
Michael thanked Topanga residents for their support which made possible for the residents at Top O'Topanga to purchase their homes. Now as

homeowners they want to address how they are going to treat their hillsides since they are at the top of the upper watershed. Rosi thanked Michael for the Associations invitation to use the Library for our monthly watershed meetings.

Topanga Creekside Homeowners Association, Rabyn Blake 455-1709
Rabyn pointed out that the creek is a bio-indicator of the health of our watershed and for the people who live on the creek, it is most evident if

something is wrong. CCHA is most concerned at this time of the plans to

remove invasive species and would like to see this program executed on public land first.

Santa Monica Coalition for Alternatives to Toxics (SCAT), Steve Hoye
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Auditorium to propose a non-herbicidal removal plan. Speakers will include Susan Kegley from the Californians for Pesticide Reform; Dr. Kirk Murphy from UCLA who is also a member of the LAUSD Safe

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which means the guiding principles of land use will be dictated the land in

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and how impressed she is with the private resident turnout that we have at our

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The 5th grade class will do a charette on the lower canyon, lagoon
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Several

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Clay introduced the interim planning team for the Lower Topanga property.

Marla Mealey, Archeologist
Alex Bevil, Historian
Brenda McMillan, Resource Ecologist
Barney Matsumoto, Senior Landscape Architect
Superintendent, Steve White

The draft document will be ready at the first of the year.

At this point he invited thoughts on a Lagoon Restoration and then we broke into

smaller groups to answer questions posed by State Parks. Copy attached.

Attendees
Fran Pavley, State Assembly
Rosi Dagit, RCDSMM
Tricia Watts, RCDSMM
Susan Chasen, Topanga Messenger
Susan Nissman, 3rd District
Larry Charles, Los Angeles County Beaches
Julie Rosa, resident
Jill Waldron, resident
Steve Williams, RCDSMM
Alfred Ramos, USDA/NRCS
Roger Pugliese, TASC
Vic Richards, CHIC
Julie Clark, RWQCB-LA
Steve Hoye, resident
John Clemens, resident
Shirley Birosik, RWQCB-LA
Jade, resident and Landscape Architect
Scott King, Historical Society
Laurie Newman, Senator Kuehl's office
Jack Topel, SMBRP
Oscar McGraw, resident
Doug Thomas

Kenneth C. Widen, resident
Lola Babalon, Topanga Community Club
Ken Whelland, resident
Mike Shore
Jack Liebster, State Coastal Conservation
Nelson Yardley, resident
Ron Fomalert, TASC
Paul Edelman, Santa Monica Mountains Conservancy
Clark Stevens, TCWC
Allen Emerson, Arson Watch
Delmar Lathers, resident
Rabyn Blake, TCCHA and SCAT
Steve White, State Parks (Topanga Superintendent)
Teag Reaves, resident
Karen Horn, resident
Carolanne Sudderth, Malibu Times
Laura Bateman, resident
Donna Christianson, resident
Jennifer Shelstead, RCDSMM
Geri Kenyon, LAUSD
John MacNeil, CHIC
Norman Karlin, TCWC
Dave Brown, Sierra Club
Craig and Jennifer Collins, Lower Canyon residents
Janek Dombrowa, resident
Susan Nelson, Friends of the SMM
Woody Hastings, RCDSMM
ChoQosh AuhHooh, Native Trust
Craig Frampton, Moffett and Nichols Engineers
Chris Webb, Moffett and Nichols Engineers
Scott Dittrich, lower canyon resident
Mary Bloom, Topanga Business Journal
Fred Freer, TCEP

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Topanga Creek Watershed Committee Meeting Minutes
20 October 2001

Topanga Elementary School Auditorium

1. Welcome - California Assemblywoman Fran Pavley

Fran Pavley welcomed participants and guests to the State of the Watershed Meeting. She thanked the people of Topanga for their concernand participation in working to maintain a healthy Topanga Watershed and read the mission statement for the Watershed Committee.

Pavley brought with her a hot off the press "green map" of the Santa Monica and Ballona Watershed, which she offered as a model educational tool,one that we in Topanga might consider. This map locates and promotes sustainablewatershed features, both natural and manmade.

Pavley also reported on a Park Bond - 2.6 Billion Dollar Park Bond Measure that will be on the March Ballot, and which will allocate 300 Million for Water Quality and 200 Million for Coastal Conservation/ Acquisition of Land.The rest will go to State Parks and the Santa Monica Mountains Conservancy.

2. Presentations - Topanga Creek Watershed Community Groups and Agencies

Arson Watch, Alan Emerson 455-4244

They have six new members and are still looking for more new people. Alan noted that there have been a few small fires so far this summer that were started by kids playing with fireworks.

Topanga Coalition for Emergency Preparedness (TCEP), Fred Freer 455-3000

They have acquired funding and are leasing a space near the Topanga Christian Science Center to set up an emergency operation headquarters. One of the residents asked about cell phone access during fires. Fred mentioned that cell phone stations require electricity to operate so the only way that you can have efficient access during an emergency would be a satellite phone which is very expensive but dependable.

Topanga Citizen's Firesafe Committee, David Totheroh 455-2600

It was reported that the Firesafe Committee would be focusing future efforts more on education. They are created a calendar with helpful tips on brush clearance and runoff, by the month! One resident was concerned that people were cutting down Manzanita trees to comply with brush clearance.

Historical Society, Scott King 455-1969

Scott brought handouts with a list of current projects that the Historical Society will address in the coming year. He noted that "The Topanga Story" book was almost sold out and that they were looking into runninga reprint. They will also be publishing a new brochure. A first of two-meeting series on the history of art in Topanga was recently held and the second meeting will take place in January featuring Megan Rice.

Topanga Community Club, Lola Babalon 455-1980

The Topanga Community Woman's Club is now known as the Topanga Community Club after fifty years. There is also now a subcommittee known as CHIC, the Community House Improvement Committee, which is operating underthe auspice of the Topanga Community Club to do a feasibility study of the needs of the community and the facilities that will meet these needs within the limitations of the site.

Community House Improvement Committee (CHIC), Jack McNeil 455-1980

This committee formed in September of 2000 consists of 15-20 members from the community. The goal is to create a master plan for the Community House property. They will be applying for Grants and doing fundraisers to pay for the improvements. They are looking to build a 6,000 -10,000 sq.ft. building on the 12 acre site, in addition to the existing building which was built in the1950s. There are also plans for a circle driveway so that buses can drop off middle school and high school students for the Topanga Youth Services after school programs. There will also be a connector trail built to access the State Park.

Topanga Canyon Town Council, Vic Richards 455-3000

Topanga Access Stickers will be available in January 2002 for ten dollars to be placed in your car window for access to the canyon during emergencies. Town Council is responsible for creating the Traffic Committee.

Topanga Mail and Message, Mary Bloom 455-1437

Mary presented a "Welcome to Topanga" packet which they sell for $6 to real estate agents for new residents to Topanga which includes the "Living Lightly in the Watershed" brochure created by the TCWC and a "Companion Animals in the Canyon" guide. They also include a "Evacuating Topanga" book published by TCEP last year.

Viewridge Owners Involved in the Community and Environment
VOICE, Herb Peterman 818-888-0209

Herb talked about plans to build more trails to access the State Parks and Conservancy properties from Viewridge. There are also plans for a trail at Summit Point over to Mulholland. Herb assured the residents that these trailsfollow closely the "Smart Plan" established by the National Park Service and uphold sensitivity to over fragmentation of wildlands.

Top O' Topanga, Michael Shore (VP Homeowners Association)
Michael thanked Topanga residents for their support which made possible for the residents at Top O'Topanga to purchase their homes. Now as homeowners they want to address how they are going to treat their hillsides since they are at the top of the upper watershed. Rosi thanked
Michael for the Associations invitation to use the Library for our
monthly watershed meetings.

Topanga Creekside Homeowners Association, Rabyn Blake 455-1709

Rabyn pointed out that the creek is a bio-indicator of the health of our watershed and for the people who live on the creek, it is most evident if something is wrong. CCHA is most concerned at this time of the plans to remove invasive species and would like to see this program executed
on public land first.

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TOPANGA CREEK
WATERSHED COMMITTEE

AGENDA
Saturday, 8 December 2001
10 AM - NOON

<u>Meeting Place</u>: **Topanga Elementary School Auditorium**
141 Topanga Canyon Blvd. Topanga CA 90290 At the top of Topanga School Road

1. Introductions and Announcements

2. Report on the revisions of the recommendations for the Draft Topanga Creek Watershed Management Plan

3. Update on watershed research projects. What have we learned?
   Steelhead Trout Survey - Dr. Camm Swift
   Erosion and Sediment Delivery Study – Dr. Tony Orme
   Frogs, Turtles, and Water Quality – Rosi Dagit
   Topanga Lagoon and Watershed Restoration Feasibility Study – Chris Webb, Weixia Jin, and Craig Frampton

Next Meeting: Thursday, 24 January 6-8pm
Top O Topanga Mobile Homes Estates

13 December 2001

Topanga Creek Watershed Committee Meeting Minutes
Saturday, 8 December 2001

Meeting held at Topanga Elementary School Auditorium

1. Introductions and Announcements:
   Rosi Dagit started the meeting at 10:15am with announcements.
4. Handouts on water quality, frog survey results, stakeholder surveys available
5. Be sure to enjoy the lagoon restoration visions drawn by the 5th graders following the watershed classes taught by the RCDSMM staff, Tricia and Rosi (4th graders also participated)
6. Donations for refreshments go towards more education materials
7. State Parks is hosting a meeting to discuss the Interim Plan for Lower Topanga on Thursday, 13 Dec at Wilbur Ave School in Tarzana, 7-9pm

2. Report on the revisions of the Topanga Creek Watershed Management Plan
   Rosi reported that the editing committee will meet on Monday 10 Dec to finalize the formatting and discuss final editing needs. She hopes the draft document will be available for review in January.

3. Update on watershed research projects.

Dr. Camm Swift presented slides of the on-going survey of steelhead trout and their habitat needs in Topanga Creek. Over 100 young trout were counted in June 2001, with about 30+ remaining. This is a fairly normal rate of mortality due to predation by birds, etc. He showed photos of the suitable habitat found along the stream corridor and discussed the instream mapping effort to quantify this. Over 5800m of creek was mapped, meter by meter and data collected on substrate, cover, habitat type, depth, width, and other important parameters for fish. The data are being summarized by Rosi and will be available in the spring. He showed photos of the non-native problem species like blue gill, carp and striped bass which are not found in Topanga.

Tidewater gobies are a special interest of Dr. Swift and he has been monitoring Topanga Lagoon since the 1970's looking for these endangered coastal fish. At the June 2001 survey, a healthy population was discovered for the first time. Dr. Swift thinks that the reintroduced population at Malibu Lagoon was able to spread downcoast and colonize Topanga. DNA analysis of the fish is in progress and will help identify the source of the population.

Overall, Topanga has much suitable habitat, although some natural low flow movement impediments (waterfalls, boulder chutes, etc.) are present and limit the extent of the fish movement. The study will continue through the summer of 2002, so more info will be presented as it becomes available.

Dr. Tony Orme then gave a summary of the erosion and sediment delivery study he has been conducting with the RCDSMM since October 2001. He has found that much sediment is stored in the upper watershed as a result of hillslope erosion. Large debris areas can stay put for long periods of time until they are activated by large storm events or earthquakes. Topanga Creek is quite young, and tectonic forcing is a major shaping force of the lower basin, resulting in the steep gradient. So once the debris gets activated, it flows directly to the coast. The importance of this study is to establish a baseline during an "average" rainfall year, when no dramatic events occurred. It takes a storm dumping over 1/2" rain/hour after the basin is saturated to activate the debris flows. Most mass movement is associated with culverts, fire roads and other disturbances of the slopes.

Most interestingly, the erosion rate is quite high, and preliminary review of the data indicates that it is higher than the rate of tectonic rise, meaning that the hills are eroding faster than they are being lifted. He also mentioned that the true source of Topanga Creek is really the end of Garapito Creek, and the drainages coming from Summit Valley are secondary to that.

Dr. Amalie Orme then discussed the data collection at cross section locations throughout the watershed which have been monitored over the last year as well. Surveys of the channel will reveal patterns of deposition and scour, bedload characteristics and suspended sediment information over time. Surveys have also been done at the lagoon to document its configuration changes during the year. These surveys are done following each storm event to identify how the event changed the area.

