

**Sediment Quality Assessment Study at  
the B Street/Broadway Piers, Downtown Anchorage, and Switzer Creek, San Diego**

**Phase I Sampling and Analysis Plan**

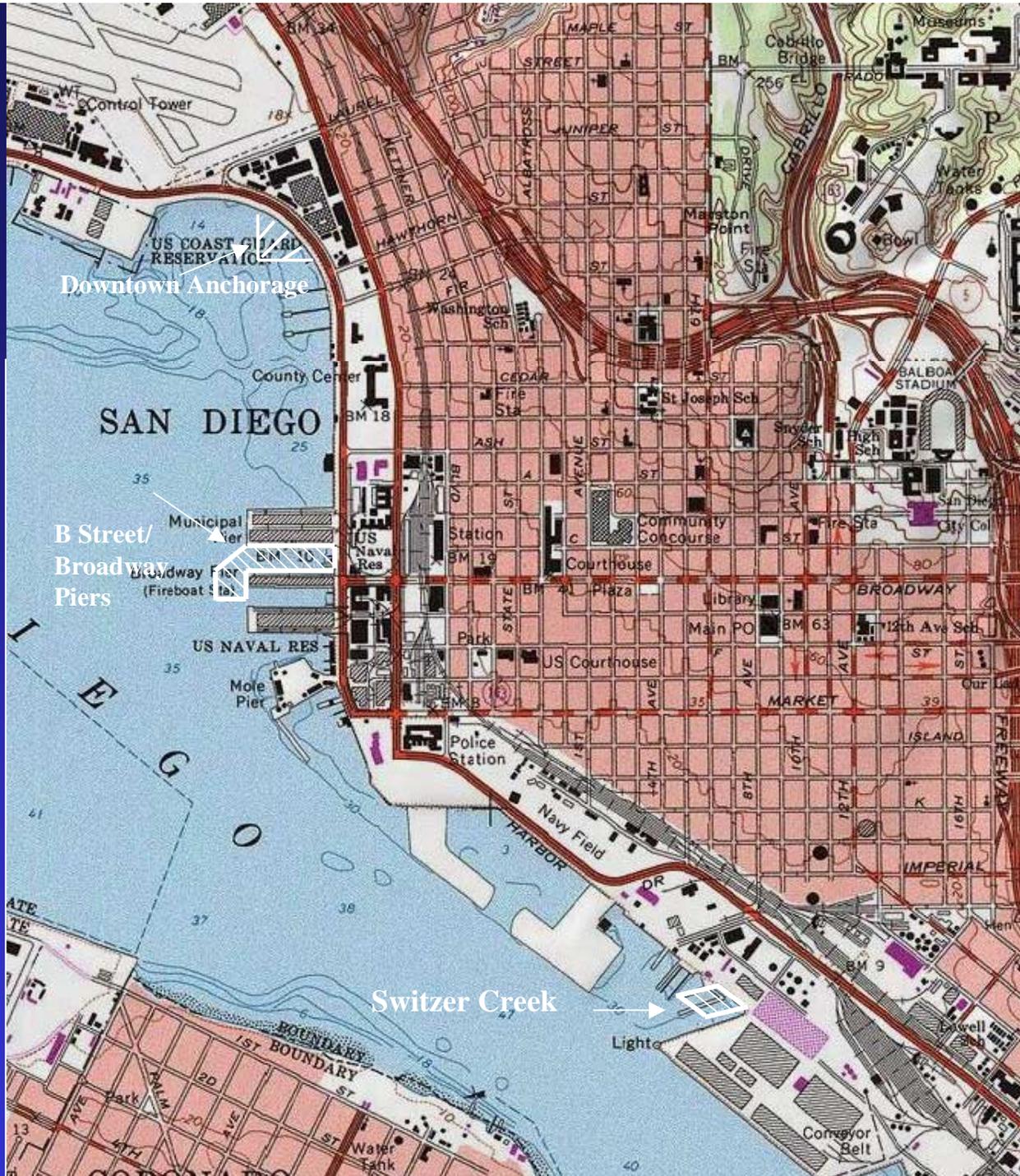
**March 10, 2003**

**Prepared by:  
Marine Pollution Studies Laboratory  
University of California  
Davis, CA**

*In cooperation with:*  
**San Diego Regional Water Quality Control Board  
City of San Diego  
Port of San Diego**

