

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

**Phase I Sampling and Analysis Plan**

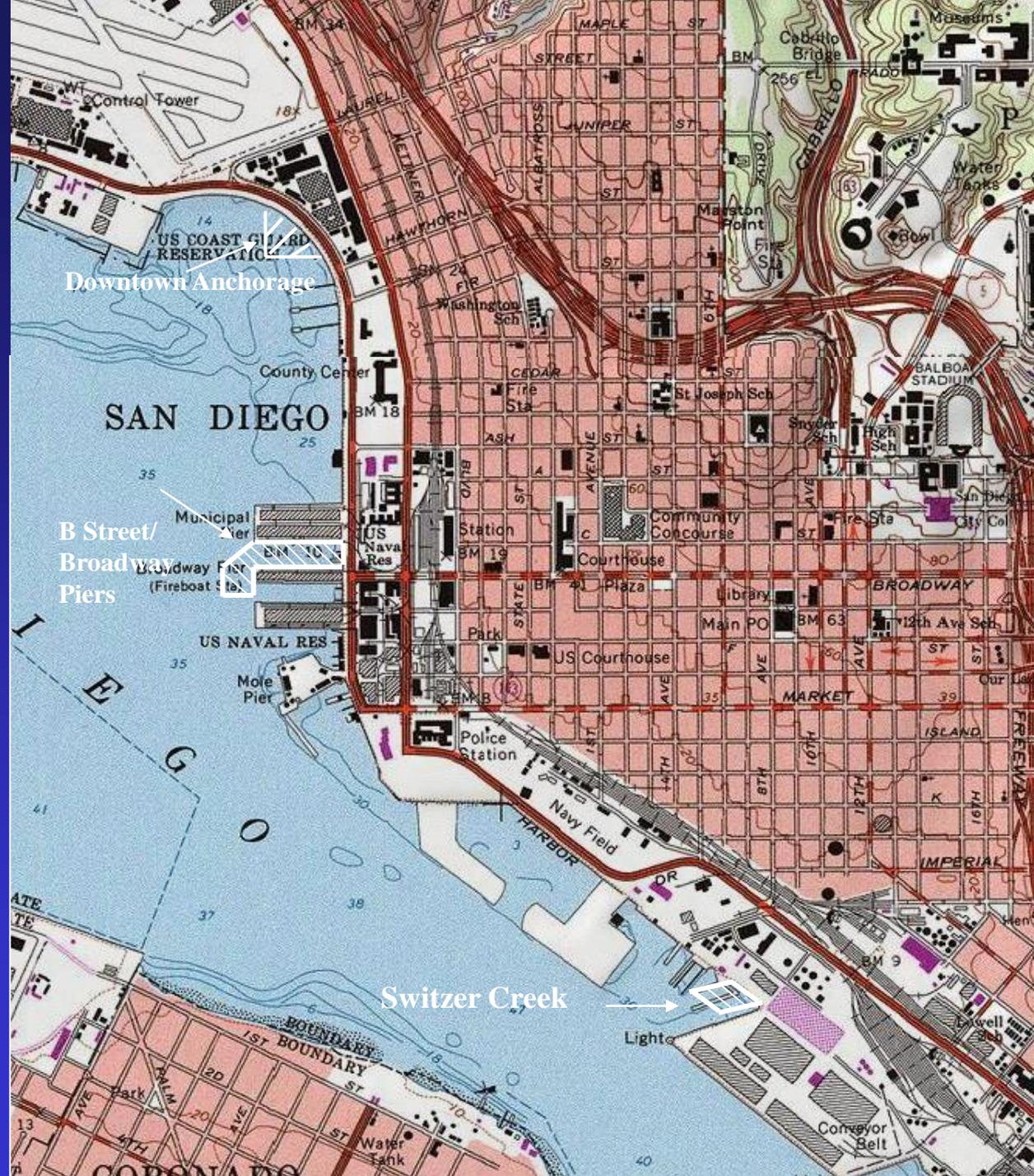
**March 10, 2003**

**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

SAN DIEGO

CORONADO

Cabrillo Bridge

BALBOA STADIUM

Navy Field

US COAST GUARD RESERVATION

US NAVAL RES

US Nava Res

US Courthouse

Police Station

Harbor

Light

Conveyor Belt

Water Tanks

San Diego City Col

Community Concourse

Main PO

Library

12th Ave Sch

Well Sch

Water Tank

Marston Point

Washington Sch

St Joseph Sch

Fire Sta

Fire Sta

Fire Sta

Fire Sta

Fire Sta

Fire Sta

Maple St

Juniper St

Albatross St

Hawthorn St

Cedar St

Ash St

Blind St

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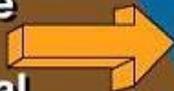
6th St

