Stormwater Runoff Toxicity in Orange County, CA A Demonstration of Evaluation Monitoring

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Evaluation Monitoring Demonstration Project

Alternative to Conventional Stormwater Runoff Monitoring for BMP Development

1996 - Field Studies of Toxicity of San Diego Creek as It Enters Upper Newport Bay

Overall Implication of Urban Stormwater Runoff Toxicity on Water Quality/ Use-Impairment

Inadequacy of Conventional Stormwater Runoff "Water Quality" Monitoring

Conventional Stormwater Runoff Monitoring

Measure Total/Dissolved Concentrations for Suite of Chemical Parameters for Several Storms per Year

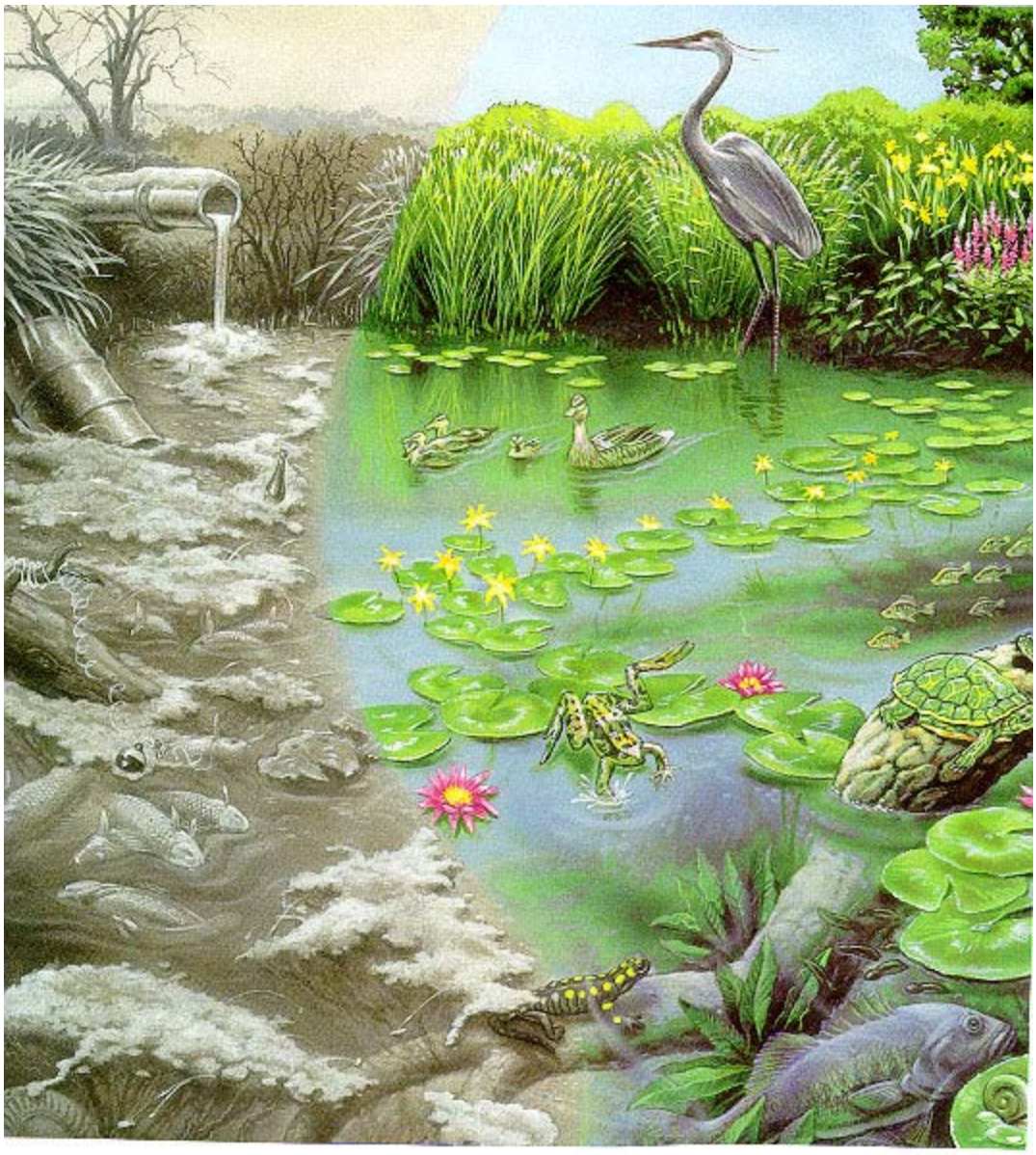
Provide No Reliable Information on Impacts of Stormwater Runoff-Associated Constituents on Receiving Water Water Quality

US EPA Stormwater Runoff Water Quality Management Regulations

Require Control of **Pollution** to Maximum Extent Practicable Using Best Management Practices

CWA-Defined **Pollution**: Use-Impairment of Water Receiving the Runoff

Conventional End-of-Pipe Edge-of-Pavement "Water Quality" Monitoring Cannot Define **Pollution** of Receiving Waters



Upper Newport Bay Designated Beneficial Uses

- Water Contact Recreation
- Non-Contact Recreation
- Commercial and Sport Fishing
- Wildlife Habitat
- Rare, Threatened, and Endangered Species
- Fish Spawning, Reproduction, and Development
- Marine Habitat

- Shellfish Harvesting
- Biological Habitats of Special Significance
- Estuarine Habitat

What Impairment Exists to Each of These Uses?

Evaluation Monitoring Approach for Water Quality Management

Focus Monitoring Resources on:

- Evaluation of Real Water Quality Use-Impairments in Receiving Water for Stormwater Runoff
- Determine the Specific Cause(s) of Use-Impairment
- Determine Source(s) of Constituents Responsible for Those Use-Impairments
- If Urban & Highway Stormwater Runoff Is Significant Source of Specific Constituent(s) Responsible for the Use-Impairment, Control **Pollutants** at the Source

  If Not Possible, Develop Site-Specific BMP's to Control Pollution to Maximum Extent Possible

  Will Result in Significantly Different Type of BMPs Than Typically Used Such as Detention Basins & Filtration

  Detention Basins & Filtration Useful Only Where Excessive Erosion Causes Water Quality/Use-Impairment Due to Siltation and/or Turbidity

Basic Engineering Approach:

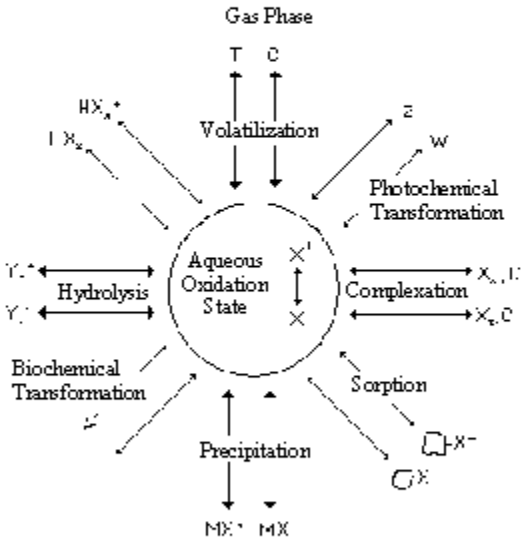
> Find the Problem & Solve It in a Technically Valid, Cost-Effective Manner

Focus Stormwater Water Quality Management on *Impacts* of Chemicals - Not on Chemicals That May Be Adverse to Water Quality at Some Location for Some Sources