Wave forcing at the lagoon is a major factor in keeping the berm closed. Only during storm events is the creek strong enough to break through.

Rosi Dagit then gave a summary presentation showing how all of the research projects relate to each other. The directive of the Watershed Management Plan was to develop a baseline understanding of all the complex interactions in the watershed since they influence each other strongly. The Plan wanted enough information to evaluate how actions taken to solve flood or fire hazard might impact other elements of watershed function. All of the current research projects are like the pieces of a puzzle being fit together to create a whole picture.

Critical to all life in the watershed is water, both quantity and quality. The results of the 2 year water quality study provided important information. We learned that the water quality is quite suitable to support a wide diversity of aquatic critters, with low levels of nutrients like nitrates and phosphates, and no evidence of heavy metals. The bacterial picture was not as good. While high levels of total and fecal bacteria have little impact on the critters, it does pose a human health problem. Four areas in the upper watershed had high levels of bacteria (Entrado Rd, Highvale, behind the Topanga Market and at Falls Drive) which may be a direct result of improper greywater disposal, as well as septic system problems. By the time the water reached the bridge 2 miles upstream from the beach, it is of excellent quality except following first flush and large storm events. Which leads to the question of why bacteria levels at Topanga Beach are so high, especially when the berm is open? It is clear that the upper watershed is not the main source of the problem. A combination of road runoff, septic and greywater inputs near PCH and possibly downcoast water movement may all be responsible. State Parks will need to look into this matter further. In the upper watershed, sediment may be the most important limiting factor of water quality influencing the distribution of aquatic critters.

From a frog point of view though, the water is fine! Nitrate levels over 4 ppt are known to have adverse impacts on frogs, even though the drinking water standard is 10ppt. The amphibian surveys conducted in cooperation with National Park Service and the US Geological Survey in spring of 2000 and 2001 are an attempt to see how the species fare today compared to a survey done in 1986. Topanga still supports a wide diversity and density of Pacific Tree Frogs, California Tree Frogs, Western Toads, CA Newts, 2 striped garter snakes is still quite high.

Western Pond turtles are another species of special concern which are found in Topanga. A study of their movements and habitat preferences will begin in spring 2002. Volunteers who wish to help with the radio tracking are invited to call Rosi for more details. Recent park acquisitions have saved important turtle habitat from potential development.

All of these critters need to eat, and the insects that live in the creek are an important food source, not only for the amphibians and reptiles, but for the steelhead trout and bats as well. Surveys of macro invertebrates found in three sections of Topanga Creek were conducted in May and October, in cooperation with a study being coordinated by Heal the Bay. The goal is to establish a baseline of species presence and absence, and evaluate the diversity and tolerance of these species to urban influences throughout the Santa Monica Mountains.

Topanga Canyon is shaped by catastrophic events, flood, fire and earthquake. It was also important to look at the way water moved through the creek to see if there were opportunities to remedy known problem locations throughout the watershed. This led to the Watershed Restoration Feasibility Study which is now in its final stages. Funded by a grant from the Coastal Conservancy Southern CA Wetlands Recovery Project, a Technical and Landowners Advisory Committee set forth an ambitious program to evaluate problems and solutions as a whole, not as separate pieces.

Moffatt and Nichols engineers were selected by the Committee to develop a computer model that would allow integration of hydraulics, hydrologic inputs, sediment delivery, water quality and biological constraints. The model is being tested using actual stream flow and rainfall data provided courtesy of LA County Dept. of Public Works for several time periods, from 1977 to present. The major flood event of 1980 as well as the more common low flow periods are all being evaluated for their role in the watershed process.

Chris Webb from Moffatt and Nichols explained that several key sites in the watershed were being examined. Starting in the upper watershed, the "Lake Topanga" landslide which has choked the creek south of Robinson Road is one location. The riprap wall below Topanga School Road is another. A large boulder waterfall that is impassible for fish in the State Park below town is an example of a natural problem.

The "Narrows" area between the 2 mile bridge and the turnout along Topanga Canyon Blvd. is a major project. Also known as the Caltrans Formation, this section of the road has been repeatedly repaired over the years by adding more and more riprap boulders to hold up the road. The current repair was done following the 1995 storms and is seriously undercut. A more lasting and durable solution is clearly warranted.

Additional landslides located downstream of the 2 mile bridge are all associated with areas where Caltrans has extended the road shoulder in order to protect the road. This deflects the force of the creek against the other banks, causing them to fail and choke the creek with debris, further accelerating the flow and causing more bank erosion downstream.

Finally, the opportunity to restore the lagoon and lower creek to more natural processes has been a major focus. Several alternative designs were suggested for consideration by the TAC. The following is a summary of his discussion.

Lagoon Alternative 1 – No Project – Lagoon remains as it is today

Size: approximately 2.5 acres

Problems: flood constriction currently, little tidal exchange, minimal habitat, poor water quality, limited recreational opportunities

Benefits: Existing public safety framework handles emergencies, beach parking access is good, no need to effect traffic on PCH, overflow and event parking available on SW dirt lot

Lagoon Alternative 2 – Remove fill on the SW side of PCH (Beaches and Harbors lot) and increase flood conveyance by tunneling 2 large (at least 12" diameter) culverts

Size: approximately 5 acres

Problems: lagoon circulation may be restricted due to thalweg location, causing some stagnation, flood debris can clog culverts, fish passage through culverts creates a barrier to migration, minimal habitat and water quality improvement, need to find location for fill disposal

Benefits: Allows PCH bridge to remain, as well as all fill on north side of PCH, slightly increases flood conveyance, car access for lifeguards to west beaches maintained

Lagoon Alternative 3 – Remove fill on the north and south WEST sides of PCH back to original grade, replace PCH bridge with longer span (approximately 300') by building a new bridge adjacent to the present one on the south side and tying the road access across the Beach Parking lot.

Size: approximately 10 acres

Problems: PCH bridge needs to be replaced with a longer span and the road realigned, need to find location for fill disposal, Wylie's Bait shop would need to be moved (it is a historic structure), beach parking and access will be displaced to north side of PCH, difficult for lifeguards to see and protect north reach of lagoon

Benefits: Restores the west side of the historic lagoon configuration which is where the creek channel wants to go, flood conveyance improved with significant water level and velocity drops, sediment delivery restored to more natural historic condition, wetland habitat restored providing more area for tidewater gobies and better conditions for migrating steelhead trout, bird foraging opportunities improved, better opportunities for natural filtration and improved water quality, maintains lifeguard access to west beach, improves recreational opportunities associated with nature walks and education programs

Lagoon Alternative 3A – Remove fill on north and south WEST AND EAST of PCH back to original lagoon grade, with a gentle slope on east side to protect Topanga Ranch Motel (historic structure), replace PCH bridge with longer span (approximately 500') by building a new bridge adjacent to the present one on the south side and tying the road access across the Beach Parking lot.

Size: approximately 15-20 acres

Problems: PCH bridge needs to be replaced with a longer span and the road realigned, need to find location for fill disposal, Wylie's Bait shop and possibly portions of the Ranch Motel would need to be moved (historic structures), beach parking and access will be displaced to north side of PCH, difficult for lifeguards to see and protect north reach of lagoon

Benefits: Restores both the east and west sides of the historic lagoon configuration, flood conveyance improved even more, with significant water level and velocity drops, sediment delivery restored to more natural historic condition, additional wetland habitat restored providing more area for tidewater gobies and better conditions for migrating steelhead trout, bird foraging opportunities improved, better opportunities for natural filtration and improved water quality, maintains lifeguard access to west beach, improves recreational opportunities associated with nature walks and education programs

The meeting concluded with a request for all stakeholders to turn in their survey forms regarding suggestions for ways the Watershed Comm. Could improve their services to the community and to evaluate the lagoon alternatives presented and provide additional input. Survey results indicated that 80% of those that turned in their surveys (18 total) were in favor of Alternative 3A.

Holiday greetings to all!

NEXT MEETING: Thursday, 24 January 2002 Top O Topanga Mobile Home Estates Library

Topanga Interim Management Plan
Proposed Goals and Actions
[*Alternatives are italicized*]
12/12/01

1. Enhance Wildlife Habitat and Plant Community Values

1) Remove manmade intrusions in the Natural Habitat Zone. Remove fences, structures and debris.
2) Roadways
   a) *Work toward removing and revegetating roadways in the Natural Habitat Zone.*
   b) *No active removal at this time. Merely close to public vehicular use.*
3) Work toward removing non-native, exotic species in the Natural Habitat Zone. (Mechanical removal is preferred.)
   a) *Only focus on the most aggressive non-native plants: Arundo and Tree of Heaven, Cape Ivy.*
   b) *Focus on the above plus other less invasive species: English Ivy, Palms and Eucalyptus.*
   c) *Focus on all non-native species: the above plus other non-native ornamental plants.*
4) State Department of Transportation Dumping
   a) *Work with the State Department of Transportation to discontinue dumping on State Park property along Topanga Canyon Blvd, and removal of existing dumped material.*
   b) *In addition to the above, add slope restoration.*
5) Continue to actively participate in and support planning efforts and studies that will result in restored natural processes and protect endangered species (including Steelhead Trout and Tidewater Goby). These planning efforts will, most significantly include lagoon restoration and streambed restoration.

2. Enhance the quality of public's environmental experience (Aesthetics, Views)

1) Remove manmade intrusions that detract from the visitors' environmental experience and access. Remove fences, structures and debris.
2) Roadways
   a) *Work toward removing and revegetating roadways in the Natural Habitat Zone.*
   b) *No active removal at this time. Merely close to vehicular use.*
3) Remove visual obstructions along Topanga Canyon Blvd. and other public use areas. (Structures, fences, debris). Restore with native plants.
4) Redesign the frontage area along PCH to be more attractive and better organized for the movement of people and vehicles.

3. Provide Support Facilities that enhance the Public's visit to Topanga State Park

1) Develop a small trailhead parking area (10 to 15 vehicles) with a few picnic tables.
   a) *The "Pit" area behind the motel site or,*
   b) *The Old Malibu Road area behind Wylie's or,*
   c) *Along PCH in front of the Topanga Ranch Motel.*
2) Develop a loop trail through the lower portions of the Natural Habitat Zone with seasonal crossings of the creek.
3) Develop trail leading to a viewpoint atop Sentinel Rock.
4) Maintain the existing Parker Mesa Overlook Trail and Santa Ynez Trail within the northeastern portion of the acquisition.
5) Allow continuation of commercial enterprises along PCH over the course of the 2 year interim period covered by this plan. (Wylie's, Topanga Ranch Motel, Cholada, Something's Fishy, the Reel Inn, Topanga Ranch Market, Ginger Snips, Money House, The Oasis, Feed Bin.)

4. Protect the Public and the site's natural and cultural resources from hazardous conditions (Safety, Ease of Access)

1) Remove vacant structures, fences, miscellaneous site debris and any hazardous material.
2) Remove sources of water quality impacts and address vegetative management issues, in compliance with regulatory agency mandates.
3) Utilize existing buildings and/or temporary modular facilities to accommodate up to 8 structures for state park operations use.
4) Implement appropriate signage.
5) Repair existing pedestrian routes.

5. Provide Educational Opportunities to the Visiting Public

1) Install interpretive panels.
2) Begin organization of volunteer docents.
3) If the current operator of the Topanga Ranch Motel chooses to relocate, utilize existing buildings for any of the following (not mutually exclusive):
   a) An Overnight Educational program (School Programs, Jr. Lifeguard, Youth Programs),
   b) Interpretive / Educational Center,
   c) Santa Monica Mts. Environmental Agencies (or Support Groups) offices and/or
   d) Park operations.

6. Continue Responsible Stewardship in the Operation of Topanga State Park

1) Eliminate all private residential use. (These Operational Costs detract from other public service. Private residential use is contrary to several components of the State Park Mission.)

7. Protect and interpret historical and archaeological resources that are potentially eligible for the National Register of Historic Places.

1) Manage eligible historic structures to assure longevity and integrity of historic features. (Topanga Ranch Motel, Wylie's and the Reel Inn)
2) Continue study for the presence and significance of archaeological sites.

Alternatives considered but deemed **not** consistent with interim management goals:

- Maintain Private residential use.
- Implement overnight camping or recreation vehicle use as suggested in 1977 general plan.
- Create formal trailhead parking along Topanga Canyon Boulevard.