4th St

2nd St



Release  
of  
Chemical



Transport



Direct  
Contact



Food



Reproduction

Growth

Bioaccumulation

Fishing

Wildlife Exposure



# 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



*Eohaustorius estuarinus*  
Goose Pt, Willapa Bay

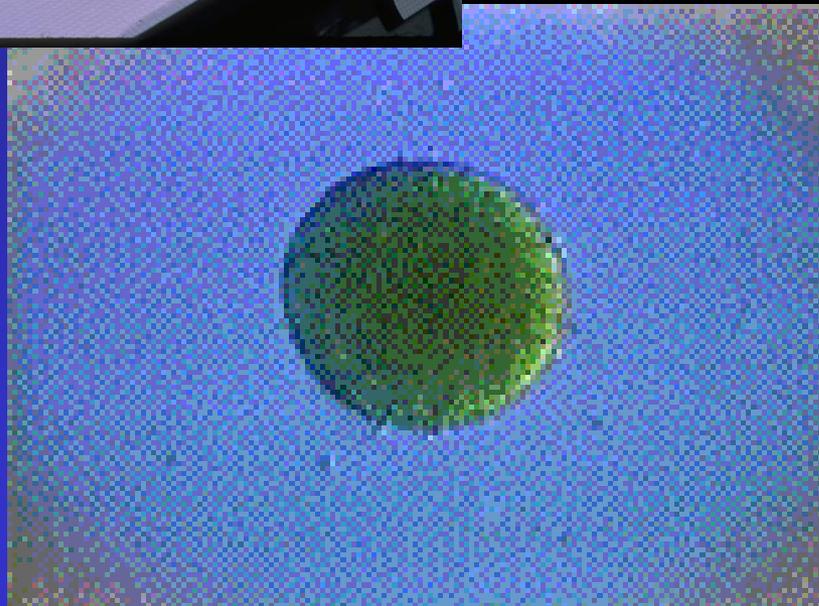


- Measures acute effects

# 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>
<b>2238</b>	<b>80%</b>	<b>99% (70%)</b>
<b>2240</b>	<b>79%</b>	<b>92% (62%)</b>
<b>2243</b>	<b>91%</b>	<b>93% (55%)</b>
<b>2433</b>	<b>92%</b>	<b>93% (53%)</b>
<b>90053</b>	<b>52%</b>	<b>96% (49%)</b>
<b>93195</b>	<b>81%</b>	<b>95% (51%)</b>
<b>Control</b>	<b>97%</b>	<b>95% (62%)</b>

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

# Reference Station Chemistry Results

	2238	2240	2243	2433	90053	93195	Guideline#
<b>Chemical</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
<b>SQGQ1**</b>	0.237	0.272	0.188	0.189	0.271	0.322	
<b>TOC (%)</b>	1.62	1.30	0.74	1.01	1.43	1.53	
<b>Grain Size</b>							