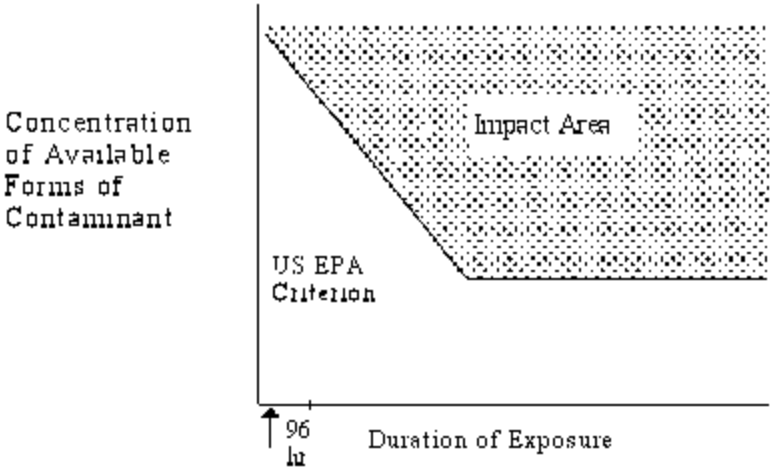
Evaluation Monitoring Is Conducted in a Watershed-Based, Technical Stake-Holder-Driven Program

Evaluation Monitoring Focuses on Using Aquatic Chemistry, Aquatic Toxicology, and Water Quality Information to Define & Manage Impacts of Urban & Highway Stormwater Runoff

Aquatic Chemistry of
Chemical Contaminants



Aquatic Toxicology

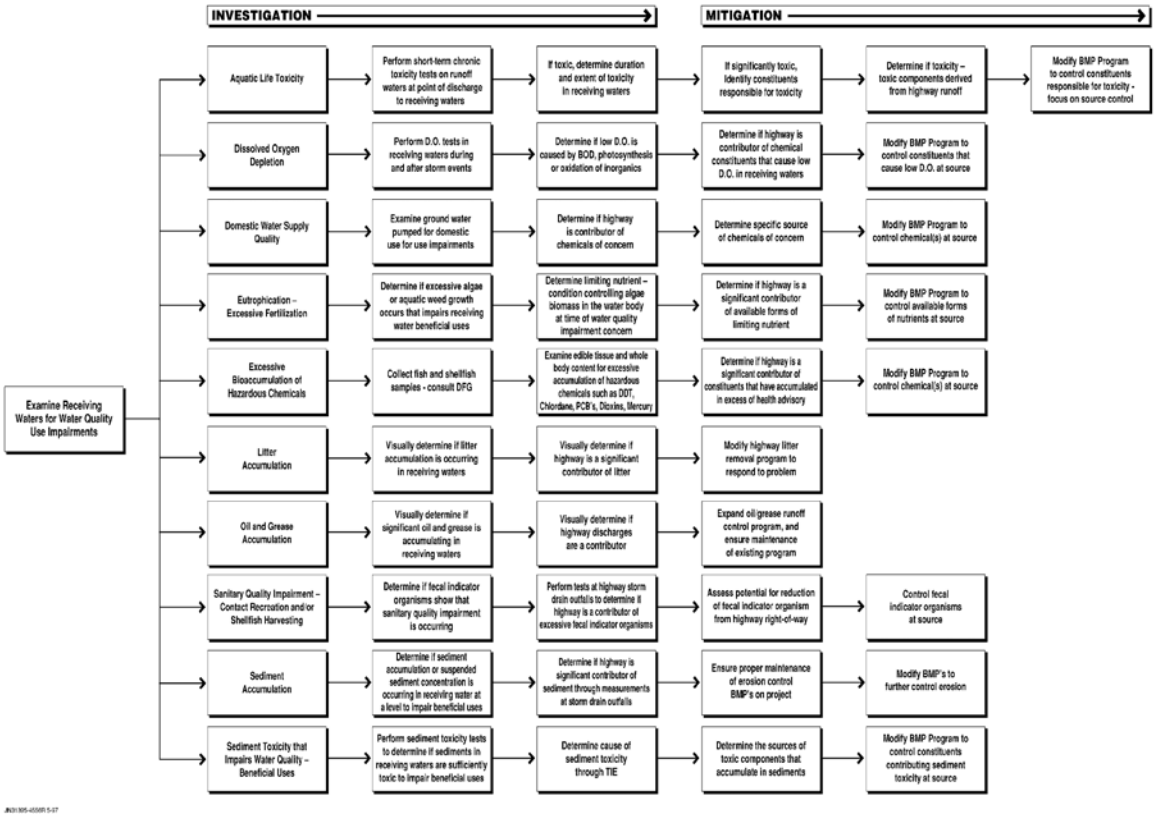


Stippled Impact Area Represents Conditions Where Magnitude of Toxicity-Duration of Exposure is Sufficient to Be Adverse to the Organisms

Laboratory Test Conditions Must Match Field Conditions of Toxicity-Duration of Exposure

Evaluation Monitoring Implementation Flow Chart
View enlarged figure with full text

Evaluation Monitoring Implementation Flow Chart



Development and Implementation of Evaluation Monitoring for Stormwater Runoff Water Quality Impact Assessment and Management

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Executive Summary

This report covers the development and application of Evaluation Monitoring (EM) to highway and urban area street stormwater runoff water quality impact assessment and management. A discussion is presented on the need for an alternative approach to the conventional approach of evaluating the water quality impacts of highway and urban area stormwater runoff associated constituents on receiving water quality. Information is presented on the background to the development and application of site-specific studies (EM) that can be conducted on the receiving waters for stormwater runoff that identify real water quality use impairments in these waters that are caused by chemical constituents and/or pathogenic organism indicators in the stormwater runoff.

It is widely recognized that conventional stormwater runoff water quality monitoring provides little in the way of useful information that can be used to evaluate the impact of stormwater runoff on the beneficial uses of the receiving waters for the runoff. The Evaluation Monitoring program is designed to replace the conventional "water quality" monitoring programs that are used for measuring the chemical constituent concentrations in highway and urban area street stormwater runoff. The results of the EM program provides a technically valid, cost effective basis for water quality best management practice (BMP) development that replaces the conventional approach that is used to develop stormwater runoff water quality BMPs. The conventional BMP development approach assumes that detention basins, grassy swales, various types of filters, etc. are effective BMPs for controlling real water quality use impairments due to heavy metals, organics and other constituents in highway and urban area stormwater runoff. However, it is now well known that particulate forms of heavy metals and other constituents that are removed in conventional stormwater runoff BMPs do not adversely impact the beneficial uses of the receiving waters for the runoff. The particulate forms of heavy metals and other constituents are in non-toxic, non available forms. Therefore, their removal in a detention basin or filter will not be of benefit to the beneficial uses of the receiving waters for the stormwater runoff.