Lower Topanga Interim Management Plan
Meeting Notes from October 20, 2001 Public Meeting

A. COMMENTS TAKEN FROM GROUP FLIPCHARTS

General Comments
43 million and prop. — public property
Are we being manipulated by the questions on the form?
It now belongs to everyone
State proposal is driven by agenda expansion and growth
State will implement its own agenda — regardless
State will not take these comments seriously.

Natural Resources
Improve water quality, habitat natural, surfing habitat (non hierarchical)
LA county has lost 98% of wetland habitat
Only partially undamaged watershed to Ocean in Santa Monica Mtns.
Protect habitat
Watershed — repair; co-exist.
An entire ecosystem benefits, nesting king fish, trout, crab
As much restored marsh as possible — not subsidiary to parking
Compatible with wildlife and environment
Exceptional occasion to preserve natural stands of white Alder
Has questions about water flow — old/new
Inland creek and riparian woodland should be preserved
Natural flows and their current obstructions (concrete berm; currently artificially woody is a fresh marsh
Provide native corridor
Remove dikes & let streams determine its own course
Restore Enhance the Natural Beauty
Restore Historical & Existing Fisheries (Restore above for the good of the public)
Restore Improve Water Quality
Restore Land forms
Restore Natural Habitat — Native Plants
Restore Natural Hydrology
Restore Preserve Historical Native and non-Native Trees
Restore riparian — lower woodlands
Restore Tidal Flows
Restore Wetlands
Serious, fertile wetlands (a replacement home for those wetlands lost)
What does the creek want to do?

Lagoon
(300 +) span bridge prior to CalTrans work
Restore lagoon and wetlands

1914 photo shows historic flood (represents extreme conditions — not daily or common conditions)
Any maps used before feasibility — flood maps starting 1938
Bridge PCH (free up lagoon)
Can a Historic Community co-exist with a Lagoon Restoration?
Development of lagoon north of P.C.H. with bottle neck at P.C.H.
Looking back to 1938 — flood records start @ that point
Reduced lagoon from 32A → 2 acres
Remove highway fill from creek boundaries and flood plain
Water Filtration — natural processes or enhancing natural process with man-made
Watershed community may be using only one set of maps not full overlay
Who benefits from a large lagoon?

Residential Use
Allow business and residents to remain until there is a permanent plan in place.
Allow for smooth transition for residents
How can tenants move out by July 2001 without interim final plan
I his opinion today state parks is not able to build appropriate visitor facilities — would like to reserve SPRINKLING of exist. Cottages for the architectural beauty and cultural significance.
In sympathy with preserving some exist uses.
Need time to relocate to find new relocation. Artistic environment and creative space
Relocation problems with artistic environment — how to duplicate the loss of community
Resident's concerns (partners in the new development)
Restore To preserve personal interests and communities
Smooth!! Transition but no long term retention of position houses
Soft-deadline
This is a dynamic area (restoration should preserve also some of the existing businesses and community and native plant & trees life (which to keep them? — cultural overlay — historic, human)

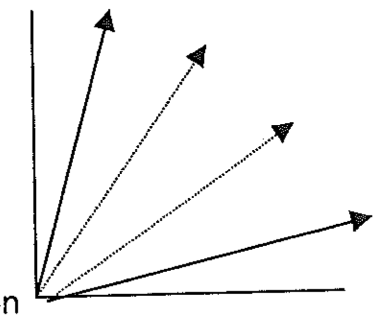
Commercial
commercial sharing historic past with visitors.
keep some business

Historic / Prehistoric
CalTrans re-aligned PCH — (1930s)
LA Athletic Club water deep water harbor
Archaeological important
CalTrans raised top — Wy +- 30 of fill
Historic resources (rodeo ground s equestrian events (writers, actors, producers)
Historical Resources = Existing Homes (Lower Topanga Culture)
Silent picture, filming, structures — landscapes

What use if historic structures preserved

Safety and Health
Any uses that are retained must be brought up to SAFE sewage disposal standards.
Cleanup of illegal, dangerous and in violation of code structures, septic
Public safety

Public Use
Campers will destroy habitat
Can provide access (traits, guided walks, some public control)
Nature/access-controlled; no nature center/parking toilets
Preserve: surfing beach, parking along beach
A gateway to Santa Monica Mountains (should not become parking oasis of asphalt)
Access from valley to the beach does not need to be a direct path
Best leave as is
Bike paths, hiking, biking, coastal camping area is needed
Camping industry has lobbied for RV camping
Concerns — no camping
Green county prosperity
Is a lagoon conducive with Public Recreation (in the lagoon)?
Limited walking access
Limited walking access
Look at topography — steepness ravines
Low public impact —
Maintain low impact use
Nature Observation
Nature Observation
NO nature center,
No overnight use
NO visitor center
Objects to Vehicle Camping
Outdoor classroom activities (limited)
Outdoor classroom activities (limited)
Parking — facilities to preserve the resources
Parking-off T.C. Blvd. Up to Brookside
Premier surf brake
Preserve cerry lane with regard to reasonable use and access.
Topanga Road beautification
Use currently unoccupied areas
Visitors center? (social activities — environmental activities — educational activities)
Where trails? access northwest corner of acquisition



B. COMMENTS TAKEN FROM INDIVIDUAL SURVEY SHEETS

Natural Resource Stewardship (Includes Plants, Wildlife, Landform and Views)

What do you consider the most important natural resources in the Lower Topanga area?

Wildlife, habitat, fisheries, wetlands, native vegetation
People
17% of wetlands have been lost — want resources to be restored.
beach (good water quality and classic night point stuff break)
- lagoon (water quality improvement possibilities) end, species restoration steelhead, goby, etc.)
- floodplain (wetlands – wildlife habitat)
Plants, animals, etc. native to area (Restored marshland) wetlands
Opportunities to restore wetlands, enhance animal corridor
The wetlands if restored also the lagoon.
Beach, clean and pristine creek
Wildlife habitat , a more functional lagoon and wetland
The plants and the people that have made home beauty
The beach, the plants, the animals, the creek
The existing community of 50 residences and 12 commercial business. An artistic community existing over 50 years or more.
Rodeo grounds — a historical location for movers and celebrity rodeos since silent films.
Establish historical and educational workshops by contemporary artists, writers, and film craftsmen.
Historic — there may be some structures — that are historic rodeo grounds. Related to Hollywood and equestrian. Restoration of lagoon to help flow of creek — nature corridor and low impact — hiking and bike — nature trails.
Creek
This should be cleaned up and remain a highly protected and monitored acreage. Protect deer, coyote, and other wildlife and native vegetation.

Old and large historical trees, native and non-native (i.e., eucalyptus and sycamore)
The lagoon (was)

What and where are the most important opportunities for restoration?

Restoration and augmentation of Southern steelhead and tidewater Gobie, restore lagoon, and wetland habitat.
preserve the endangered community and feet of lower Topanga.
Lagoon (remove dirt lot) as much fill removal as possible immediate clean up of abandoned, illegal, dangerous, not up to code.
Remove fill and restore original lagoon/wetland footprint
    Widen PCH Bridge to accommodate
Restoring good hydrology and natural environment
Restore lagoon/wetlands
Remove dikes to let creek take its own course. A new bridge to let creek run its natural course. Restore lagoon to former area of 1926 as visible in airphoto by removing fill areas placed in 1940. Lengthen PCH bridge to widen channel.
Widening of waterway moving fill
Water filtration flows mechanisms — manufactured natural (bush trees) enhancements
A balance of history and natural environment.
Restore lagoon and flood planes
Clean up septics (remove those not in compliance; use present buildings like those in Temescal. Do not overbuild parking and or public building and restroom facilities.
The lagoon

Do you have any suggestions for how to accomplish restoration?

Remove all unnatural berms, homes, septic tanks, unnatural fill, remove non-native plants, re-vegetation where advisable.
slowly
Think big, but be sensitive.
Remove fill/widen bridge/expand lagoon to former footprint
Re-plant native plant species (wetland and upland as required)
    Remove exotic trees/plants
Not by building more structures and the problems they bring about.
Involve the community
    Involve students from county schools K-college, to assist as a learning and serving project — restore site to previous condition
Remove fill at beach and dikes to open up stream and lagoon.
Remove fill areas from former lagoon footprint.
    Lengthen PCH Bridge to widen flow channel
    Possibly relocate highway south to former footprint to reduce fragmentation at lagoon
Be willing to change and put up with transition period

I do not think things need to be changed other than I would like to see the waterways closed to the ocean

Slowly

A balance of historic and natural — some visitor related commercial to stay near PCH due to CalTrans probably not redoing PCH.

Remove fill

carefully, without use of pesticides and without commerce being the main motivation.

Limit vehicular access to pristine areas.

Fix septics! Remove arundo. Consult a bioengineer! Community restore lagoon. Input.

Prehistoric and Historic Resource Stewardship

What places seem significant to you? Do you have any information regarding archaeological or historical resources in the park?

The lagoon and wetlands are important to me.

The rugged beauty of the creek and rock formations — quiet and sanctuary for birds, fish and plants.

Reuse for structured for museum.

Lagoon, tidal wetlands, beach, coastal sage scrub, steelhead pools

I know when and how the Reel Inn was built and it is recent.

All those spaces that were used by native Americans. For example, all the rich history involving Bonnell Park (a space owned by the community on Bonnell). There are living native Americans who can supply history and text)

Traditional animal coordinator

I am Chumash Indian and Early California Spanish De Ramirez family. My informant to the History of lower and upper Topanga is Victor Lopez/Montecito and Justo — 18 to 1923 or so both Chumash elders>

Tenants should remain as volunteer docents to share a lifetime and lifestyle worth sharing and preserving.

Feed Bin — Willey s bat- 2-3 restaurants at and very near PCH. Perhaps Topanga cabins. A few residences. It can be done with restoration of lagoon.

The houses at LTC are mostly junk.

Feed bin, houses which are to code; tripped buildings and trails. Wildlife corridors.

Group old community as a historical resource — this is not trivial, it should be considered public resource and not removed.

How should State Parks be effective stewards of those places?

Manage the steward ship to restore lagoon and wetland ecosystem and maintain this ecosystem.

Try to keep trash dumping and fires out and creek area.

Minimum infrastructure on-site

No new buildings other than possible small interpretive facility
Provide trash cans at key public areas

Be aware that people have lived there and consider the place their hope . With that in mind, be gentle in your approach.

There should be limited access to lower 1 mile of lagoon and creek thru established trails like Malibu Lagoon with small parking areas along Topanga Canyon Blvd.

Leave natural Topanga Canyon Interp. Center

Not to invite hundreds of thousands of people to invade those areas. Not to pave over the ground for cors. Not to create increased traffic congestion. No to build toilet for homes of people — food services; present existing

To work for and with the residents and park visitors.

Develop relationship with businesses to promote the historic significance of their structures — make them informative for visitors.

Preserve and protect land.

Do not asphalt horse and walking trails and seal that surface until trail too slick for equne or human traction. Do minimal ecological damage. Continue to involve existing community groups and stakeholders.

By considering humans and community as a valuable preservable resource.

Minimal change and minimal public use (traffic and environmental impact)

Not to invite thousands of people in the walk in the area.

Recreation Activities

What should be the recreational focus for this property?

On the ocean — active recreation on the landside of lagoon — passive recreation.

Nature walks — but not high impact in creek area.

No overnight camping; perhaps hike-in or bike-in for long range P.C.H.

Low impact uses — hiking, surfing, birdwatching

Low, low, impact and density! No camping, RVs

Provide a sense of movement through time. The past, present, the future — earth changes — and how people existed here, do, and eventually will.

Hiking, observing nature. No camping, no fishing

Hiking, birdwatching. Beach use, no equestrian

Walking, sitting, smelling, looking

It is a state park protecting environment — not a recreational park in lower Topanga.

Low impact — nature — preserve mixed with some preservation.

Hiking, bird watching

That depends upon its geography and fragility.

Observational/restricted outdoor classroom activities.

What types of public recreational activities would be appropriate here?

Ocean — swimming — surfing, etc. Inland — hiking, birding, nature observing

Hikes and studying the creek, etc.

Day use, hiking, mountain biking. No fishing! (yet)
Nature tours, surfing, beach access, look to Pt. Mugu State Park as an example of overuse (cycling, camping)
Same
Walking bridges/elevated wetland
Led informational walks — small groups only
There are other parcels in Topanga State Park already making recreation available — other than lower Topanga.
Hiking, bird watching — poss. Bike trail (and horse) along Topanga Canyon Blvd. and upper terrain above creek.
Hiking and learning about nature
Docent walking tours on riparian habitat, educational water testing and monitoring on the entire property in educational and workshop mode. Equine only if that does not damage fragile environs.
Limited walking access.