\*all values below MDL

\*\* after Fairey et al. 2001

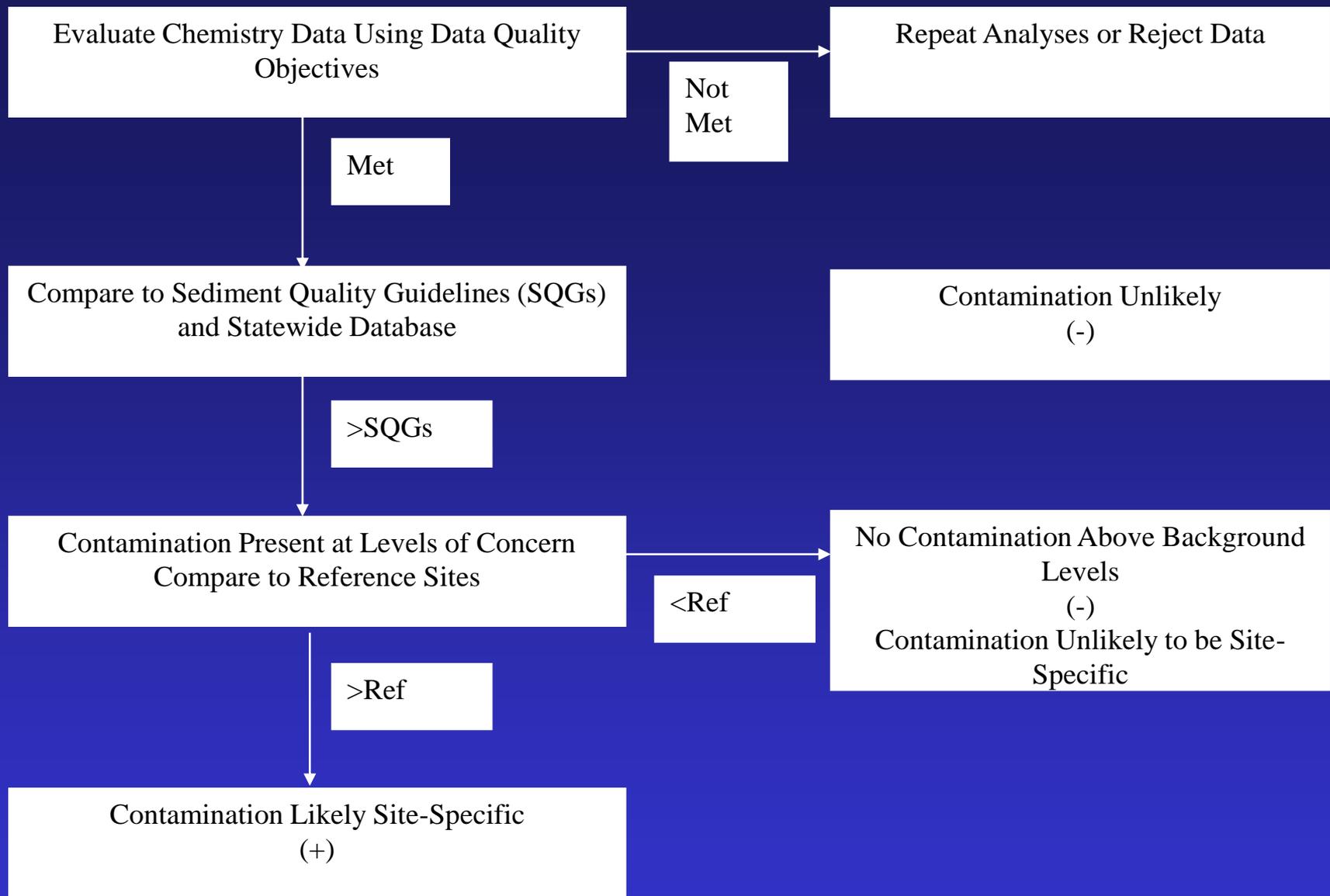


Figure 4-1. Procedure for assessing sediment chemistry data. Symbols in parentheses indicate the classification of the station as either contaminated (+) or uncontaminated (-) relative to the potential for impacts on aquatic organisms or humans.