Basically, the EM program shifts the funds that are used for end-of-the-pipe runoff monitoring to site-specific, highly directed studies designed to find real water quality use impairments of the receiving waters for the stormwater runoff. When such use impairments are found that are due to highway and/or urban area street runoff, then site-specific BMPs are developed that control the

Evaluation Monitoring Demonstration Project
Upper Newport Bay (UNB)/Orange County

Cooperative Project with:

Santa Ana Regional Water Quality Control Board
Several Orange County Stormwater Agencies
Other Parties Interested in Upper Newport Bay Water Quality

Initiated July 1, 1996

- Comprehensive Review of Existing Water Quality Information on Upper Newport Bay and Lower Santa Ana River
- Field Studies of Aquatic Life Toxicity in San Diego Creek Which is an Upper Newport Bay Tributary

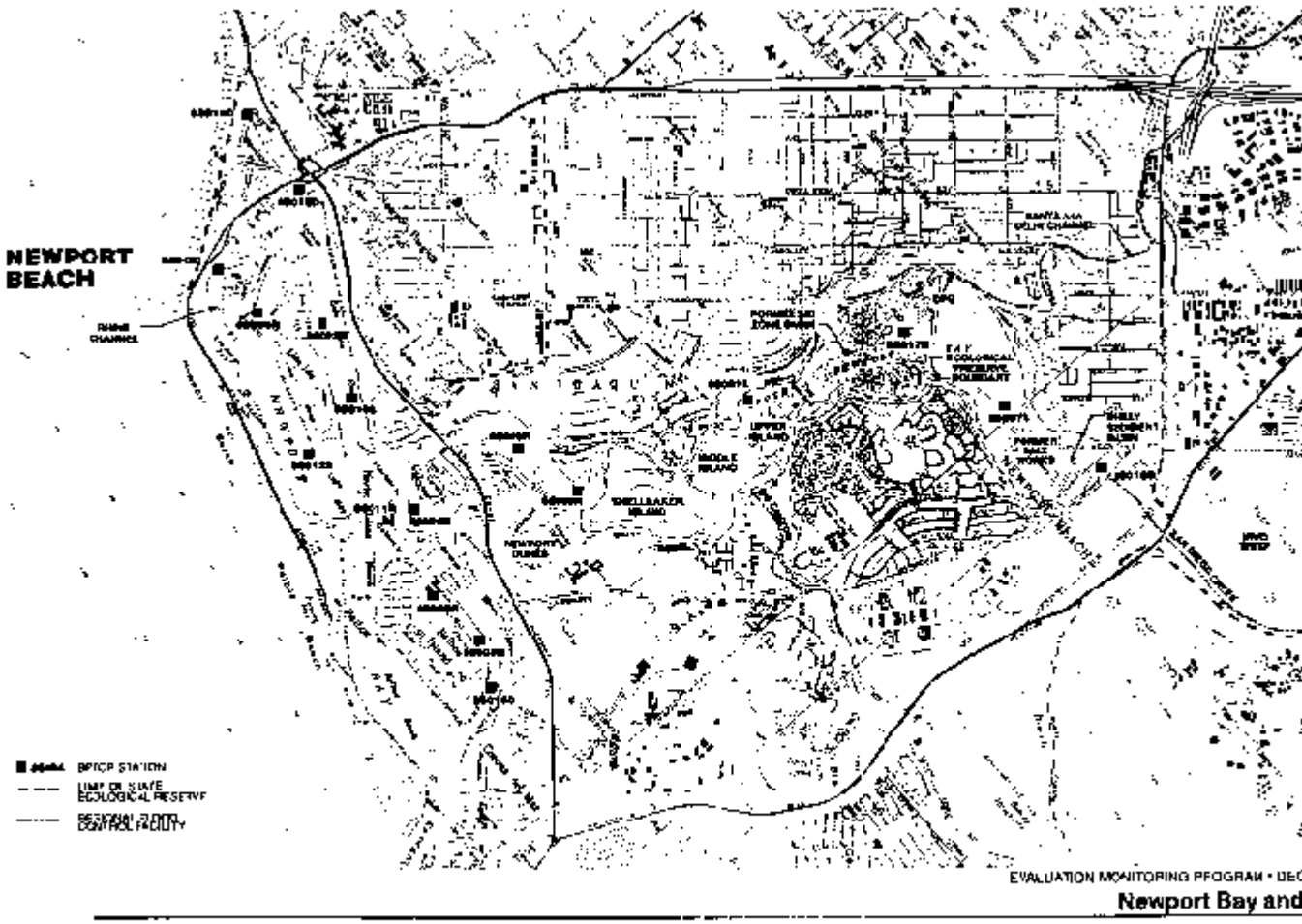
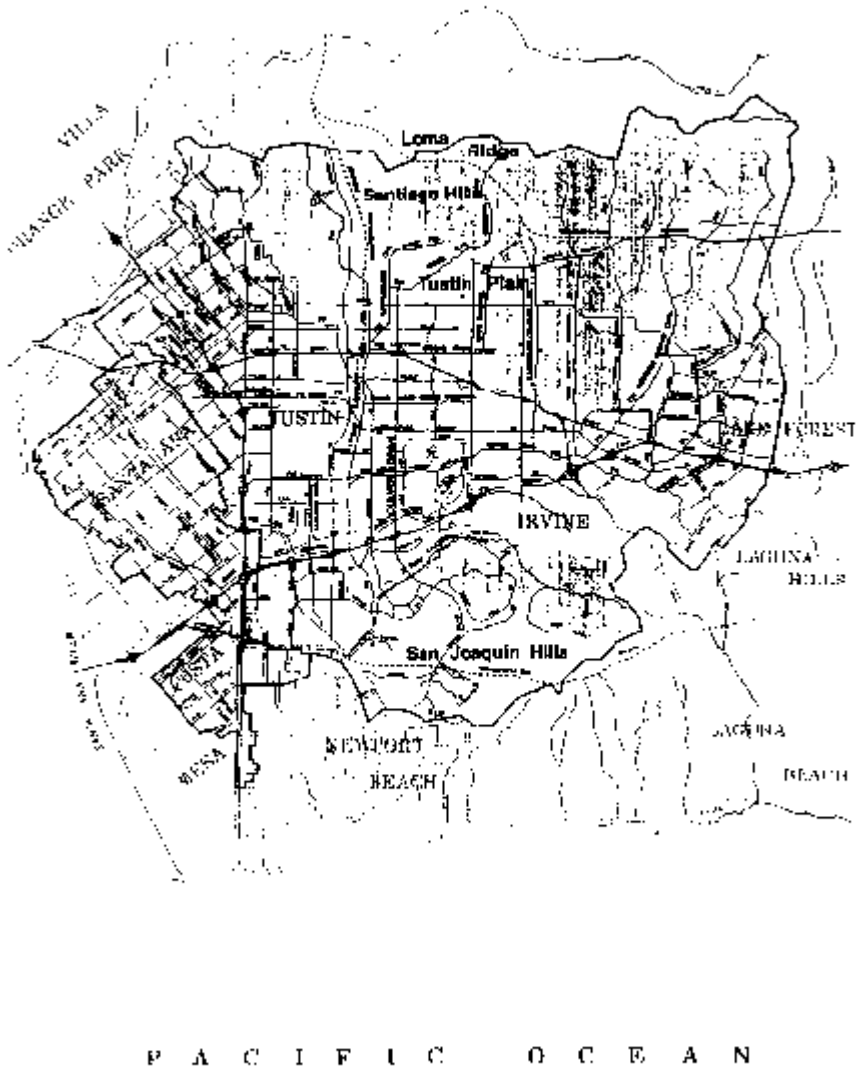


Figure 3. Newport Bay & Vicinity

Figure 2. Upper Newport Bay Watershed



Land Use - San Diego Creek Watershed

Land Use	Percent
Residential	15
Commerical	8
Industrial	6.3
Open Space/Vacant	23.1
Agriculture/Randhing	10
Public	0.3
Recreation	0.3
Transportation & Communication/Utility	1.2
Roads	35.8

Discharges for San Diego Creek

Concentration Point	Area (mi^2)	Q_{100} (cfs)	Q_2 (cfs)
Near Culver Drive	42.9	18,050	3,700
At Jamboree Road	119.2	34,300	7,000

Review of Existing Water Quality Characteristics of Upper Newport Bay, Orange County CA and its Watershed

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June 1997

Executive Summary

As part of an upper Newport Bay watershed-based water quality evaluation and management program a review of existing information on the water quality characteristics of Upper Newport Bay has been conducted. A summary of the findings is presented below.