Where should recreational facilities (and support facilities like parking lots) be located? And to what degree?
Along Topanga Canyon Blvd. and where the furniture sales are and abandoned gas stations.
Very few if any.
Where homes currently exist along TCB just about PCH.
Pavement alternatives (porous or soil bonding)
Small lots
This is the part that is unfair to current residences — it should not be more developed than it is.
Very limited.
Small parking along PCH and Topanga Canyon Blvd. with restrooms. No visitor center.
Along TC Blvd., away from water porous surface pavements
Along PCH only — free
Not in lower Topanga. Wildlife should be protected and preserved in their natural state.
Near Topanga Canyon and PCH. Poss along street to some extent.
No facilities.
In least invasive area; nearest coast highway as possible.
None. None (no more than existing)

Education / Interpretation

What topics could be taught at this property? What are the most important?
Observation of steelhead run — birding, wildlife observation.
Nature walks
Important resource for all of Los Angeles; No visitor center
Watershed natural resources
Endangered species (steelhead, TW goby, etc.)

Habitat restoration — hydrology
Estuary, natural resources possibly native American studies.
As above.
Ecology of area — stream — wetlands — lagoon
Water quality; wetland impts.; watershed signific.
I can t go along with any of this.
Artistic tenants should share years of experience with park visitors interested in history and current film and storytelling.
Historic and nature — both. Beach and creek access with low impact.
Importance of river systems.
Water; geology, history, ecology.
Environmental/cultural/historical birding/steelhead/restoration ecology/tansva/chumash

How can State Parks provide education here?
Guides, Botany — California History
Naturalists giving lectures and programs on a limited basis — not huge crowds
Concentrated on the children.
Small info center with how to live with ecology
Inert. Center
Stay out!
Using volunteer resident docents.
Docents local volunteers and State Parks staff.
Let people see for themselves
Link with community, county, state educational resources like colleges, public schools, resource conservation groups already established.
Doesn t have to be on site — tell the stars of the lagoon restoration in classrooms in the urban case study for classroom activities (LA schools!) (K-12)

Visitor Support (Commercial, Park Operations)

What kind of commercial enterprises are important to provide in support of public use?
Leave in place the way it is now.
none, Malibu Feed Bin should be allowed to stay
None
None. Especially NO fastfoods.
None
Corner of PCH and TC Blvd.; light commercial/no fast food
The ones that already here
Historic with appropriate memorabilia.
Food, historic commercial related to past.
None
No camping RV or other overnight — fire hazard; pollution hazards.
Keep as many local business already existing as possible.

What park operational facilities are appropriate here?

Few if any.

No pavement

Maint. And other facilities located off-site (out of watershed)

As little as possible.

Parking, restrooms

bathrooms — no septic, composting toliets

None

Access to both sides of Topanga Creek during all four seasons.

Visitors center — poss. Feed bin area. And support staff poss. Living in historic structures.

None

Historical, geological, ecological library resource buildings and support of facility for small staff. Perhaps a film lib or workshops executed by artists. Use of community (existing) as docents in preserving historical reality, and the community.

Actually — I would like to see State Parks lease some existing buildings to create an environmental charter school — Middle School for Topanga 50-100 kids max)

There is already a group in place to make this happen.

Lower Topanga IMP Dec. 13, 2002 Public Meeting #2

- Interim Management Plan EIR needs to be made widely available for public review.
- Attach resource studies as appendix to IMP EIR. Include hydrology, water quality reports and criteria.
- State Parks should consider reacquiring Topanga State Beach.
- Put EIR on a web site.
- Park is a museum of past — supportive of removal of non-native plants and as much restoration as possible.
- Topanga Ranch Motel should be saved as Historic Resource.
- Business area should be cleaned up and the Tijuana -like look cleaned up.
- Be sensible with removal of structures, etc. Alt#1 — Goal 1, Part 3
- Restoration goal must include a comp. Resource Inventory and steelhead habitat; water quality impacts.

- Monitor roads to prevent further or re-intro. of exotic sp.
- CalTrans dumping — ensure that it does not occur at other locations within SP prop.
- Phase out residential use ASAP
- Keep public informed at all stages
- Trail head parking should happen as soon
- Of the 1600 ac purchased — focus has only been on the most difficult issues at the lower end. Why not start at the top and work down.
- Another sit. like Crystal Cove can occur at Lower Topanga — i.e., limited access, budget prob. of state.
- A less aggressive stance towards residential use should be taken.
- Comply with all env. & public health and safety codes — risks = landslides, fire and floods (currently out of compliance and pose a liability to taxpayers)
- Do determination of eligibility for veg. and roads.
- Would like to see it as a preserve that is closed to the public except maybe by appt.
- As restoration progresses — new things may come to light that would affect placement of trailhead parking/trail use.
- Temporary modular facilities are not aesthetically pleasing. Avoid these becoming permanent
- Are areas — eg. Connector trail via parker mesa overlook trail — that could be used to provide public access
- Don t force people out on a fast track
- Retain businesses — they provide economic support (sales tax).
- Snake Pit location would be dangerous — esp. coming out onto Topanga Canyon Blvd. & PCH.
- Along PCH location access back & forth to Bch very dangerous across PCH numerous accidents.

- Other resources available for immediate use while longer plans are being researched.
- Lower Topanga offer numerous hiking trails that are currently available to public use. Across to Tuna Canyon for ex.
- Use wisdom and compassion when planning for public use, species pres., and business pres.
- Well thought out ranger of goals
- Encourage the phased removal of exotics except where they are assoc. of cultural landscapes covers restoration and road removal also.
- Lagoon ecosystem — encourage a full restoration
- Encourage use for education esp. due to proximity to LA Basin
- How will trail/restoration public access work with structural removal.?
- What are obligations to public — i.e., why allow public access in an area to be restored.
- Topanga Canyon Watershed Com. Is separate from the Landowners and Stakeholders Technical Advisory Comm. which is responsible for following and developing a Topanga Ck. Restoration. TAC is compose of var. State Agencies, landowners, county, etc.
- A vision that focuses on Education and Science is a good start but should consider re-intro of sp. That could have historically occurred there.
- Lagoon needs to be flat and broad — must inc. cooperation with CalTrans — could allow for qualification fx grants assoc. with deep water and endangered sp. Habitats
- Urge State to take back Co. beach
- Allow residents to live in their (rich Malibu residents) for a while until they can find a place to live
- Need for strategic partnerships with other agencies (water quality, CalTrans, beaches and harbors)
- Keep open communication with residents
- Residents within area of historic lagoon in the way of restoration process

Major Storm damage repairs along State Route 27 (Topanga Canyon Boulevard)

Date of Order	Approx. Date of Event (If Known)	Location - Post Mile (PM)	Type of Repair
January 13th, 1995		PM 2.3, PM, 4.0, PM 4.1, PM 4.5	• Install K-Rail • Repair washout of Hwy • Re-stripe pavement
January 13th, 1995		PM 4.0-4.5 Creek behind gas company experienced high flows taking out Culverts to the North and South the Lumberyard.	• Replace Roadway and Culverts due to high water.
March 17th, 1995	March 10th, 1995	PM 2.0, PM 2.6, PM 3.2	• Wash out of Hwy • Install K-Rail • Re-stripe Pavement
March 17th, 1995	March 10th, 1995	PM 7.2, PM 10.0, PM 10.6	• Repair of damaged slopes • Repair Culverts/Pipes
March 8th, 1998	February 23rd, 1998	PM 3.7-3.9	• Soldier pile tieback wall constructed.
February 13th, 1998	February 9th, 1998	PM 4.4-4.6	• Place riprap.
February 13th, 1998	February 11th, 1998	PM 10.0-10.1	• Repair large slipout

Additional years requiring major emergency repair work:

- 1978- 79
- 1984
- 1993

State of California – The Resources Agency
DEPARTMENT OF PARKS AND RECREATION

NOTICE OF PREPARATION

PROJECT TITLE: Lower Topanga Interim Management Plan

PROJECT LOCATION: The project site is located between the communities of Santa Monica and Malibu along Pacific Coast Highway and bisected by Topanga Canyon Boulevard, in Southern California. In August 2001, 1,659 acres of land in Lower Topanga Canyon was acquired by the Department of Parks and Recreation and added to Topanga State Park in the Angeles District of the California State Park System.

PROJECT DESCRIPTION: The Interim Management Plan for this newly acquired land will provide the framework for management until such time as a General Plan amendment can be completed, and subsequent management plans are prepared as directed by the General Plan amendment. Nine businesses, forty-nine residences, Topanga Creek and its floodplain, riparian vegetation, chaparral and a variety of trees are present on the project site. The project will implement wildlife and natural habitat enhancement, remove visual obstructions, structures and debris, improve minor visitor facilities including trails, signage and parking, implement minor site repairs for health and safety, relocate residents and some businesses, and protect and interpret historical and archaeological features.

POSSIBLE ENVIRONMENTAL EFFECTS: The project has potential beneficial effects on the natural environment (wetlands, wildlife and vegetation), water quality, recreation, aesthetics, and cultural resources. Early coordination with appropriate resource agencies will commence immediately. The project may also have adverse impacts that include housing, local businesses, aesthetics, erosion, water quality, transportation and short-term effects on biological resources. The Interim Management Plan will endeavor to identify appropriate avoidance and mitigation measures where necessary to reduce potential impacts.

PUBLIC WORKSHOPS: Public involvement in the development of this Interim Management Plan is being sought through a series of public workshops. The first workshop, focusing on issues to be developed in the plan was held October 20, 2001. The second is currently scheduled for December 13, 2001, from 7 P.M. to 9:30 P.M. at the Wilbur Avenue School, 5213 Crebs Avenue in Tarzana, and will focus on plan alternatives. The third and final public workshop is currently scheduled for early January 2002, at which time the prepared plan alternative will be presented.

State of California – The Resources Agency
DEPARTMENT OF PARKS AND RECREATION
INITIAL STUDY CHECKLIST

I. BACKGROUND INFORMATION

A. Name of Project: **Lower Topanga Interim Management Plan**
B. Contact Person: **Patricia K. Autrey** Telephone: **(619) 278-3769**
C. Location: **Topanga State Park**
D. Checklist Date: **12-3-01**
E. Project Description: The Interim Management Plan for this newly acquired land will provide the framework for management until such time as a General Plan amendment can be completed, and subsequent management plans are prepared as directed by the General Plan amendment. Nine businesses, forty-nine residences, Topanga Creek and its floodplain, riparian vegetation, chaparral and a variety of trees are present on the project site. The project will implement wildlife and natural habitat enhancement, remove visual obstructions, structures and debris, improve minor visitor facilities including trails, signage and parking, implement minor site repairs for health and safety, relocate residents and some businesses, and protect and interpret historical and archaeological features.

II. ENVIRONMENTAL CHECKLIST

	Potential Significant Impact	Potential Significant Impact Unless Mitigated	Less than Significant Impact	No Impact
LAND USE AND PLANNING Would the proposal:				
1. Conflict with General Plan designation and zoning?	☐	☐	☒	☐
2. Conflict with applicable environmental plans or policies adopted by agencies with jurisdiction over the project?	☐	☐	☒	☐
3. Be incompatible with existing land use in the vicinity?	☒	☐	☐	☐
4. Affect agricultural resources or operations?	☐	☐	☐	☒
5. Disrupt or divide the physical arrangement of an established community (including a low income or minority community)?	☐	☒	☐	☐

SOURCES: (Use additional page(s) if necessary.)

EXPLANATION OF ANSWERS: (Use additional page(s) if necessary.)
#1. General Plan calls for RV parking, which is not considered in this interim management plan
#2: The California Coastal Commission, California Department of Fish and Game, Us Fish & Wildlife Service, US Army Corps of Engineers, Santa Monica Mountains Resources Conservation District, and the State Regional Water Quality Control Board will need to approve actions that fall within their jurisdictions at the project site. These actions may include improved visual and water quality impacts.
#3: Existing private residential and some commercial uses are incompatible with park mission and operation.
#5: The current residents and commercial businesses have leases that are expected to terminate June 30, 2002. The lessees are not anticipated to be part of a low income or minority community, but reside in below market housing.