*and*

**Steven Bay  
Southern California Coastal Water Research Project  
Westminster, CA**

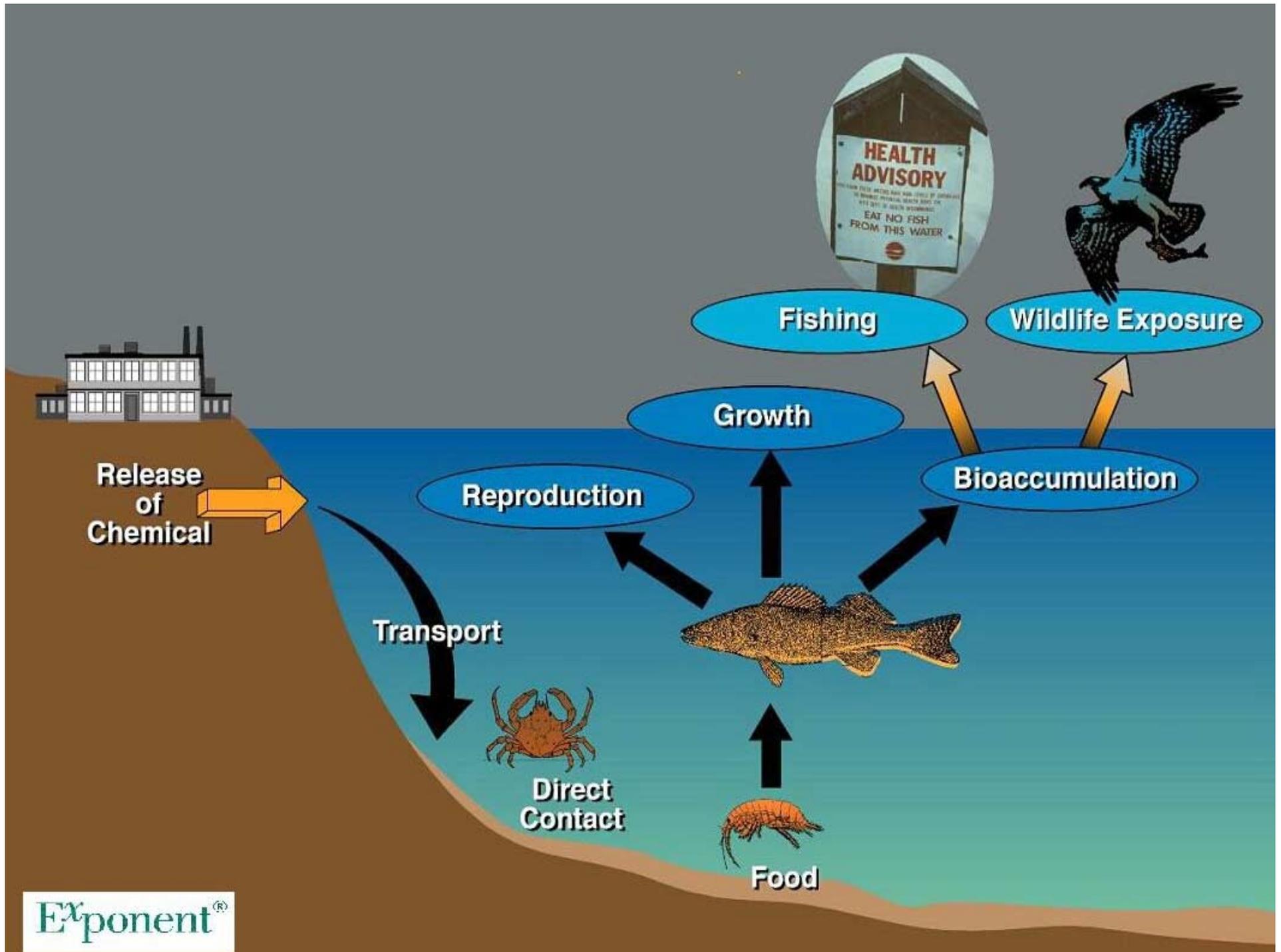


Downtown Anchorage

B Street/  
Broadway  
Piers

Switzer Creek

Light



# Phase I

## Measure Spatial Extent and Magnitude of Sediment Impacts

Measure sediment quality indicators at many stations:

**Sediment contamination**

**Sediment toxicity**

**Benthic community structure**

**Bioaccumulation**



Identify and map areas of impaired or potentially impaired beneficial uses:

**Aquatic life**

**Human health**

**Wildlife**

## **Phase II (TMDL Actions)**

### **Determine cause of impairment**

**Sediment/Porewater TIEs**

**Additional sediment/tissue chemistry**

### **Document key indicators of impact**

**Temporal study of toxicity and benthic community impacts**

### **Determine sources**

**Spatial analysis of data**

**Historical data review**

**Watershed/facility sampling**

# Phase III (Cleanup Actions)

Identify indicator chemicals

Calculate aquatic life cleanup levels

**Porewater chemistry/toxicity**

**Derive cleanup levels using AET, EqP, or other methods**

Calculate human health cleanup levels

**Resident seafood tissue analysis**

**Risk modeling**

Calculate wildlife cleanup levels

**Resident animal tissue analysis**

**Risk modeling**

Determine cleanup boundaries

**Core sampling**

## TMDL Implementation

Implement Source Control

Verify Source Reduction

## Cleanup Implementation

Evaluate remedial options for site cleanup

Implement Cleanup Actions

## Sampling

### Moss Landing Marine Laboratories (Russell Fairey)



**Chemical Analyses**  
**(CRG Laboratories – Rich Gossett)**

- **Trace elements**
- **Pesticides**
- **PCBs**
- **Polycyclic aromatic hydrocarbons (PAHs)**
- **Total Organic Carbon**