Aquatic Toxicity

Previous studies (conducted in late 1992 and early 1993) on San Diego Creek waters as they enter Upper Newport Bay show that aquatic life toxicity was measured in the Creek waters. These studies were limited to two samples, where the cause of this toxicity was not identified. Further, chemical analysis of tributary waters and Bay waters has shown that the concentrations of some heavy metals with potential to cause aquatic life toxicity, were present in excess of United States Environmental Protection Agency (U.S. EPA) water quality criteria. There is, therefore, a potential that these exceedances of the water quality criteria may represent toxic conditions to aquatic life in the waters where they occur. Further studies are needed to determine whether San Diego Creek waters entering Upper Newport Bay are toxic to aquatic life. If toxicity in the Creek waters is found, then the significance of this toxicity to aquatic life within San Diego Creek and Upper Newport Bay should be evaluated. If toxicity is judged to be significant with respect to potentially impairing the beneficial uses of Upper Newport Bay and/or San Diego Creek waters, then the cause of this toxicity and the sources of the constituents that cause the toxicity should be identified and, if possible, controlled at the source.

Reference as: Lee, G.F. and Taylor, S., "Review of Existing Water Quality Characteristics of Upper Newport Bay and its Watershed" Report to Silverado, Irvine, CA, Submitted by G. Fred Lee & Associates, WI Macero, CA, June (1997).

Overall Water Quality of Upper Newport Bay

Overall, Upper Newport Bay Is Experiencing Significant Water Quality Impairment Due to:

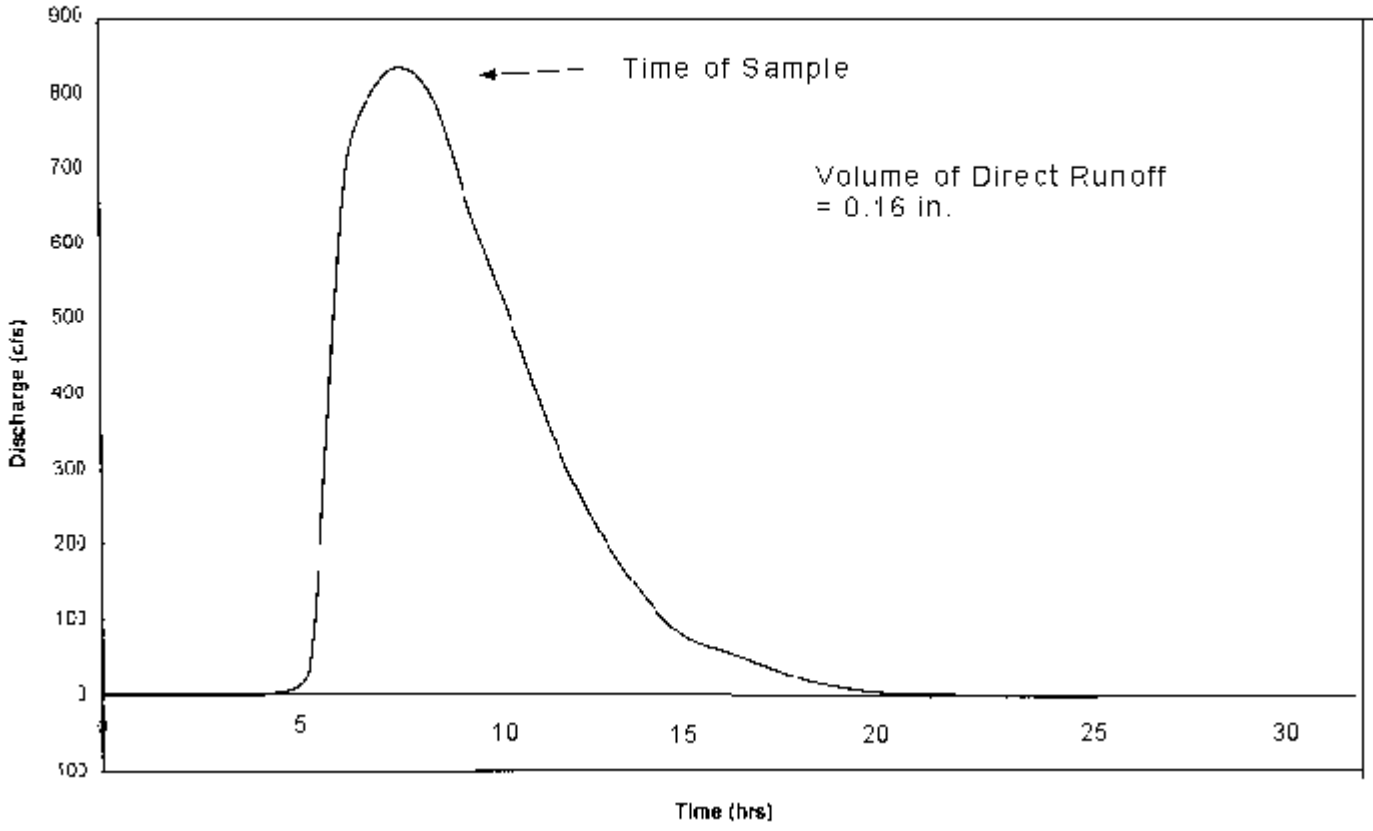
- Excessive Accumulation of Hazardous Chemicals in Aquatic Life Tissue That Causes Organisms to Be a Threat to Those Who Eat Them
- Excessive Fertilization That Causes Algal Growth That Impairs Recreational Use of the Bay
- Excessive Siltation That Causes Shoaling That Impairs Boating and Changes the Distribution of Aquatic Plant Communities That Develop in the Bay
- Excessive Litter That Impairs Use of Bay Nearshore Waters
- Impairment of Sanitary Quality of Upper Newport Bay That Increases Risk of Disease to Those Who Contact-Recreate in Bay Waters
- Restricted Shellfish Harvesting Due to Poor Sanitary Quality
- Maybe a Sediment Toxicity Problem-Need Further Study

Evaluation Monitoring Review of Existing Water Quality Data Shows That There Are Insufficient Data to Determine If Real Aquatic Life Toxicity-Related Water Quality Impairment Occurs

"Excessive" Levels of Heavy Metals in Tributary Discharges to Upper Newport Bay Relative to Water Quality Criteria

No Information on Whether Heavy Metal Exceedances Represent Toxicity or "Administrative Exceedances" of Water Quality Criteria

Figure 4. Hydrograph of San Diego Creek at Culver Drive
October 30, 1996



US EPA Standard Three Species Aquatic Life Toxicity Tests

Ceriodaphnia - Zooplankton - fish food

Pimephales - Fish Larva

Selenastrum - Algae

Toxicity Test Results for San Diego Creek:
Standard Three Species Test
Sample Collected on 10/30/96