	Potential Significant Impact	Potential Significant Impact Unless Mitigated	Less than Significant Impact	No Impact
POPULATION AND HOUSING Would the proposal:				
6. Cumulatively exceed official regional or local populations projections?	☐	☐	☐	☒
7. Induce substantial growth in an area, either directly or indirectly?	☐	☐	☐	☒
8. Displace existing housing, especially affordable housing?	☐	☒	☐	☐

SOURCES: (Use additional page(s) if necessary.)

EXPLANATION OF ANSWERS: (Use additional page(s) if necessary.)
#8: As stated in # 5 above, lessees reside in below market housing..

	Potential Significant Impact	Potential Significant Impact Unless Mitigated	Less than Significant Impact	No Impact
GEOLOGIC PROBLEMS Would the project result in or expose people to impacts involving:				
9. Fault rupture?	☐	☐	☐	☒
10. Seismic ground shaking?	☐	☐	☐	☒
11. Seismic ground failure?	☐	☐	☐	☒
12. Seich, tsunami, or volcanic hazard?	☐	☐	☒	☐
13. Landslides or mudflows?	☐	☐	☒	☐
14. Erosion, changes in topography, or unstable soil conditions from excavation, grading or fill?	☐	☐	☒	☐
15. Subsidence of land?	☐	☐	☐	☒
16. Expansive soils?	☐	☐	☐	☒
17. Scientifically significant paleontological resources, geological or physical features?	☐	☐	☒	☐

SOURCES: (Use additional page(s) if necessary.)

EXPLANATION OF ANSWERS: (Use additional page(s) if necessary.)
#13,14, 17: There is potential for tsunami due to the coastal location. Past landslides have occurred in the area. There will be minor grading in certain locations for interim parking and trails. Paleontological resources are known to exist on the site and will be recorded and/or preserved when located as necessary.

	Potential Significant Impact	Potential Significant Impact Unless Mitigated	Less than Significant Impact	No Impact
WATER Would the proposal result in:				
18. Changes in absorption rates, drainage patterns, or the rate and amount of surface runoff?	☐	☐	☒	☐

II. ENVIRONMENTAL CHECKLIST

	Potential Significant Impact	Potential Significant Impact Unless Mitigated	Less than Significant Impact	No Impact
45. Result in the loss of availability of a known mineral resource that would be of future value to the region and residents of the state?	☐	☐	☐	☒

SOURCES: (Use additional page(s) if necessary.)

EXPLANATION OF ANSWERS: (Use additional page(s) if necessary.)

HAZARDS Would the proposal involve:

	Potential Significant Impact	Potential Significant Impact Unless Mitigated	Less than Significant Impact	No Impact
46. A risk of accidental explosion or release of hazardous substances (including but not limited to oils, pesticides, chemicals, or radiation)?	☐	☐	☒	☐
47. Possible interference with an emergency response plan or emergency?	☐	☐	☐	☒
48. The creation of any health hazard or potential health hazard?	☐	☐	☒	☐
49. Exposure of people to existing sources of health hazards?	☐	☐	☒	☐
50. Increased fire hazard in areas with flammable brush, grass, or trees?	☐	☐	☒	☐

SOURCES: (Use additional page(s) if necessary.)

EXPLANATION OF ANSWERS: (Use additional page(s) if necessary.)
#46, 48, 49: The department will test for hazardous substances; if found, they will be removed according to approved practices.
#50. The area will be returned to a more natural state, and as such is subject to natural wildfires. The Department will use prescribed burn procedures if appropriate.

PUBLIC SERVICES Would the project have an adverse effect upon, or result in a need for new or altered government service in any of the following areas:

	Potential Significant Impact	Potential Significant Impact Unless Mitigated	Less than Significant Impact	No Impact
51. Fire protection?	☐	☐	☐	☒
52. Police protection?	☐	☐	☐	☒
53. Schools?	☐	☐	☐	☒
54. Maintenance of public facilities, including roads?	☐	☐	☒	☐

SOURCES: (Use additional page(s) if necessary.)

EXPLANATION OF ANSWERS: (Use additional page(s) if necessary.)
#54. There will be an increase in State Parkbworkload due to the maintenance of the infrastructure and protection of resources and public safety.

UTILITIES AND SERVICES SYSTEMS Would the project result in a need for new systems or supplies, or substantial alterations to the following utilities:

	Potential Significant Impact	Potential Significant Impact Unless Mitigated	Less than Significant Impact	No Impact
55. Power or natural gas?	☐	☐	☒	☐
56. Communications systems?	☐	☐	☒	☐
57. Local or regional water treatment of distribution facilities?	☐	☐	☒	☐
58. Sewer or septic tanks?	☐	☐	☒	☐
59. Storm water drainage?	☐	☐	☒	☐
60. Solid waste disposal?	☐	☐	☒	☐
61. Local or regional water supplies?	☐	☐	☒	☐

SOURCES: (Use additional page(s) if necessary.)

EXPLANATION OF ANSWERS: (Use additional page(s) if necessary.)
#55 thru 61: There will be decreased utility usage due to removal of the majority of private residences and businesses. Septic systems at private residences will be abandonded. Overall demand for water and energy will decrease.

NOISE Would the proposal result in:

	Potential Significant Impact	Potential Significant Impact Unless Mitigated	Less than Significant Impact	No Impact
62. An increase in existing noise levels?	☐	☐	☐	☒
63. Exposure of people to severe noise levels?	☐	☐	☐	☒

SOURCES: (Use additional page(s) if necessary.)

EXPLANATION OF ANSWERS: (Use additional page(s) if necessary.)

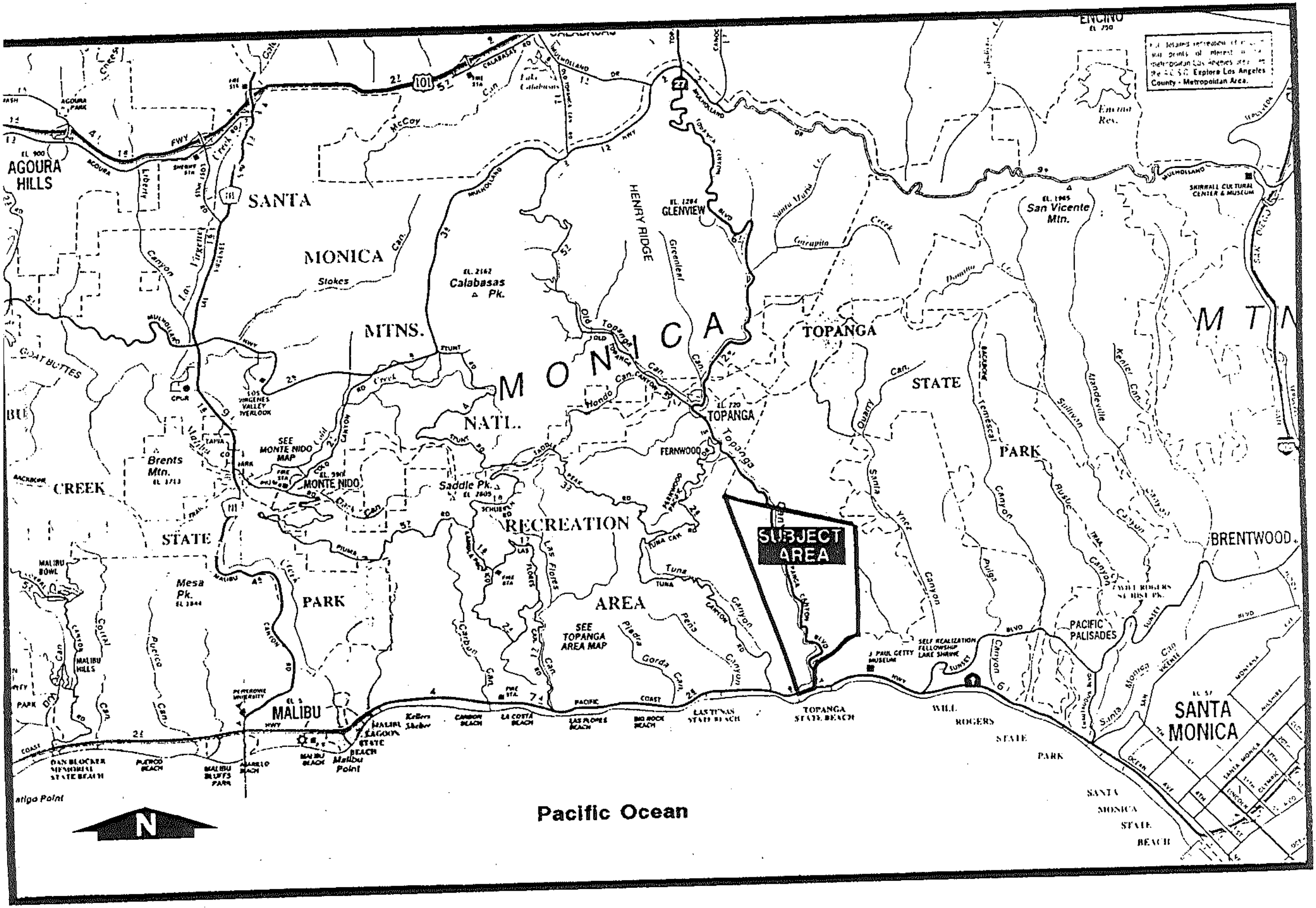
AESTHETICS Would the project:

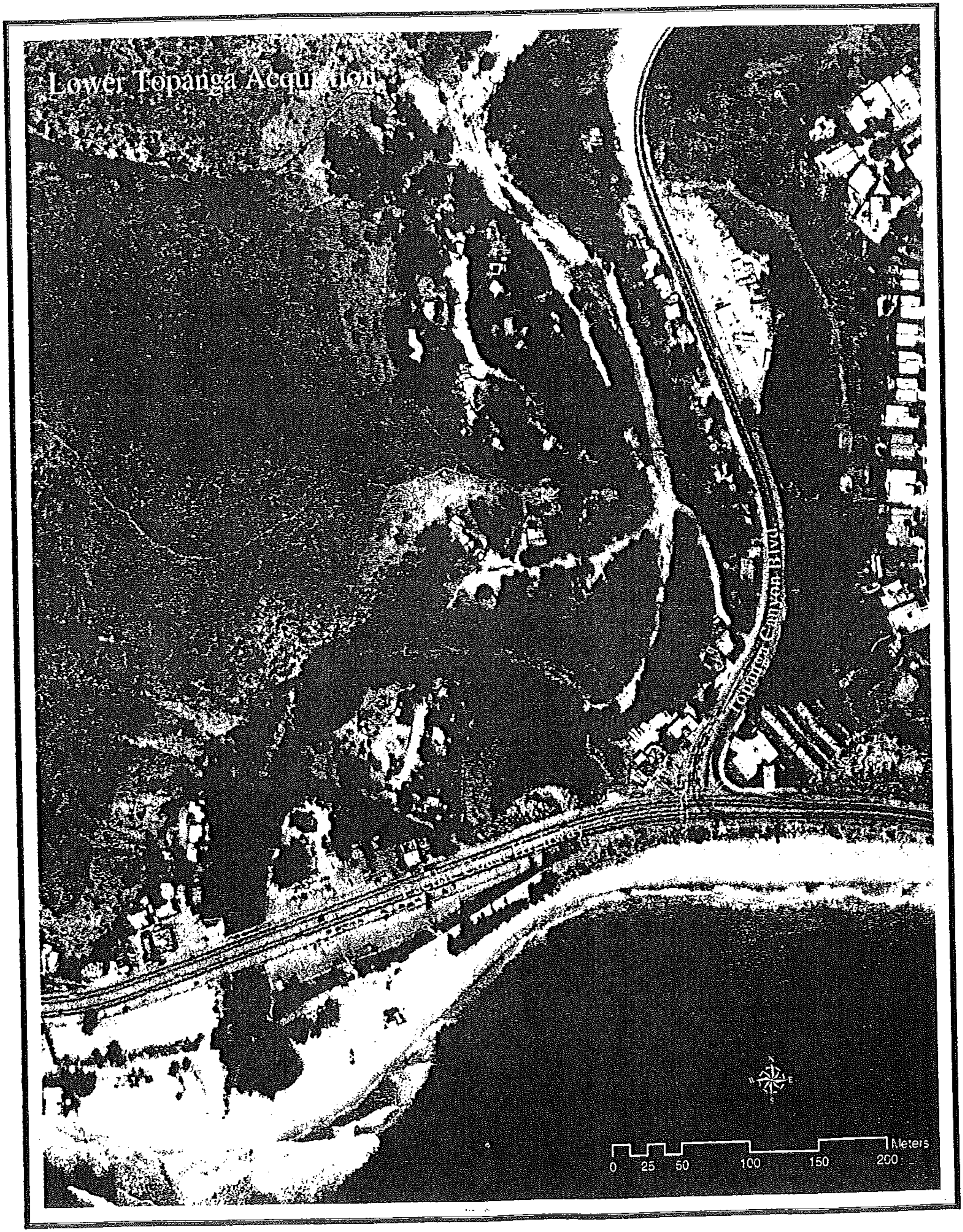
	Potential Significant Impact	Potential Significant Impact Unless Mitigated	Less than Significant Impact	No Impact
64. Adversely affect a scenic vista or scenic highway?	☐	☐	☒	☐
65. Have a demonstrable negative aesthetic effect?	☐	☐	☐	☒
66. Create light or glare?	☐	☐	☐	☒

SOURCES: (Use additional page(s) if necessary.)