**Physical Analyses**  
**(AMEC – Barry Snyder)**

- **Sediment Grain Size**

# Laboratory Toxicity Testing (UC Davis – Marine Pollution Studies Lab)

## Amphipod 10-d survival test

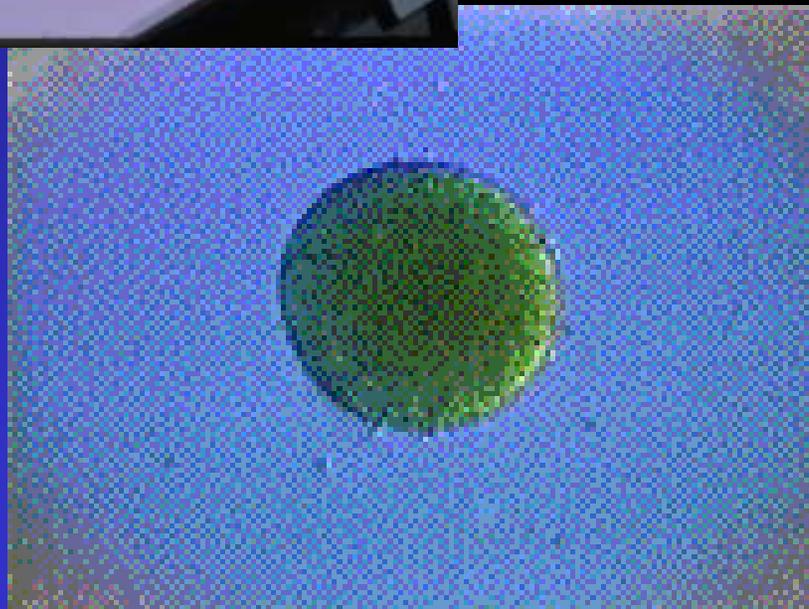


- Measures acute effects

# Mussel embryo development @ sediment-water interface

- 48-h exposure
- Sublethal endpoint





**Sea Urchin  
Fertilization test  
in porewater**

# Benthic Community Characterization (Jim Oakden – Moss Landing Marine Laboratories)

- Measure of chronic impacts
- BPTCP methods/Bight '98 methods



**Bivalve molluscs**



**Crustacea**



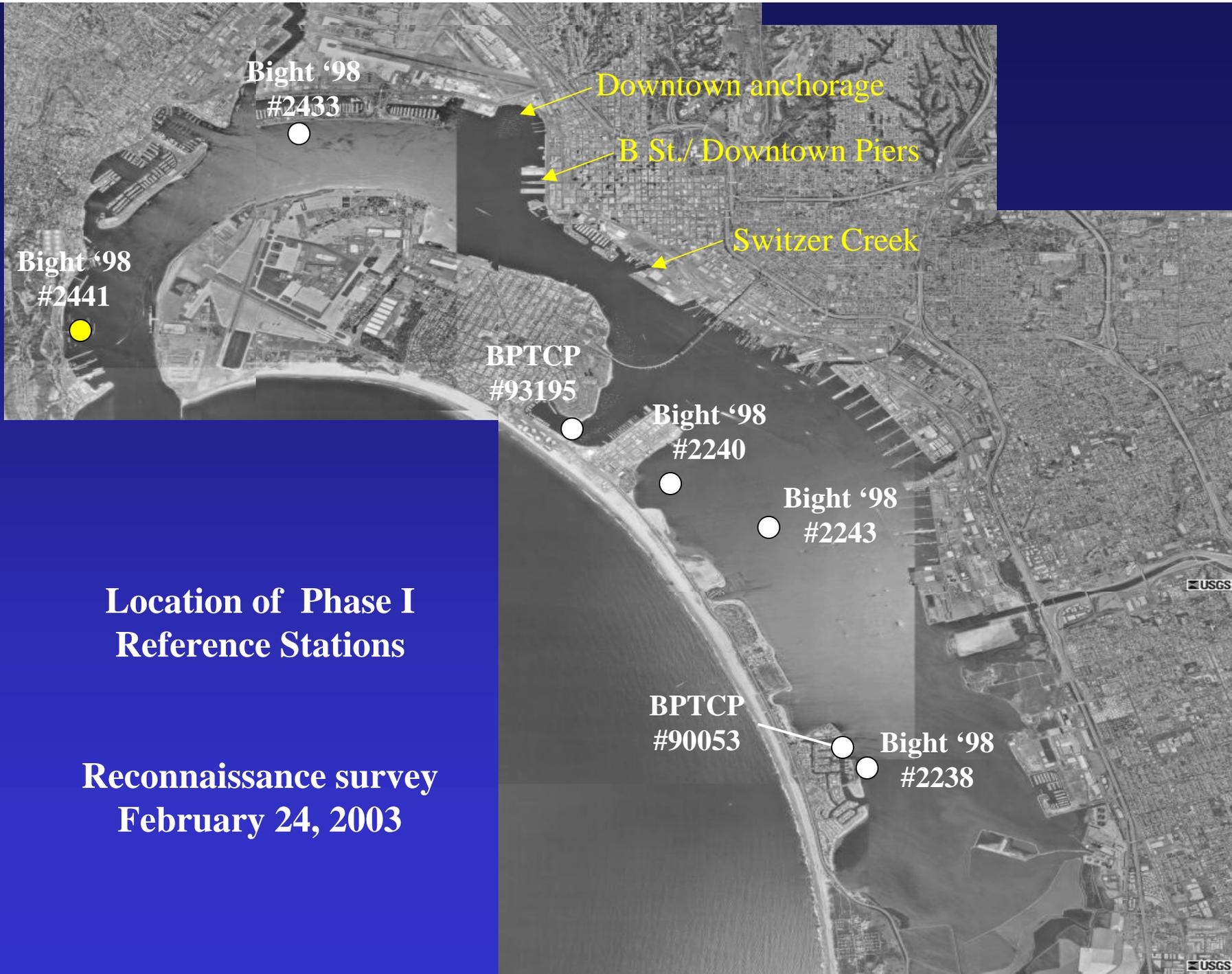
**Polychaetes**

# Bivalve (*Macoma nasuta*) 28-d sediment bioaccumulation test (AMEC/CRG labs)

U.S. EPA / U.S. ACOE methods



- Measures contaminant uptake from sediments
- Data may be used to evaluate potential for food chain transfer