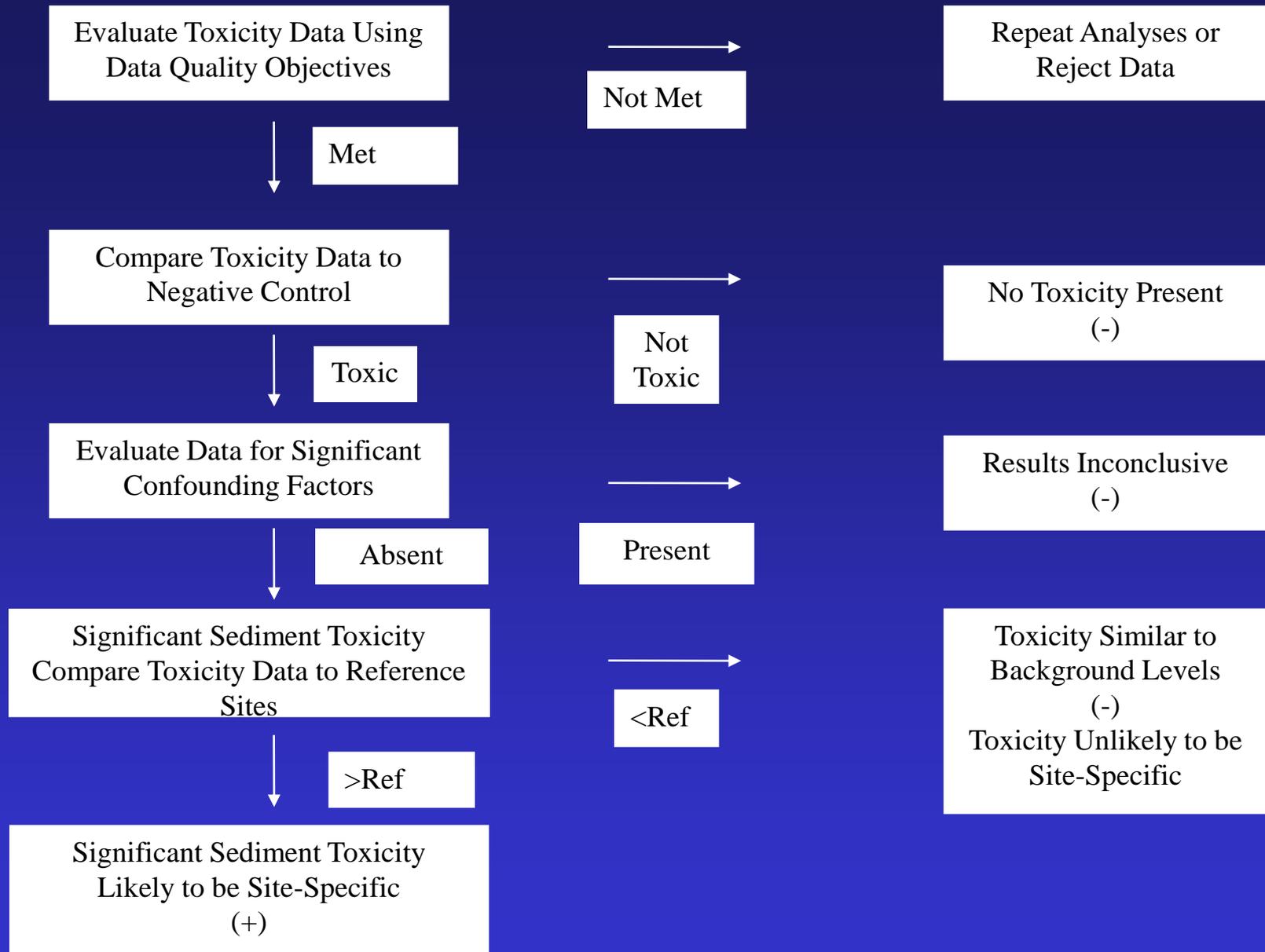


Figure 4-2. Procedure for assessing sediment toxicity data. Symbols in parentheses indicate the classification of the station as either impacted (+) or unimpacted (-) relative to the potential for effects on aquatic organisms.

## Weight-of-Evidence Decision Matrix

Sediment Contam.	Toxicity	Degraded Benthos	Bioaccumulation	Beneficial Use		Recommended Action
				<u>Impairment</u> Aquatic Life	Human/Wildlife	
+	+	+	+	Highly Likely	Possible	Phase II studies Phase III studies Refine Health Assess.
+	-	+	-	Likely	Unlikely	Phase II studies?
+	+	-	-	Likely	Unlikely	Phase III studies?
+	-	+	+	Likely	Possible	Phase II studies?
+	+	-	+	Likely	Possible	Phase III studies? Refine Health Assess.
+	-	-	+	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

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**B Street / Broadway Piers**

**Downtown Anchorage**

**Switzer Creek**

*Anderson@ucdavis.edu*

**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**