EXPLANATION OF ANSWERS: (Use additional page(s) if necessary.)
#64: There may be a temporary negative effect during minor construction/demolition projects, but overall long term aesthetics and scenic values will dramatically improve.

LOCATION MAP





Lower Topanga Acquisition
Topanga Canyon Blvd
Meters
0 25 50 100 150 200

- Go with minimal alts.
- Be careful which structures are removed — so that don t remove cultural resources. Also buildings along PCH provide a noise barrier
- Agrees need to remove and reveg. roads and do slope restoration
- For restoration — need to gather sound scientific data — what is the biggest impediment?
- Support more minimal approach to removal — e.g. adaptive management
- Strongly advocate using non-chemical methods for exotic removal — mechanical, volunteers.
- Supports keeping Oasis business
- To be a good steward of the land you need to leave it alone.
- Use compassion and moderation
- Supports removal of most aggressive exotic plants. First — but all should be removed eventually
- Good to wait a couple of years to deal with commercial properties and not opposed to retaining some as historic resources
- Are 70+ residences not only 43/49
- Artist Colony is a cultural resource
- There is no way surrounding community can absorb more than 1-15 families in a year — need more time to relocate
- Fire/flood/landslide risks (see other sheet)
- Residences area liability to state
- If businesses are allowed to remain need to have competitive rents and not be subsidized by state
- 98% of historical wetlands have need lost in LA
- Worried about state parks staffing shortages

APPENDIX E

COMMENT LETTERS FROM THE TECHNICAL AND LANDOWNERS ADVISORY COMMITTEE

State of California • The Resources Agency
DEPARTMENT OF PARKS AND RECREATION
Angeles District
1925 Las Virgenes Road
Calabasas, CA 91302
818/880-0350

Gray Davis, *Governor*
Rusty Arelas, *Director*

March 5, 2002

Rosi Dagit
Resource Conservation District
122 N. Topanga Canyon Blvd.
Topanga, California, 90290

Dear Ms. Dagit:

The California Department of Parks and Recreation, Angeles District, has read the Preliminary Draft Report Topanga Creek Watershed and Lagoon Restoration Feasibility Study and offers the following comments.

The Draft Report contains an excellent analysis of the impacts to the biological and recreational resources of the lower Topanga Canyon watershed by identifying potential sources of excessive sediment and bacterial contamination in the creek. Several locations were identified where opportunities exist to stabilize the creek bank and allow the creek to occupy its floodplain while improving public safety. We look forward to working with the Technical and Landowners Advisory Committee to refine the proposals in the Draft Report and to seek funding and cooperation in accomplishing these improvements.

The Draft Report also identifies several alternatives for the restoration of Topanga Lagoon by the removal of fill material that has considerably reduced the size of the lagoon and the floodplain of the lower watershed. Our mission to preserve California's biological diversity supports the restoration of historic wetlands at the mouth of Topanga Creek to the maximum extent feasible, particularly given the extensive loss of wetlands that has occurred in Los Angeles County. We concur with the conclusion of the Draft Report that Alternative 4, which prescribes the restoration of the lagoon to 8 acres, best accomplishes the stated goals of the study, and we would like to see this alternative developed further.

We wish to acknowledge the commitment of the Resource Conservation District and the Coastal Conservancy to the completion of this initial research and the work of Moffatt and Nichol Engineers in the identification of negative impacts to the watershed and potential solutions to these impacts.

Sincerely,
Suzanne Goode
Suzanne Goode
Senior Resource Ecologist

COUNTY OF LOS ANGELES
DEPARTMENT OF BEACHES AND HARBORS

STAN WISNIEWSKI
DIRECTOR
KERRY GOTTLIEB
CHIEF DEPUTY

March 11, 2002

Ms. Rosi Dagit
Resource Conservation District of the
Santa Monica Mountains
122 North Topanga Canyon Boulevard
Topanga, CA 90290

Dear Rosi:

PRELIMINARY DRAFT REPORT: TOPANGA CREEK WATERSHED AND LAGOON RESTORATION FEASIBILITY STUDY

The Department of Beaches and Harbors congratulates you on the highly professional result of the above referenced study. We have reviewed in detail the alternatives presented for lagoon expansion from the viewpoint of retaining a viable beach sanitizing and contouring operation, and continued visitor enjoyment and public safety on Topanga County Beach. In addition, creating an expanded lagoon has prompted comments from the County of Los Angeles Beach Advisory Commission at its February 20, 2002 meeting, a local surfer (possible change in surf break), and our County lifeguards (impairment of routine patrol and emergency response operations).

In order to approve of your plan, this Department requires the incorporation of the following design and construction considerations relative to each alternative, provided one of them is implemented. We do this in order to protect our required operational responsibilities and to retain our latitude in controlling beach configurations for public safety and ease of lifeguard operations.

Thank you for the opportunity to review this preliminary draft and to be represented on the Technical and Landowners Advisory Committee. Our departmental requirements for each alternative are attached.

Very truly yours,
STAN WISNIEWSKI, DIRECTOR

Joseph Chesler, AICP
Chief, Planning Division

JJC:lh

Attachment
cc (w/attachment): Mike Fraser, Chief of Lifeguards
Bob Schroeder, Section Chief

Fax: (310) 821-6345
(310) 305-9503 13837 FIJI WAY, MARINA DEL REY, CALIFORNIA 90292

Attachment

LOS ANGELES COUNTY DEPARTMENT OF BEACHES AND HARBORS REQUIREMENTS FOR TOPANGA LAGOON EXPANSION 2/28/02

Alternative 1 (NO PROJECT- EXISTING CONDITION REMAINS; 2.2 acre lagoon)

DBH Requirements:

- Continue to improve upstream conditions, removing non-point source pollution in Topanga Creek to improve lagoon and ocean water quality.

Alternative 2 (LAGOON EXPANSION SOUTHWEST OF PCH; 4 acre lagoon)

DBH Requirements:

- Provide alternative continuous access at the beach level (not using PCH) for Beaches and Harbors, and lifeguard vehicles and personnel for maintenance and rescue operations west of Topanga Creek.
- Consider screening of upstream opening of new culverts to prevent debris entrapment inside.
- Provide a plan to reconfigure the lagoon outlet, when necessary, to prevent eastward migration of waters that encroach on lifeguard facilities and operations, handicapped parking and picnic facilities, and beach sanitizing and contouring operations.

Alternative 3 (LAGOON EXPANSION SOUTHWEST AND NORTHWEST OF PCH; 6 acre lagoon)

DBH Requirements:

- Provide full or expanded replacement public parking north of PCH on State Park land prior to any construction on the existing County parking lot. The number of spaces should be a minimum of 100.
- Assure safe all-weather access for beach patrons across or under PCH, and avoiding direct public access across PCH at unauthorized locations.
- Develop realigned PCH that is designed to minimize visual, noise and air quality impacts on beach-goers.
- Provide a plan to reconfigure the lagoon outlet, when necessary, to prevent eastward migration of waters that encroach on lifeguard facilities and operations, handicapped parking and picnic facilities, and beach sanitizing and contouring operations.

Alternative 4 (LAGOON EXPANSION TO BOTH THE WEST AND EAST; 8 acre lagoon)

County Requirements: See Alternative 3, above.

Date: February 28, 2002

To: Rosi Dagit

From: Section Chief Bob Schroeder

Subject: **TOPANGA CREEK LAGOON AND WATERSHED RESTORATION FEASIBILITY STUDY**

The major findings of the Moffatt and Nichol feasibility study for restoring the Topanga Creek Lagoon addresses the specific objective in alternative 2,3, and 4, of improving the water quality, improving the habitat for endangered fishes and other aquatic species, reduce flood hazard, and improved recreational opportunities. There are public safety concerns, which are not addressed in the various alternatives and also the security of the Topanga Lifeguard Station. It would be prudent to address these concerns early in the planning stage. The Los Angeles County lifeguards provide the highest level of trained water rescues personnel with emergency medical training and desire to maintain this service as part of our 72 miles of seamless service along the Los Angeles Coast. The following recommendations will only enhance the service to the public.

AREAS OF PUBLIC SAFTEY

1. The improved recreational opportunities provided by the expanded lagoon restoration will increase the unauthorized water activities in the larger body of water on both sides of Pacific Coast Highway. An access for emergency vehicles should be provides under Pacific Coast Highway for response to water and medical related emergencies.

2. The plan should incorporate safety measures to prevent the public direct access across Pacific Coast highway from the parking lot to the Beach. This would reduce the potential pedestrian Vs vehicle accident on a busy section of the highway.

3. The physical encroachment of the expanded water toward the Topanga Lifeguard Station threatens the facility and inhibits the lifeguards rescue path. It will also impact the handicap access that is provided next to the tower. The restoration study should include a plan to reconfigure the lagoon outlet when nessecary to prevent migration of water toward the facility.

STATE OF CALIFORNIA—BUSINESS, TRANSPORTATION AND HOUSING AGENCY GRAY DAVIS, Governor

DEPARTMENT OF TRANSPORTATION
DISTRICT 7, DIVISION OF ENVIRONMENTAL PLANNING
120 SO. SPRING STREET
LOS ANGELES, CA 90012-3606
PHONE (213) 897-0610
FAX (213) 897-0685
TDD (213) 897-6610

Flex your power!
Be energy efficient!

March 21, 2002

Ms. Rosi Dagit
Resource Conservation District of the Santa Monica Mountains
122 North Topanga Canyon Boulevard
Topanga, CA 90290

Subject: Preliminary Draft Report Comments

Dear Ms. Dagit:

The Preliminary Draft of the Topanga Creek Watershed and Lagoon Restoration Feasibility Study has been reviewed by the Division of Environmental Planning. Upon reviewing the Study, we are submitting the following comments for your consideration.

For our first comment, we suggest that the recommendations made in the Feasibility Study also address the potential effects of each proposed modification on public safety. Additionally, any long-term economic benefits that these projects may have, especially if they could reduce future maintenance costs, should also be included. This information would provide additional support for project implementation. One question we would like to raise is, if a greatly expanded lagoon could be accomplished by installing additional culverts to Alternative 2, while leaving the existing PCH Bridge?

All of the project locations are definitely worthwhile and respect a more detailed analysis. However, due to current personnel shortages, these potential projects cannot be fully reviewed by the Division of Project Development, until a project study is initiated. Once a project study is completed these projects would go through the process of qualifying under the State Transportation Improvement Program (STIP) to get funding, at which point, the Project Approval/Environmental Document, Project Development, and finally the Construction Phase would subsequently follow. This Division will recommend that these projects are placed on the STIP and we will be sure to submit a copy of that recommendation for your records.

Should you have any further questions, please contact Paul Caron of the Division of Environmental Planning at (213) 897-0610.

Sincerely,

RONALD J. KOSINSKI
Deputy District Director
Division of Environmental Planning

STATE OF CALIFORNIA—BUSINESS, TRANSPORTATION AND HOUSING AGENCY

DEPARTMENT OF TRANSPORTATION
DISTRICT 7, DIVISION OF ENVIRONMENTAL PLANNING
120 SO. SPRING STREET
LOS ANGELES, CA 90012-3606
PHONE (213) 897-0610
FAX (213) 897-0685
TDD (213) 897-6610

Flex your power!
Be energy efficient!