**Location of Phase I  
Reference Stations**

**Reconnaissance survey  
February 24, 2003**

## Reference station reconnaissance toxicity test results

<u>Station#</u>	<u>Amphipod survival*</u>	<u>SWI embryo dev.**</u>
2238	80%	99% (70%)
2240	79%	92% (62%)
2243	91%	93% (55%)
2433	92%	93% (53%)
90053	52%	96% (49%)
93195	81%	95% (51%)
Control	97%	95% (62%)

\*Control adjusted survival, \*\* sea urchin embryo development

# Reference Station Chemistry Results

	2238	2240	2243	2433	90053	93195	Guideline#
<b><u>Chemical</u></b>							
<b>Metals (ug/g dry)</b>							
Cadmium	0.24	0.15	0.11	0.25	0.23	0.17	4.21
Copper	82.2	98.8	60.6	59.6	100	138	270
Lead	24.2	34.9	20.5	18.9	26.1	47.9	112.2
Silver	0.8	1.13	0.72	0.65	1.03	1.21	1.77
Zinc	235	227	128	134	275	283	410
<b>Organics (ng/g dry)</b>							
Tot Chlordane*	2.5	2.5	2.5	2.5	2.5	2.5	6
Dieldrin*	0.5	0.5	0.5	0.5	0.5	0.5	8
Tot. PAHs (ng/g oc dry)	5.4	28.1	25.6	64.9	11.5	36.5	1800
Tot. PCBs*	18	18	18	18	18	18	400
SQGQ1**	0.237	0.272	0.188	0.189	0.271	0.322	
TOC (%)	1.62	1.30	0.74	1.01	1.43	1.53	
Grain Size							