7-day *Ceriodaphnia* Test

Treatment	Reproduction (neonates/adult)		% Mortality
	mean	standard error	
Lab Control	24.6	0.93	0.0
San Diego Creek	0.0	0.00	100 (24 hr)

7-day *Pimephales* Test

Treatment	Growth (mg)		Mortality (%)	
	mean	standard error	mean	standard error
Lab Control	0.470	0.01	0.0	0
San Diego Creek	0.473	0.02	0.0	0

96-hour *Selenastrum* Test

Treatment	Cell Count (x 10^4)	
	mean	standard error
Lab Control	138.2	10.6
San Diego Creek	450.3	7.3

Toxicity Test Results for San Diego Creek:
Additional *Ceriodaphnia* Testing
Sample Collected on 10/30/96

96-Hour *Ceriodaphnia* Dilution Series

Treatment	% Mortality for each day of the test			
	1	2	3	4
Lab Control	0	0	0	0
Lab Control + 100 μg/L PBO	0	0	5	20

Lab Control + 200 μg/L PBO	0	0	53	84
San Diego Creek 100%	100	100	100	100
San Diego Creek 50%	100	100	100	100

96-Hour *Ceriodaphnia* Dilution Series

Treatment	% Mortality for each day of the test			
	1	2	3	4
San Diego Creek 50% + 100 μg/L PBO	0	0	0	5
San Diego Creek 50% + 200 μg/L PBO	0	0	5	5
San Diego Creek 25%	0	100	100	100
San Diego Creek 25% + 100 μg/L PBO	0	0	0	0
San Diego Creek 25% + 200 μg/L PBO	0	0	60	60
San Diego Creek 12.5%	0	0	0	5

Figure 9. Hyetograph, Sand Canyon Gage, San Diego Creek Watershed
November 21, 1996

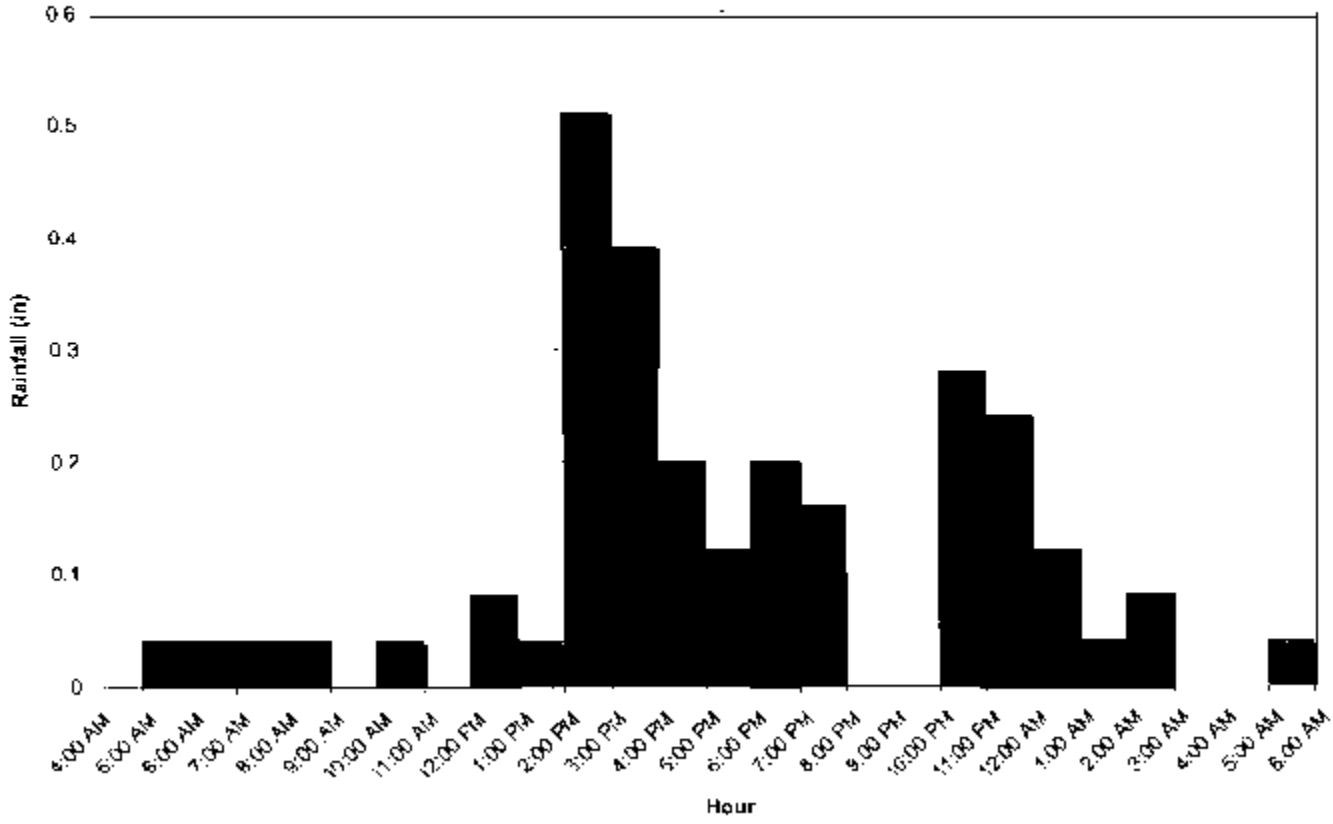
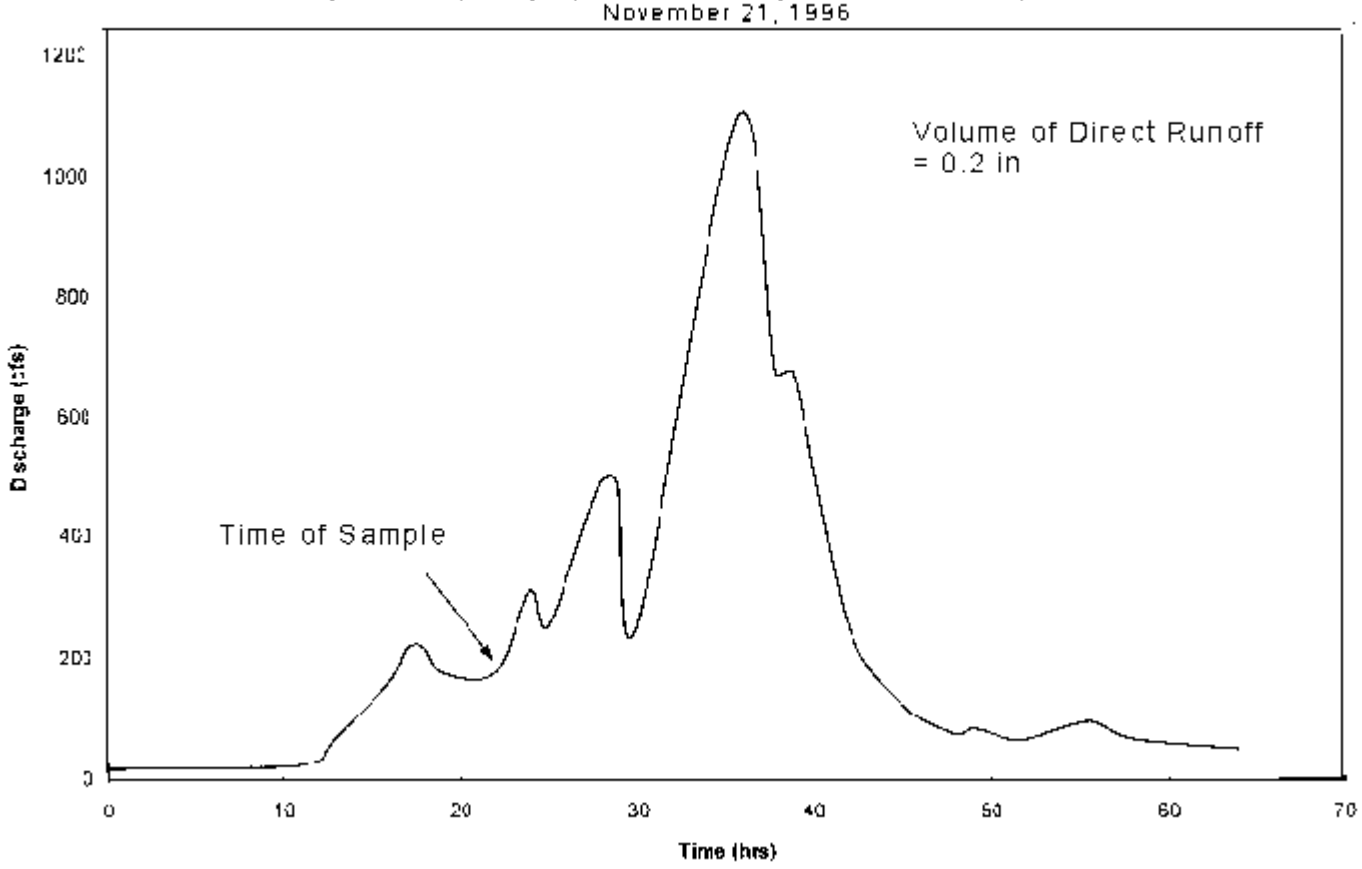