February 21, 2002

Guang-yu Wang
Santa Monica Bay Restoration Project
320 W. Fourth Street, 2nd Floor
Los Angeles, CA 90013

Subject: Phase II Topanga Lagoon and Watershed Restoration Plan

Dear Guang-yu Wang:

We understand the concern about the chronic road failure location upstream of the MM2.2 Bridge on Topanga Canyon Blvd. referred to as the "Narrows." This site has been a problem ever since the road was first expanded in the 1930's. The constraints of vertical bedrock walls, high flood flow velocities and year round input from several fresh water seeps make road maintenance in that section of the watershed particularly difficult. Emergency repairs costing millions of dollars have been necessary on a regular basis. The existing grouted riprap wall installed in 1995 is undermined by over 6 feet in several places, placing the wall at risk in the next large flood event. We also recognize that this is an important area for spawning, rearing and residence for the endangered steelhead trout found in Topanga Creek. It has also been brought to our attention that the lone remaining sycamore tree is an important feature of the landscape for the community.

Therefore, we will work with the Resource Conservation District of the Santa Monica Mountains and the CA Department of Parks and Recreation to develop a strategy to solve the problem. We appreciate the funding support for a more detailed engineering evaluation of potential solutions, and we look forward to a creative resolution which will increase public safety and protect and restore sensitive biological resources in that reach of the creek.

Sincerely,

Ronald Kosinski

Ronald J. Kosinski, Deputy District Director
Division of Environmental Planning

cc: Rosi Dagit, Resource Conservation District of the Santa Monica Mountains

COUNTY OF LOS ANGELES

DEPARTMENT OF PUBLIC WORKS

900 SOUTH FREMONT AVENUE
ALHAMBRA, CALIFORNIA 91803-1331
Telephone: (626) 458-5100

JAMES A. NOYES, Director

ADDRESS ALL CORRESPONDENCE TO:
P.O. BOX 1460
ALHAMBRA, CALIFORNIA 91802-1460

IN REPLY PLEASE REFER TO FILE: WM-7

March 21, 2002

Ms. Rosi Dagit
Senior Conservation Biologist
Resource Conservation District of the Santa Monica Mountains
122 North Topanga Canyon Boulevard
Topanga, CA 90290

Dear Ms. Dagit :

REVIEW OF TOPANGA CREEK WATERSHED AND LAGOON RESTORATION FEASIBILITY STUDY PRELIMINARY DRAFT REPORT

We have reviewed the Topanga Creek Watershed and Lagoon Restoration Feasibility Study, Preliminary Draft Report and have the following comments and/or revisions:

<u>Section 1.3 Ownership and Regulatory Requirements</u>

A new survey may be required to accurately determine property ownership in the Lake Topanga area.

<u>Section 2.3.c Sediment Sources and Sinks: The Channel System</u>

"The impact of discharged imported water, concentrated road runoff, vegetation conversion, and other land-use changes have combined to disrupt the previously stable system."

Increased human activities and development always change the watershed characteristics and produce more concentrated runoff. The Topanga watershed as stated in Section 2.3.a is unstable and very erosive due to its natural geological condition. Erosion is a natural process and unavoidable in the subject watershed. The impact of overall increased erosion rate due to human activities was not documented and compared with previous or predevelopment watershed equilibrium.

Section 2.5 Water Quality

"All households rely upon on-site septic systems for waste disposal, and there are numerous potential non-point sources of pollution within the watershed, such as corralled animals and graywater systems."

High bacteria counts are a water quality issue at Topanga Beach and the proposed lagoon. Funding has been granted for the study to identify the sources of bacterial contamination and determine the impairments from the pollutant. It is essential to reduce and eliminate the pollution and contamination in the proposed lagoon if recreational opportunities and natural habitat are to be introduced, since the total pollutant discharged into the river mouth remains the same for four alternatives.

Section 2.6.d Fishes: Steelhead Trout

Report needs to cite the studies that indicate steelhead and rainbow trout are one species.

Typo (page 2-29) in survey date **"June 2002, a population of 6 adults steelhead were found.........3 adult fish have remained in the system since spring 2000"**

"Steelhead are sensitive to poor water quality, excessive sedimentation and barriers to passage throughout the creek system."

Enlarging the lagoon area as proposed in Alternatives 3 and 4 reduces the flow velocity but also increases the deposition of finer sediment. It is our understanding that sedimentation of fine particles is damaging to some sensitive species such as steelhead and some wetland biological resources. The impact of sedimentation on protected biological resources in the proposed lagoon needs to be investigated for each alternative.

Section 2.8 Watershed Zones and Proposed Restoration Sites

The study recommends two existing 20-foot-high dams be blasted or dislodged to allow for continued fish passage. These two dams may act as energy dissipaters to reduce flow velocity, bank erosion, and scouring. If they are to be removed, the impact of increased velocity may cause scouring and undermining of the river bank stability. The study needs to investigate these potential impacts.

Section 2.8.a

Further research will be necessary to verify the cause of the landslide activation and the merits of the proposed solution, as the landslide has been the subject of a lawsuit by the landowner.

Section 2.8.b. to e.

Enlarging the creek cross-section areas and installing new vertical walls along the channel banks are effective approaches to prevent scouring at various locations. However, any change in cross-section and streambed will affect the entire system. Hydraulic and scour analysis are necessary to determine the impact of the proposed solution on the overall river system in terms of flow depth, velocity, sedimentation, scouring, and transition from the improved reach to the natural reach. Environmental impacts due to any construction and maintenance activities also need to be identified and approved by the proper regulatory agencies.

Section 3.0 Topanga Lagoon Restoration Alternatives Analysis

Table 3.1 shows a summary of a simulation of a 1980 storm, the most severe storm in the records of Topanga Creek Watershed, for four proposed alternatives. This storm is close to a 100-year rainfall event. This storm has been used to evaluate the merit of each alternative. Since the MIKE II model used in this study has the capability of continuous simulation, we suggest that the historical records be used to simulate the long-term effects on the ecosystem of Topanga Creek watershed under each alternative. Thus, a quantitative analysis based on continuous simulation and a probabilistic approach is recommended. The selection of the best alternative should be based on technical, economic, and financial feasibility in addition to the environmental acceptability and political practicality. The study should be extended to include all these planning phases of project development.

Sediment Transport

Analysis for Alternatives 3 and 4 indicates that severe floods will not cause backwater conditions upstream of the Pacific Coast Highway bridge. Sediment will be conveyed to the delta and beach. The slower flow velocity may accelerate the settling of finer sediment in the proposed lagoon. Further studies need to be conducted on the impact of accelerated sediment deposition on the biological resources such as sensitive species and induced habitat within the proposed lagoon.

Water Quality

Restoration of native wetland vegetation is expected to provide significant filtration and nutrient reduction. A bigger lagoon area in Alternative 3 and 4 may be more effective in improving water quality and providing dilution to reduce pollution. However, the total bacteria input concentration to the lagoon remains the same for each alternative. The recommended studies to identify and eliminate the sources of bacteria are necessary. Additionally, lead, DDT, and PCBs were not considered for each alternative. These constituents should be considered since they are included in the 303(d) list for Topanga Beach and Topanga Canyon Creek.

Long-term Management Issues

Based on Public Works' experience in obtaining the necessary approvals for its sediment removal, bank stabilization, and bridge repairs projects, regulators and other stakeholders will likely have concerns about the potential impacts from the study's suggested long-term maintenance activities on the endangered and sensitive species and vegetation in the restored lagoon and wetland. Environmental impacts associated with the maintenance activities should be investigated thoroughly, mitigated, and approved by the proper regulatory and environmental agencies. The study should also consider any potential flooding impact on adjacent structures.

Alternative Review and Ranking Process

Each alternative has merits and issues that need to be resolved. The feasibility of each can be better judged if more study results and information are available. Impact from long-term maintenance activities and cost may be an issue for Alternatives 3 and 4. Based on the information reviewed, Alternative 3 appears to be a reasonable proposal in terms of feasibility on maintenance and funding, and also provides sufficient lagoon area for habitat.

Please give special consideration to the public safety recommendations of the County lifeguards and to the design and construction suggestions set forth by the Department of Beaches and Harbors, as we share their concerns.

Thank you for allowing us the opportunity to participate in the Technical and Landowners Advisory Committee and to comment on this report. If you have any questions, please contact Ms. Laura Gajdos of my staff at (626) 458-4330.

Very truly yours,

JAMES A. NOYES
Director of Public Works

ROD H. KUBOMOTO
Assistant Deputy Director
Watershed Management Division

LG:ro
A:\feasibilitystudycomments.wpd

United States Department of the Interior

NATIONAL PARK SERVICE
Santa Monica Mountains National Recreation Area
401 West Hillcrest Drive
Thousand Oaks, California 91360-4207

In reply refer to:
L7621 (SAMO)

March 7, 2002

Rosi Dagit
Resource Conservation District of the Santa Monica Mountains
122 North Topanga Canyon Boulevard
Topanga, CA 90290

Dear Ms. Dagit:

We are pleased to see the important feasibility effort for the restoration of Topanga Creek Lagoon moving forward. I applaud the leadership of the Resource Conservation District and the efforts of all parties involved. Listed below are comments on the Topanga Creek Lagoon and Watershed Restoration Feasibility Study, Preliminary Draft Report of February 5, 2002:

The National Park Service supports Alternative 4 because it clearly provides superior natural resource and recreational benefits. However, we would defer to the site owner, California Department of Parks and Recreation, to plan and implement a program for the newly acquired property that addresses the primary concern for resources with secondary issues related to commercial tenants, cultural resources and other matters.

We also recognize the importance of maintaining parking for beach goers and addressing other concerns related to beach recreation and the responsibilities of Los Angeles County.

Should efforts to fund design and construction of Alternative 4 fall short, Alternative 3 would also be a very significant restoration effort with substantial benefits.

Three minor notes on the draft report:

A. The statement on 3-18 that Alternative 4 would be more expensive to maintain may not be true. Although the larger bridge would have greater cyclical maintenance in some respects, this cost may be offset over the long term. The larger bridge will be minimally impacted by even the largest storm events, whereas the other alternatives would see impacts during such events.

B. Alternatives 3 and 4 need to insure the preservation of certain recreational values, including the availability of parking for beach users. A little preliminary design work to roughly configure sufficient space for relocated parking would be helpful prior to taking the preferred alternative to Caltrans.

C. In reference to the drawing on Alternative 4, the bridge cost may be reduced if a straight rather than curved bridge is used.

Thank you for the opportunity to comment on this critical effort. If you have specific questions or concerns, please feel free to contact Dana Heiberg of my staff at 805-370-2347 or via email at dana_heiberg@nps.gov.

Sincerely,

Woody Smeck

Woody Smeck
Acting Superintendent

Heal the Bay

3220 Nebraska Avenue
Santa Monica CA 90404

ph 310 453 0395
fax 310 453 7927

info@healthebay.org
www.healthebay.org

March 19, 2002

Rosi Dagit
RCD/SMM
122 N. Topanga Canyon Blvd.
Topanga, CA 90290

Dear Rosi,

We appreciated the opportunity to participate in the Technical and Landowners Advisory Committee for the Topanga Creek Watershed and Lagoon Restoration Feasibility Study. After reviewing the Draft Final Report, we offer the following comments:

1. The proposed restoration actions both in the upper watershed and at Topanga Lagoon offer an exciting possibility for substantially improving water quality throughout the watershed, and particularly at Topanga Beach. We support the maximum amount of sediment reduction, erosion control, streambank restoration and lagoon restoration to accomplish this important task.

2. The proposed restoration actions substantially increase habitat for endangered steelhead trout and tidewater gobies. In particular, expansion of the lagoon to as much of its historic extent as possible will help achieve this goal. We support the maximum amount of lagoon restoration possible to expand and enhance habitat vital to the life cycles of these fishes.

3. Reduction of water pollution, habitat improvement, expansion of recreational opportunities and flood hazard reduction will make this proposed project financially viable over the long term. Lagoon and wetland ecosystems have been identified as one of the most economically productive ecosystems on earth, contributing thousands of dollars per hectare of avoided costs, as well as direct benefits to fisheries and water treatment. (Costanza, et al 1997).

Los Angeles County has lost over 95% of its coastal wetland resources. Restoration of the Topanga Lagoon represents a rare opportunity to restore some of these losses.

In summary we support the restoration actions proposed in the Feasibility Study and look forward to participating in the development of detailed, integrated plans that will move the process towards implementation.