\*all values below MDL

\*\* after Fairey et al. 2001

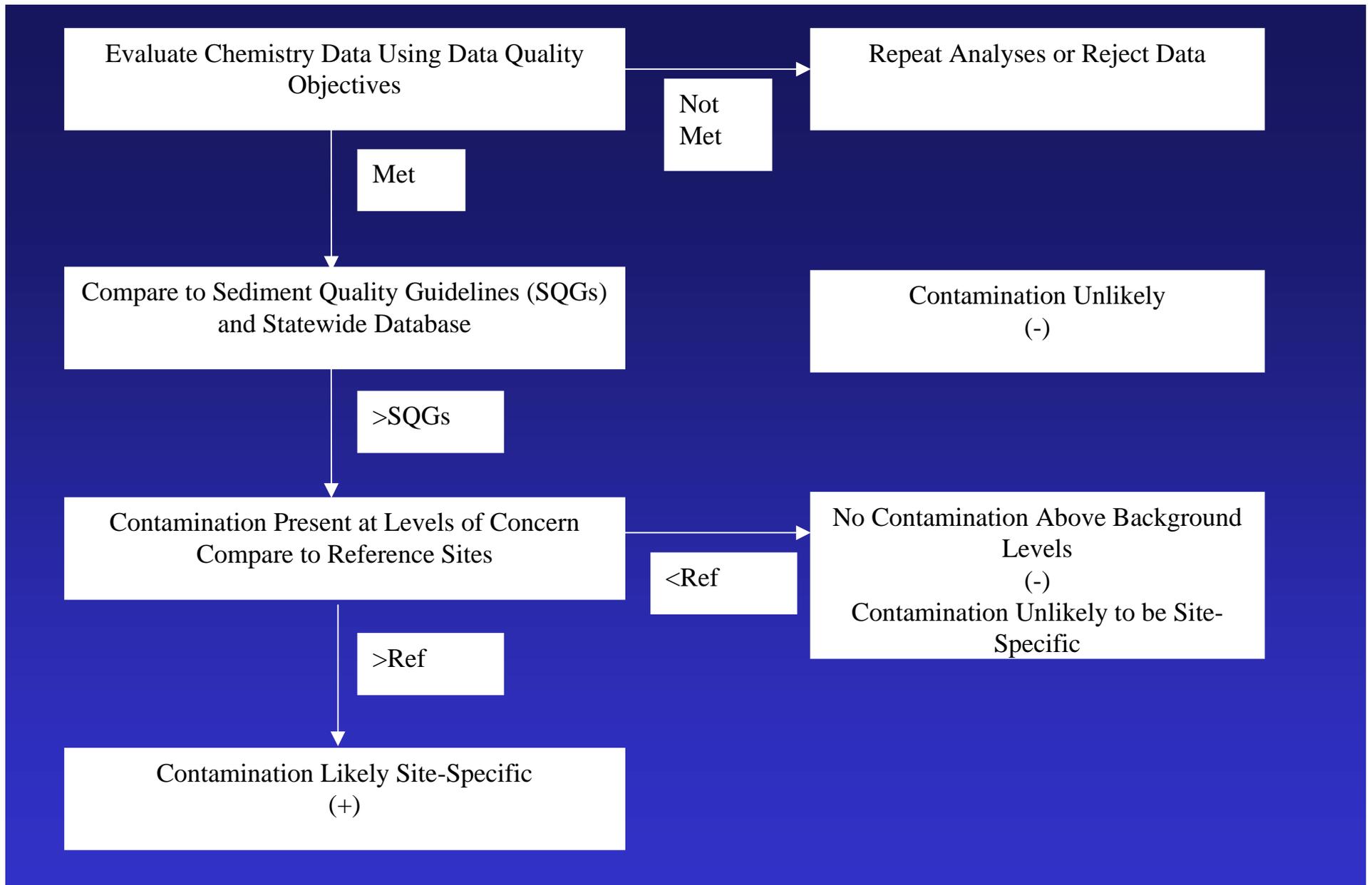


Figure 4-1. Procedure for assessing sediment chemistry data. Symbols in parentheses indicate the classification of the station as either contaminated (+) or uncontaminated (-) relative to the potential for impacts on aquatic organisms or humans.