Figure 8. Hydrograph of San Diego Creek at Campus Drive
November 21, 1996



Toxicity Test Results for San Diego Creek:
Additional *Ceriodaphnia* Testing
Sample Collected on 11/21/96

96-Hour *Ceriodaphnia* Dilution Series

Treatment	% Mortality for each day of the test			
	1	2	3	4
Lab Control	0	0	0	0
Lab Control + 100 μg/L PBO	0	0	0	0
San Diego Creek 100%	100	100	100	100
San Diego Creek 65%	100	100	100	100

San Diego Creek 65%+ 100 μg/L PBO	100	100	100	100

96-Hour *Ceriodaphnia* Dilution Series

Treatment	% Mortality for each day of the test			
	1	2	3	4
San Diego Creek 50%	100	100	100	100
San Diego Creek 25%	100	100	100	100
San Diego Creek 25% + 100 μg/L PBO	0	45	100	100
San Diego Creek 12.5%	0	100	100	100

7-day *Pimephales* Test

Treatment	Growth (mg)		Mortality (%)	
	mean	standard error	mean	standard error
Lab Control	0.498	0.006	0.0	0.0
San Diego Creek	0.477	0.014	2.5	2.5

San Diego Creek Base Flow Studies

Monitoring San Diego Creek between the Two Monitored Storms Showed That Creek Waters

Were Non-Toxic

Had Low, Non-Toxic Concentrations of OP Pesticides during Dry Weather/Base Flow Conditions

Toxicity Associated with Stormwater Runoff

Composition of San Diego Creek Stormwater Runoff Sample Obtained on 11/21/96

Pesticide	Appl (GC)	UCD (ELISA)
Diazinon	540	359
Chlorpyrifos	130	133
Pendimethalin (Prowl)	450	
Simazine	3200	
Carbaryl	900	
Methomyl	2000	
Malathion	90	

Cause of Toxicity

Based on ELISA, PBO Testing, and Chemical Analysis, Determined Some of the Toxicity Is Due to

Diazinon - Urban Pesticide

Chlorpyrifos - Urban Pesticide

Methomyl - Ag Pesticide

About Half of Toxicity Due to Unknown Causes

Estimated Toxicities of Selected Pesticides (Concentrations in ng/L)

Pesticide	Bailey *et al.* 96-hr LC50	Foe 96-hr LC50
Chlorpyrifos	60	100
Diazinon	450	500

Malathion		1400
Methomyl		5560
Carbaryl		3500 - 5200
Simazine		
Pendimethalin (Prowl)	--	--

**Total Pounds of Diazinon Applied, by Use,
in Orange County in 1995**

	Agriculture	Landscape	Right of Way	Commercial	Structural	Pest Control	Total
January	442.38	19.00	0.00	82.42	91.08	0.00	634.88
February	401.40	20.51	0.75	62.58	1,793.84	0.00	2,279.08
March	157.24	71.89	0.00	72.24	1,380.08	0.00	1,681.45
April	34.53	51.79	0.00	98.87	1,405.64	0.00	1,590.83
May	34.63	293.40	0.00	104.38	1,825.28	0.00	2,257.69
June	331.98	74.58	0.00	115.90	1,612.09	0.00	2,134.55
July	22.11	73.93	0.06	148.30	1,939.89	0.00	2,184.29
August	13.09	65.19	4.99	106.10	2,182.62	0.00	2,371.99
September	13.30	146.40	3.99	78.96	1,840.38	0.00	2,083.03
October	2.29	105.22	46.88	0.00	1,438.45	0.00	1,592.84
November	234.64	80.73	0.00	86.75	979.60	0.00	1,381.72
December	316.39	27.19	0.00	33.71	973.79	0.00	1,351.08
Total	2,003.98	1,029.83	56.67	990.21	17,462.74	0.00	**21,543.43**

Data from the Department of Pesticide Regulation's Pesticide Use Reporting Database

**Total Pounds of Chlorpyrifos Applied, by Use,
in Orange County in 1995**

	Agriculture	Landscape	Right of Way	Commercial	Structural	Pest Control	Total
January	207.03	27.12	0.00	21.67	601.56	0.00	857.38
February	328.49	42.24	0.00	33.94	2,318.79	0.00	2,723.46
March	69.76	37.17	0.00	66.13	2,922.25	0.00	3,095.31
April	52.50	76.65	0.00	27.75	3,439.35	0.00	3,596.25
May	56.00	89.62	0.00	37.04	2,584.46	0.00	2,767.12
June	0.00	67.52	0.00	64.20	2,535.76	0.00	2,667.48
July	52.95	140.93	6.00	59.66	5,122.69	0.00	5,382.23
August	40.42	506.28	0.00	76.05	2,903.44	0.00	3,526.19
September	145.52	174.79	11.62	57.49	3,243.81	0.00	3,633.23
October	227.00	178.61	12.67	56.17	3,121.21	0.00	3,595.66
November	0.00	65.30	0.00	90.77	5,384.06	0.00	5,540.13
December	210.60	40.03	0.00	60.78	4,085.16	0.00	4,396.57
Total	1,390.27	1,446.26	30.29	651.65	38,262.54	0.00	**41,781.01**

Data from the Department of Pesticide Regulation's Pesticide Use Reporting Database

Determination of Water Quality Significance of Aquatic Life Toxicity in Stormwater Runoff on Beneficial Uses of Receiving Water