Mark Gold

Mark Gold, D. Env.
Executive Director

Santa Monica
BAY
Restoration
PROJECT

320 W. Fourth Street
2nd Floor
Los Angeles, CA 90013
213/576-6615
Fax 213/576-6646

A Partnership to
Restore and Protect
Santa Monica Bay

Funded by US EPA
and the State Water Resources
Control Board in cooperation
with the public, local agencies,
and industry.

February 28, 2001

Rosi Dagit
RCDSMM
122 N. Topanga Canyon Blvd.
Topanga, Ca 90290

Dear Ms. Dagit,

We appreciate the opportunity to offer our comments on the Draft Topanga Creek and Lagoon Restoration Feasibility Study. As you are aware, the restoration and protection of coastal wetlands in the Santa Monica Bay watershed is an important goal of the Bay Restoration Plan. An equally important goal of The Plan is protecting recreational users of the Bay from the health risks associated with exposure to pathogen-contaminated water.

After reviewing the draft report, we believe that the restoration alternative offering the greatest potential for a successful restoration of Topanga Lagoon is Alternative Four. This alternative appears to offer the most benefits in terms of increased wetland acreage and associated habitat for endangered and threatened species, and the protection of public health through improved water quality in Topanga Lagoon and along Topanga Beach. Our recommendation is based on the assumption that additional data analysis will not significantly affect the designs of the various alternatives. It is also based on the assumption that cost differences between Alternatives Three and Four are not so large as to minimize the benefits of the additional acres of wetland area gained in the later alternative.

Congratulations on the successful completion of this phase of the Topanga Lagoon restoration process. We look forward to working with you and the Topanga Watershed Team on future phases of this important and exciting project.

Sincerely,
Jack Topel
Santa Monica Bay Restoration Project

Subj: **Lagoon restoration alternatives**
Date: Monday, March 11, 2002 4:20:21 PM
From: Vern.Finney@ca.usda.gov
To: oaksrus@aol.com, Jr.Flores@ca.usda.gov, walt.sykes@ca.usda.gov

Hi Rosi!
It has been my pleasure to serve as a Technical Advisor in your solicitation of a contractor to assist the Resource Conservation District Of The Santa Monica Mountains in preparing the report Topanga Creek Wateshed And Lagoon Restornation. It is not NRCS policy to advocate one alternative over another. Moffatt & Nichol Engineers have assisted the RCD in preparation of alternatives. NRCS's position is that the sponsors should choose the alternative. All of the proposed alternatives will require maintenance, maintenance costs should be part of the information provided to the sponsors in determining which alternative to go with. The intent of the Lagoon Restoration to increase fisheries diversity and numbers via improving passage for steelhead and improving habitat for gobi is good. If you would like this sort of support letter from NRCS, please direct a written request to CA State Conservationist Chuck Bell with a c.c. to J.R. Flores and V.L. Finney.

APPENDIX F

SUMMARY OF DATA FILES

Appendix F – Summary of Data Files

Resource Title	Originator	Date
Existing Topography of Lower Watershed projected into UTM coordinate zone - NAD 27, zone 11, meters	LA County Dept of Public Works	4-29-85
Existing Topography of Upper Watershed projected into UTM coordinate zone - NAD 27, zone 11, meters	LA County Dept of Public Works	4-29-85 and 7-20-00
Existing Topography for Topanga Lagoon and beach	LA County – Architect/Engineering Div.	May 1985
Existing Bathymetry for Topanga Lagoon	Resource Conservation District of the Santa Monica Mountains	Sept 2001
1876 Topography of lower watershed	ROTO Architects Inc.	Dec. 2001
Existing right-of-way for Topanga Canyon Blvd; partial data only	LA County deed maps	Unknown
Cross-Sections of Existing Topanga Creek and Old Topanga Creek	LA County Dept of Public Works	4-29-85 and 7-20-00
Topanga Creek wet cross-sections	Resource Conservation District of the Santa Monica Mountains	July 2001
Topanga Creek wet cross-sections	Topanga Creek Erosion and Sediment Delivery Study	July 2001
Topanga Lagoon Restoration Alternative Concept 1	Moffatt & Nichol Engineers	Dec. 2001
Topanga Lagoon Restoration Alternative Concept 2	Moffatt & Nichol Engineers	Dec. 2001
Topanga Lagoon Restoration Alternative Concept 3	Moffatt & Nichol Engineers	Dec. 2001
Topanga Lagoon Restoration Alternative Concept 4	Moffatt & Nichol Engineers	Dec. 2001
The Narrows Restoration Concept	Moffatt & Nichol Engineers	Dec. 2001
The Landslides Restoration Concept	Moffatt & Nichol Engineers	Dec. 2001
Topanga School Road Restoration Concept	Moffatt & Nichol Engineers	Dec. 2001
Lake Topanga Restoration Concept	Moffatt & Nichol Engineers	Dec. 2001
Vicinity Map of Topanga Creek Watershed with Santa Monica Mountains overlay	Topanga Creek Erosion and Sediment Delivery Study	Dec. 2001
Evaporation Data for LA Basin	California Irrigation Management Information Systems	1993-1996
Precipitation in Topanga Watershed and its vicinity	LA County Dept of Public Works	1927-2001
Stream flow records at the stream gage	LA County Dept of Public Works	1931-2001
Sedimentation Data for Topanga Watershed and Creeks	Topanga Creek Erosion and Sediment Delivery Study	Dec. 2001
Sedimentation Data for Topanga creek system	Resource Conservation District of the Santa Monica Mountains	Dec. 2001
Water Levels and Velocities at creek and lagoon	Moffatt & Nichol Engineers	Dec. 2001
Sediment transport rates and volumes in the creek and lagoon	Moffatt & Nichol Engineers	Dec. 2001
Sediment rating curves at Confluence and Stream Gage	Moffatt & Nichol Engineers	Dec. 2001
Runoff under brush fire impact	Moffatt & Nichol Engineers	Dec. 2001
Water quality dilution analysis in the lagoon	Moffatt & Nichol Engineers	Dec. 2001

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Listing by Record Title

Catalog Title: *Topanga Creek Watershed and Lagoon*
Organization: *Resource Conservation District of the Santa Monica Mountains*
URL: ***httpd://ceres.ca.gov/catalog/bin/list_records?catalog=306***

Resource Title	Originator	Record
Center Points of 1997 Aerial Photos - Topanga Creek Watershed	Resource Conservation District of the Santa Monica Mountains	Browse | Update
Color Infrared Digital Orthophoto (Quarter) Quadrangles - Topanga Creek Watershed	Resource Conservation District of the Santa Monica Mountains	Browse | Update
Cross Sections (Sediment Study) - Topanga Creek Watershed	Resource Conservation District of the Santa Monica Mountains	Browse | Update
Culverts and Bridges - Topanga Creek Watershed	Resource Conservation District of the Santa Monica Mountains	Browse | Update
Digital Raster Graphic Files - Topanga Creek Watershed	Resource Conservation District of the Santa Monica Mountains	Browse | Update
Fire (Burned Areas) History - Topanga Creek Watershed	Resource Conservation District of the Santa Monica Mountains	Browse | Update
Geology - Topanga Creek Watershed and Encompassing USGS 7.5' Quadrangles	Resource Conservation District of the Santa Monica Mountains	Browse | Update
Georeferenced 1997 Aerial Photos - Topanga Creek Watershed	Resource Conservation District of the Santa Monica Mountains	Browse | Update
Georeferenced Base Maps and Aerial Photos - Lagoon and Lower Canyon	Resource Conservation District of the Santa Monica Mountains	Browse | Update
Hydrography (Streams and Water Bodies) - Topanga Creek Watershed	Resource Conservation District of the Santa Monica Mountains	Browse | Update
Hypsography (Elevation Contours) - Topanga Creek Watershed	Resource Conservation District of the Santa Monica Mountains	Browse | Update
Land Use/Land Cover Historical Time Sequence (1876-1997) - Lagoon and Lower Canyon	Resource Conservation District of the Santa Monica Mountains	Browse | Update
Precipitation Gages (Closest) - Topanga Creek Watershed	Resource Conservation District of the Santa Monica Mountains	Browse | Update
Study Area - Lagoon and Lower Canyon	Resource Conservation District of the Santa Monica Mountains	Browse | Update

Vegetation - Topanga Creek Watershed	Resource Conservation District of the Santa Monica Mountains	Browse | Update
Water Quality Sampling Sites [205(j)] - Topanga Creek Watershed	Resource Conservation District of the Santa Monica Mountains	Browse | Update
Watershed Boundary - Topanga Creek Watershed	Resource Conservation District of the Santa Monica Mountains	Browse | Update
Watershed Subareas - Topanga Creek Watershed	Resource Conservation District of the Santa Monica Mountains	Browse | Update

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Catalog: *Topanga Creek Watershed and Lagoon*
Dataset Title: *Georeferenced Base Maps and Aerial Photos - Lagoon and Lower Canyon*

List Records in this Catalog

Identifier:	YYYY_27.tif [nine (9) files, where YYYY is a four-digit year in a sequence of years from 1876-1977]
	Citation Information
Title:	Georeferenced Base Maps and Aerial Photos - Lagoon and Lower Canyon
Originator:	Resource Conservation District of the Santa Monica Mountains
Publication Date:	20010702
Information Resource Type:	Format: Computer file Content: Spatial data
Scale:	0.3[m]x0.3[m] to 2[m]x2[m] pixels
Other Citation Details:	These images were used for map/photo-interpreting Land Use/Land Cover for a specified study area in the lower canyon/lagoon vicinity, for various years. For the associated output shapefiles, see the record: "Lagoon and Lower Canyon - Land Use/Land Cover Historical Time Sequence (1876-1997) - Data Layers". For the study area, see the record: "Lagoon and Lower Canyon - Study Area - Data Layer". The specific years represented by the maps/photos are: 1876, 1924, 1928, 1940, 1946, 1956, 1980, 1990 and 1997. Projection: UTM Zone 11 NAD27, meters
	Identification Information
Abstract:	A multi-year time sequence (1876-1997) of georeferenced image files created from various historic maps and aerial photos.
Purpose:	Examine Land Use/Land Cover changes in a historical time sequence to determine how the lagoon and surrounding lower canyon have changed over time.

Supplemental Info:	1876_27.tif - 1876 U.S. Coast Survey topographic map on file at the RCDSMM (lagoon and lower canyon area) 1924_27.tif - 1924 U.S. Geological survey geologic map 1928_27.tif - April 10, 1928 aerial photo. The Fairchild Aerial Photography Collection at Whittier College (C300 J182). 1940_27.tif - March 5, 1940 aerial photo. The Fairchild Aerial Photography Collection at Whittier College. 1946_27.tif - November 15, 1946 aerial photo. The Fairchild Aerial Photography Collection at Whittier College (11023). 1956_27.tif - August 14, 1956 aerial photo. The Fairchild Aerial Photography Collection at Whittier College. 1980_27.tif - 1980 aerial photo. The Fairchild Aerial Photography Collection at Whittier College(?). 1990_27.tif - September 7, 1990 aerial photo. U.S. Geological Survey Color Infrared Digital Orthophoto. 1997_27.tif - October 9, 1997 aerial photo. One of a set flown for the Topanga Creek watershed contracted by RCDSMM.
Time Period:	Start: 1876-01-01 End: 1997-01-01
Currentness:	Ground Condition
Progress:	Complete
Update Frequency:	As Needed
Place:	*Topanga Creek Watershed (encompassing the city of Topanga) (user)*
Geographic Region:	West: -118.6516 East: -118.5504 North: 34.1402 South: 34.0375
Themes:	Anadromous fishes; Aquatic animals; Aquatic habitats; Aquatic plants; Aquatic resources; Beaches; Coastal Processes; Coastal resources; Conservation of natural resources; Ecological communities; Endangered Species; Fire; Fish; Floods; Habitat Restoration; Land; Natural environment; Ocean waves; Plant communities; Plants; Pollution; Resource conservation districts; Riparian communities; Rivers; Salmon; Soils; Special status species; Tides; Vegetation; Water quality; Water resources; Watersheds; Wetland communities; Wetlands; Wildlife
User Keywords:	
Access Limitations:	*No Restrictions*
Use Limitations:	*No Restrictions*
Data Contact:	Rosi Dagit

Distribution Information

Distribution Format:	image/tiff

Distribution Contact: Rosi Dagit

Metadata Information

Date: 2002-02-05

Metadata Contact: Rosi Dagit

Metadata Standard: FGDC

Last Updated: 2002/02/11 19:09:48 GMT

List Records in this Catalog

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