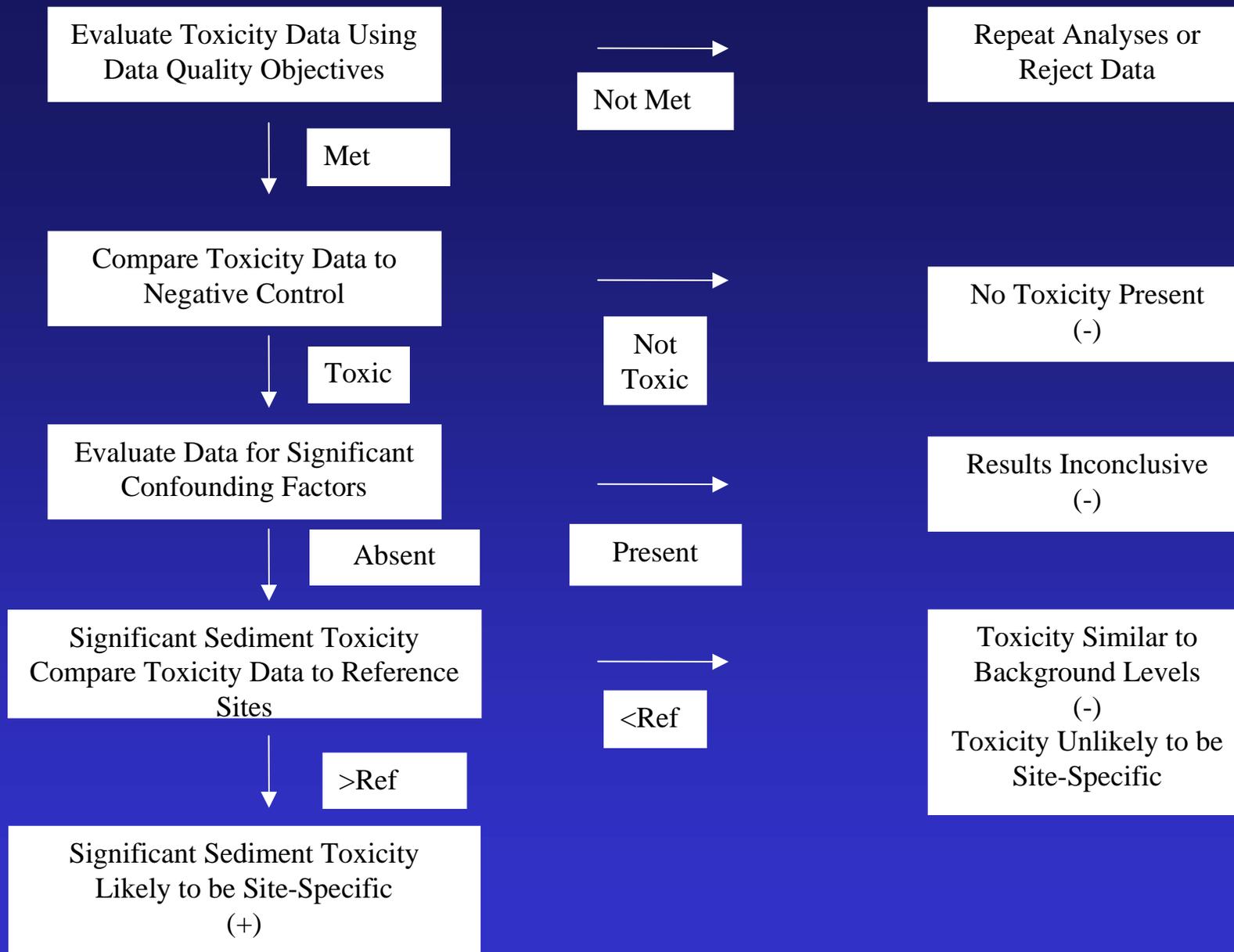


Figure 4-2. Procedure for assessing sediment toxicity data. Symbols in parentheses indicate the classification of the station as either impacted (+) or unimpacted (-) relative to the potential for effects on aquatic organisms.

## Weight-of-Evidence Decision Matrix

Sediment Contam.	Toxicity	Degraded Benthos	Bioaccumulation	Beneficial Use Impairment		Recommended Action
				Aquatic Life	Human/Wildlife	
+	+	+	+	Highly Likely	Possible	Phase II studies Phase III studies <u>Refine Health Assess.</u>
+	-	+	-	Likely	Unlikely	Phase II studies?
+	+	-	-	Likely	Unlikely	Phase III studies?
+	-	+	+	Likely	Possible	Phase II studies?
+	+	-	+	Likely	Possible	Phase III studies? <u>Refine Health Assess.</u>
+	-	-	+	Unlikely	Possible	Refine Health Assess.
-	-	-	+	Unlikely	Possible	Refine Health Assess.
+	-	-	-	Unlikely	Unlikely	No further action
-	-	-	-	Highly Unlikely	Highly Unlikely	No further action

## Toxicity Identification Evaluations (TIEs)

- **Phase I – characterization: e.g., metals vs organics, ammonia, H<sub>2</sub>S**
- **Phase II – identification: specific metal or organic compound(s) responsible for toxicity**
- **Phase III – confirmation**
- **Consider confounding factors: grain size, ammonia, pH etc.**



**Once identified, chemical responsible for toxicity are emphasized for later studies :**

**Source identification and control**

Phase II studies: Contract process initiated  
Studies to begin in 2004

- **Causes of impairment**
- **Temporal variability**
- **Sources of contaminants**

# Sediment TMDL Projects

@

**B Street / Broadway Piers**

**Downtown Anchorage**

**Switzer Creek**

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**831-624-0947**









# **Toxic Hotspot Designation: Bay Protection Toxic Cleanup Program**

**(Fairey et al. 1996, 1998)**

## **B Street/Broadway Piers:**

**Benthic community degradation**

**Elevated concentrations of polycyclic aromatic hydrocarbons (PAHs), copper, chlordane, and chemical mixtures**

## **Downtown Anchorage:**

**Toxicity**

**Metal and organochlorine pesticide contamination**

**Benthic community degradation.**

## **Switzer Creek:**

**Toxicity**

**Benthic community degradation**

**Elevated concentrations of copper, PAHs, chlordane and chemical mixtures**