Regional Boards' Basin Plan Objectives

No Discharge of "Toxics" in Toxic Amounts

No Ambient Water Toxicity

Enforced for POTW's & Industrial Wastewater Dischargers

Not Being Enforced for Urban Stormwater Runoff & Non-Point (Ag) Sources

New State WRCB California Toxics Rule (CTR) Proposed Requirements

Toxicity Provisions:

Chronic Toxicity Objective

Surface Waters Outside of Any Allowed Mixing Zones Shall Be Free from Lethal or Sublethal Toxicity at Levels Which Impair Designated Aquatic Life Beneficial Uses

Water Quality-Based Toxicity Control

A Chronic Toxicity Effluent Limitation Is Required in WDRs for All Discharges That Will Cause, Have Reasonable Potential to Cause, or Contribute to Chronic Toxicity in Receiving Waters

JULY 1997: THE CALIFORNIA TOXICS RULE (CTR)

PUBLIC HEARINGS ON THE U S EPA'S PROPOSED
WATER QUALITY CRITERIA FOR PRIORITY TOXIC POLLUTANTS:
SAN FRANCISCO Sept 17th, 1 00 p m , U S EPA Hawthorne 51
LOS ANGELES: Sept. 18th, 1:00 p.m., LA Dept. of Water & Power
111 N. Hope St. (across from the LA Music Center)

FOR A COPY OF THE CTR, VISIT U S EPA'S WEBSITE AT
http //www epa gov/OST/Rules/index html#open

The U.S. Environmental Protection Agency (U.S EPA) implements the objectives of the Clean Water Act, one of which is to restore and maintain the quality of our nations' waters to protect human health and aquatic life from harmful pollutants. The U.S. EPA will propose water quality criteria for priority toxic pollutants for the State of California in the Federal Register during the week of July 28th. The Agency will then take public comment on its proposal This proposed rule will, when finalized, establish ambient water quality criteria for priority toxic pollutants for California inland surface waters, enclosed bays and estuaries.

BACKGROUND: The Clean Water Act (CWA) requires that states adopt water quality standards for priority toxic pollutants in order to ensure adequate protection of waters for certain uses such as swimming and fishing. The State of California adopted statewide water quality control plans for inland surface waters, enclosed bays and estuaries in 1991, partly to satisfy this CWA requirement; however, a state court, in 1994, overturned the State's plans on procedural grounds. California is the only state in the nation that lacks comprehensive water quality standards for priority toxic pollutants. The U.S. EPA and the State are currently working to restore water quality standards for priority toxic pollutants for those California water bodies: the U.S. EPA is now proposing water quality criteria, and the State will soon be proposing implementation procedures to ensure that the resulting water quality standards will be appropriately and consistently applied throughout the State.

After the State adopts implementation procedures, it plans to begin the process of readopting comprehensive statewide water quality control plans for inland surface waters, enclosed bays and estuaries. After such plans are adopted, the U.S. EPA will review and approve, as appropriate, the State's plans The U.S. EPA intends to stay the CTR when State criteria are developed and approved.

WHAT IS A PRIORITY TOXIC POLLUTANT? The CWA at section 307(a) identifies the initial list of priority toxic pollutants. This section gives the U.S. EPA the authority to add or remove pollutants from the list after taking into account such factors as the toxicity of the pollutant, its persistence, its degradability, and its effect on

DRAFT
Policy for Implementation of Toxics Standards for Inland Surface Waters, Enclosed Bays, and Estuarines of California

(Phase 1 of the Inland Surface Waters Plan and the Enclosed Bays and Estuaries Plan)

AND

FUNCTIONAL EQUIVALENT DOCUMENT

September 11, 1997

STATE WATER RESOURCES CONTROL BOARD

California Environmental Protection Agency

Toxicity Reduction Requirements

"If a discharge causes or contributes to chronic toxicity in receiving waters, a toxicity reduction evaluation (TRE) is required. The TRE shall include all reasonable steps to identify the source(s) of toxicity. Once the source of toxicity is identified, the discharger shall take all reasonable steps necessary to eliminate toxicity.

"If persistent toxicity is identified in ambient waters, and it appears to be due to nonpoint source discharges, the appropriate nonpoint source dischargers, in coordination with the RWQCB, shall perform a TRE. Once the source of toxicity is identified, the discharger shall take all reasonable steps to eliminate toxicity."

Water Quality Impact of Aquatic Life Toxicity Depends on

Magnitude of Toxicity/Duration of Exposure Relationship Relative to the Sensitivity of the Test and Field Organisms

Event-Mean Concentrations Not Valid for Characterizing Water Quality Impact of Chemicals & Toxicity

Must Relate Toxicity/Duration Relationship for the Test Organism(s) & Key Ambient Organisms

Areal Extent of Toxic Concentrations & Rate of Change of Toxic Conditions

Toxicant Transformations

Dilution of Toxic Concentrations Due to Mixing

Characteristics of Toxicity

Rapid- or Slow-Acting (1 or 4-day)

Species of Aquatic Organisms Impacted

Fish, Shellfish, Zooplankton, Algae

Importance to Water Quality & Society

Table 11. Combined toxicity database. Acute toxicity (EC50 and LC50 concentrations, in ng/L) of diazinon to aquatic organisms. N=number of LC50 or EC50 values included in geometric mean. Data from: EPA (1995), Mienconi and Cox (1994), and AQUIRE (1995).

Species	Common Name	EC50 or LC50 (Geometric Mean, ng/L)	N
Gammarus fasciatus	Amphipod	200	1
Ceriocaphna dubia	Daphnid	493	3
Daphnia pulex	Daphnid	776	3
Daphnia magna	Daphnid	1020	10
Simocephalus serrulatus	Daphnid	1590	2
Gammarus pseudolimnaeus	Amphipod	2080	1
Acartia tonsa	Copepod	2570	1
Neomysis mercedis	Mysid	4150	2
Mysidopsis bahia	Mysid	4500	2
Cloeon dipterum	Mayfly	7800	1
Orconectes propinquus	Crayfish	15000	1
Acroneuria ruralis	Stonefly	16000	1
Asellus communis	Amphipod	21000	1
Hyalella azteca	Amphipod	22000	1
Chasmichthys dolichognathus	Goby	23400	3
Baetis intermedius	Mayfly	24000	1
Pteronarcys californica	Stonefly	25000	1
Palaemonetes pugio	Shrimp	28000	3
Penaeus aztecus	Shrimp	28000	1
Sericia quinqueradiata	Yellowtail	40000	1
Paraleptophlebia pallipes	Mayfly	44000	1
Physa gyrina	Snail	46000	1
Lestes congener	Damselfly	50000	1
Anguilla anguilla	Eel	80000	1
Girella punctata	Green fish	94700	2
Orthetrum albistylum	Dragonfly	140000	1
Leuciscus idus	Golden orf	150000	1
Mugil cephalus	Mullet	150000	1
Gammarus lacustris	Amphipod	184000	2
Lepomis macrochirus	Bluegill sunfish	204000	13
Mugil curema	White mullet	250000	1
Notemigonus crysoleucas	Golden shiner	400000	1

(from Novartis Crop Protection, 1997) 120

Test Conditions

Must Consider Physical, Chemical, Biological Characteristics of Toxicity Test Relative to Those Experienced by Key Ambient-Water Organisms

Should Match Laboratory Exposure to Field Conditions in Follow-Up Testing

Interpretation of Toxicity Test Results Complex - Yes, But:

Far More Reliable Than Estimating Toxicity Based on Chemical Measurements

Chemical Approach Has All the Interpretation Problems of Toxicity Testing in Addition to the Need to Evaluate Whether the Regulated and Unregulated Chemicals in Sample Are Toxic

Urban OP Pesticide Toxicity - Water Quality Issues

- Only Toxic to *Ceriodaphnia, Others ?*
- Importance of *Ceriodaphnia*-Like Toxicity Sensitivity to Upper Newport Bay Waters
- Additive Toxicity
- Stormwater Runoff-Related

  Short, Pulse Toxicity

- Importance of OP Pesticides to Society
- Political Power of Pesticide Companies & Ag Interests

Future Upper Newport Bay Toxicity Studies

With Support of US EPA 205(j) and 319(h) Grants as Part of the SARWQCB Watershed Initiative, and in Cooperation with the SARWQCB, Orange County Public Facilities & Resources Department, and Others, Will Determine:

- Pattern of Toxicity over the Year in San Diego Creek as It Enters Upper Newport Bay
- Fate and Persistence of Toxicity and Toxic Components in the Bay Waters
- Cause of the Toxicity through TIEs
- Water Quality Significance of the Toxic Pulses That Enter Upper Newport Bay in Stormwater Runoff
- Through Forensic Studies, Sources of Toxicity and Toxic Components

Information to be Used by the SARWQCB to Develop TMDL for Toxicity in Upper Newport Bay

Conclusions

Occurrence of Urban Stormwater OP Toxicity to *Ceriodaphnia* Does Not Necessarily Mean That There Will Be Use-Impairment / Adverse Impact on Water Quality

Need Detailed, Site-Specific Investigation to Evaluate Water Quality (Use-Impairment) Significance of the Toxicity

Best Done in Evaluation Monitoring Program Framework

Suggested Regulatory Approach

WRCB, Regional Boards, Regulated Community, Environmental Groups, & the Public Should Develop an Approach to Acquire the Information Needed to Define the Water Quality Significance of Aquatic Life "Toxicity"

Need to Appropriately Implement WRCB CTR Implementation Approach for Defining Significant Water Quality Impacts Due to Toxicity

Water Quality Evaluation & Management

Wastewater Discharges and Stormwater Runoff

Regulatory approaches typically used today tend to significantly over-regulate regulated chemicals in point-source domestic and industrial wastewater discharges and non-point-source runoff from urban, agricultural, rural, forested, and mining areas. This is due to inadequate considerations being given to the aquatic chemistry of chemical constituents that influence their impacts on the beneficial uses of waterbodies. Dr. G. Fred Lee has worked on the development of water quality criteria and their implementation into water quality standards and discharge limits since the mid-1960's. He and Dr. Anne Jones-Lee have published extensively on this topic, with particular attention to residual chemicals in municipal and industrial wastewater discharges, urban and highway stormwater runoff, and non-point-source stormwater runoff from urban, agricultural, range, and forested lands. They have also developed a water quality-based hazard assessment approach for the evaluation of the impact of chemical constituents in a waterbody or tributary to it, on the beneficial uses of the waterbody.

While regulated chemicals tend to be over-regulated by current regulatory approaches, there is a vast arena of unregulated or inadequately regulated chemicals, such as the organophosphorus pesticides, that are adverse to the beneficial uses of waterbodies, which are not being adequately addressed by current regulatory approaches. Urban area and some rural stormwater runoff has been found to be highly toxic to aquatic life due to these and other chemicals.

An area of emphasis of their work has been the impacts of chemical constituents in urban area runoff and in highway stormwater runoff on water quality/use-impairment of receiving waters. They have published information on an Evaluation Monitoring approach for the identification of real water quality problems-use impairments caused by stormwater runoff. That suggested alternative to the traditional, mechanical monitoring of stormwater runoff provides a technically valid, cost-effective approach for developing reliable BMPs for managing stormwater runoff water quality impacts.

Additional Information on Water Quality Evaluation and Management

If you would like additional information on the work of Drs. Lee and Jones-Lee in the area of water quality evaluation and management, including their work on impact and management of pesticides, water quality standards and NPDES permits, and stormwater quality evaluation and management, or would like to access downloadable technical publications on those topics, click on the topic below.

http://home.pacbell.net/gfredlee/watrqual.html

Contaminated Sediments - Aquafund

Aquatic sediments tend to accumulate a variety of chemical constituents that represent potential threats to water quality. The issue of pollutants in aquatic sediment is of sufficient concern to potentially lead to a new national Superfund-like program - "Aquafund" - in which large amounts of money could be spent to investigate and remediate contaminated sediments. Further, the US EPA is in the process of developing approaches for placing restrictions on NPDES permitted discharges that are based on the potential of constituents in these discharges to accumulate in aquatic sediments to a sufficient extent to be adverse to the waterbody's beneficial uses.

Drs. G. Fred Lee and Anne Jones-Lee have worked for many years on the evaluation of the water quality significance of contaminants in harbor and waterway sediments. Their work included conducting more than $1 million in research on the significance of contaminants in waterway sediments associated with navigational dredging projects that are conducted throughout the US. They have published papers and reports on the technical issues of impacts of sediment-associated contaminants, including factors that affect the availability of such contaminants.

There is considerable interest today in developing sediment quality criteria for regulating contaminated sediments. Several approaches have been proposed for the evaluation of the water quality significance of chemical constituents in aquatic sediments. While chemical-concentration-based approaches, such as equilibrium partitioning and co-occurrence, are being used, such approaches tend to be unreliable in their assessment of the water quality significance of chemicals in aquatic sediments. Drs. Lee and Jones-Lee's writings discuss many of the reasons that chemical-concentration-based approaches are not reliable for estimating sediment toxicity or bioaccumulation of sediment-associated chemicals into aquatic life. They recommend that biological-effects-based approaches (sediment toxicity and actual bioaccumulation) be used.

Dr. Lee presents a several-day short-course on sediment quality/water quality issues which can be made available at any location where a local sponsor will make arrangements.

Additional Information on Contaminated Sediments

If you would like additional technical information on the evaluation and management of sediment-associated contaminants, including deficiencies in some of the current approaches and making more technically reliable assessments and management decisions, or would like to access downloadable technical publications on that topic, click on the link below.

http://home.pacbell.net/gfredlee/aquafund.html

Evaluation & Remediation/Management of Impacts of Hazardous Chemicals

In some areas, industrial, municipal, or agricultural properties, and waterbodies (including groundwater) contain significantly elevated concentrations of potentially hazardous and otherwise deleterious chemicals. Those situations pose real or potential threats to public health, surface and groundwater resources, the environment, and/or the interests of those who own or use properties in the areas under the influence of those chemicals.

Drs. G. Fred Lee and Anne Jones-Lee have developed several professional papers and reports that discuss important issues for investigating and remediating areas that contain hazardous or otherwise deleterious chemicals. Information is provided on evaluating the adequacy of site investigation and remediation relative to the long-term threats that hazardous and otherwise deleterious chemicals may represent to public health, surface and groundwater resources, and the environment.

Additional Information on Evaluation & Management of Hazardous Chemicals

If you would like additional information on the evaluation and remediation/management of the impacts of hazardous and otherwise deleterious chemicals, or would like to access downloadable technical publications on that topic, click on the link below.

http://home.pacbell.net/gfredlee/hazchem.html

G. Fred Lee and Anne Jones-Lee
Recent Publications on Water Quality Aspects of Urban Area and Highway Stormwater Runoff

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