Support for Sediment Remediation to Background Levels in San Diego Bay

San Diego Bay Council
June 18th, 2002

Historical Perspective

1960-2002
40+ years of Contamination

1/91
Board requests initial sediment study

1990-99
Shipyard Permit Violations

6/8/95
Campbell levels established

1996
BayKeeper reaches settlement with NASSCO

8/27/96
BayKeeper Sues SWM

4/97
Toxic Hot Spots Identified

1998
NOAA Study

3/10/99
Interim cleanup levels set

10/18/99
NASSCO loses Permit appeal

12/15/99
Peer Review

10/11/00
Staff presents six cleanup options

2/16/01
Regional staff recommends site-specific study

10/01
Board requires Workshop

1960-2002

40+ years of shipyard-induced Bay contamination. NASSCO (founded in 1960) and Southwest Marine (founded in 1976) shipyards earned millions of dollars in profit while discharging toxic chemicals into San Diego Bay.

January 91

Regional Board requests that NASSCO and SWM participate in a study to determine if sediment cleanup is required w/in their Bay leasehold.

6/8/95

Cleanup levels are established at Campbell Shipyard (AET). CAO 95-21 states "(t)he cleanup levels in the order are applicable for cleanup at the Campbell's Shipyard and shall not be construed to be applicable to any other location."

1990-99 Shipyard Permit Violations

Violations	NASSCO	Southwest Marine
Air Quality (1994-99)	19	6
Hazardous Waste (1990-98)	41	31
Waste Discharge (1990-98)	9	6
Sewer (1990-98)	8	18

1996

BayKeeper reaches settlement with NASSCO to conduct a complete environmental audit of their 75-acre facility and implement recommendations to reduce contaminated runoff from their site. NASSCO also agreed to help fund the restoration of least tern and clapper rail nesting sites in the nearby Sweetwater River Refuge.

8/27/96

BayKeeper and the Natural Resources Defense Council sue SWM in federal district court for chronic stormwater discharge violations. Plaintiffs prevail, injunctive relief is granted, and SWM is fined $799,000 in civil penalties. Judge Brewster blamed SWM's "pattern of poor housekeeping" for causing the leasehold around the shipyard to be "devoid of life." SWM appeals all the way to the US Supreme Court, which denies certiorari on 6/11/01.

4/97

Funded by the Bay Protection and Toxic Cleanup Program, the SWRCB and NOAA release their final report on Chemistry, Toxicity, and Benthic Community Conditions in Sediments of the San Diego Bay Region. Of six toxic hot spots, two are adjacent to the SWM and NASSCO leaseholds.

1998

NOAA assessment: San Diego Bay has the second most toxic sediments in the nation.

The overall toxicity patterns can be categorized as pervasive, patchy, isolated, or slight. In areas such as Newark Bay, NJ, and San Diego Bay, CA, toxicity was apparent throughout (pervasive).

--State of the Coastal Environment, Sediment Toxicity
NOAA
http://state-of-coast.noaa.gov/bulletins/html/sed_15/national.htmlu

3/10/99

Regional Board adopts Resolutions 99-12 and 99-20, establishing interim cleanup levels derived from studies at Campbell Shipyard (Campbell AET for copper, zinc, lead, and PCBs) and Shelter Island Boatyard (Shelter Island AET for mercury).

10/18/99

NASSCO argues that new discharge permits for shipyards are unnecessary, unreasonable, and too costly. EHC joins the United Waterfront Council and the State of California in defending the stricter requirements. NASSCO loses its appeal.

12/15/99

Peer Review to consider validity of using Campbell AET as final cleanup level at NASSCO and SWM. Peer reviewers are Steven Bay of SCCWRP, Russell Fairey of Moss Landing Marine Laboratories, and Todd Thornburg of Hart Crowser, Inc. Steven Bay and Russell Fairey find the interim levels are not appropriate to apply at NASSCO and SWM.

10/11/00

Staff presents six cleanup options for Board consideration, ranging from background levels to inaction.

2/16/01

Staff recommends that the Regional Board require NASSCO and SWM to conduct site specific studies for developing cleanup levels. Based on this information, Staff would develop cleanup level recommendations.

October, 2001

Board directs Staff to organize a public workshop to address status of sediment remediation studies being undertaken by SWM and NASSCO.

SDRWHUCB Mission Statement

"(T)o preserve and enhance the quality of California's water resources and ensure their proper allocation and efficient use for the benefit of present and future generations."

Obligation to Remediate Sediment to Background Levels

- Legal Requirements
- Scientific Justification

Water Code Section 13304

Requires a person to clean up waste or abate the effects of the waste if so ordered by a Regional Board in specific circumstances, including:

- If there has been a discharge in violation of waste discharge requirements, or
  if a person has caused or permitted waste to be discharged in the waters of the state and creates or threatens to create a condition of pollution or nuisance

Resolution 92-49

- State Board's implementation of Water Code s.13307.
- Chief counsel for the State Board has determined 92-49 applies to sediment *and* water quality
- Requires cleanup to background levels; Alternatives may only be considered if background cannot be restored
- When determining whether greater levels of contamination can be approved, 23 CCR s2550.4 applies

Application of 92-49 to Sediment Remediation

"A regional board must apply Resolution 92-49 when setting cleanup levels for contaminated sediments ***if such sediments threaten beneficial uses*** of the waters of the state, and the contamination or pollution is a result of a discharge of waste."

-Craig M. Wilson
Office of Chief Counsel

23 CCR 2550.4

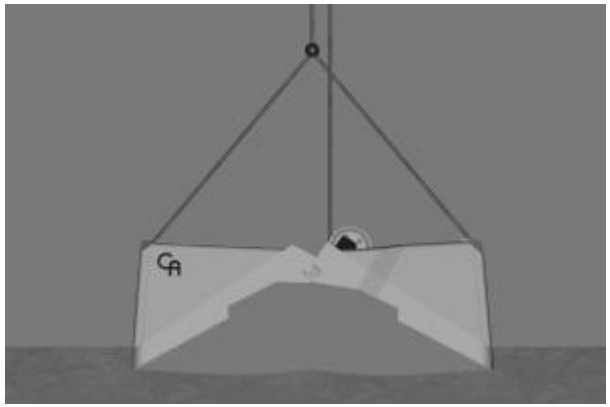
Contamination levels greater than background may only be approved if:

- Background is technologically infeasible
- Background is economically infeasible

Technological Infeasibility

- EPA has determined dredging is a viable method of contaminant reduction

- Dredging technologies have been used around the country to clean contaminated sediment



Economic Infeasibility

- Requires board to balance all incremental costs and benefits of cleanup, tangible and intangible

NASSCO and SWM: Economic Titans

- NASSCO expected to earn $485 million in 1998, and has contracts worth $1.6 billion, ensuring work until 2006. General Dynamics, NASSCO's parent company, boasts $12 billion per year in sales.

- Southwest Marine earned $171 million in 1997, and has contracts worth about $65 million. The Carlyle Group, 49% owner, raised approximately $14 billion from investors in just the past five years.

Financial Cost of Cleanup

- Shipyards were responsible for estimating costs of cleanup: $29.1 million for NASSCO and $8.7 million for SWM
- One-time present cost of cleanup can be thought of as payment that should be spread over the last 20-40 years - the amount of time the shipyards have been contaminating the Bay.

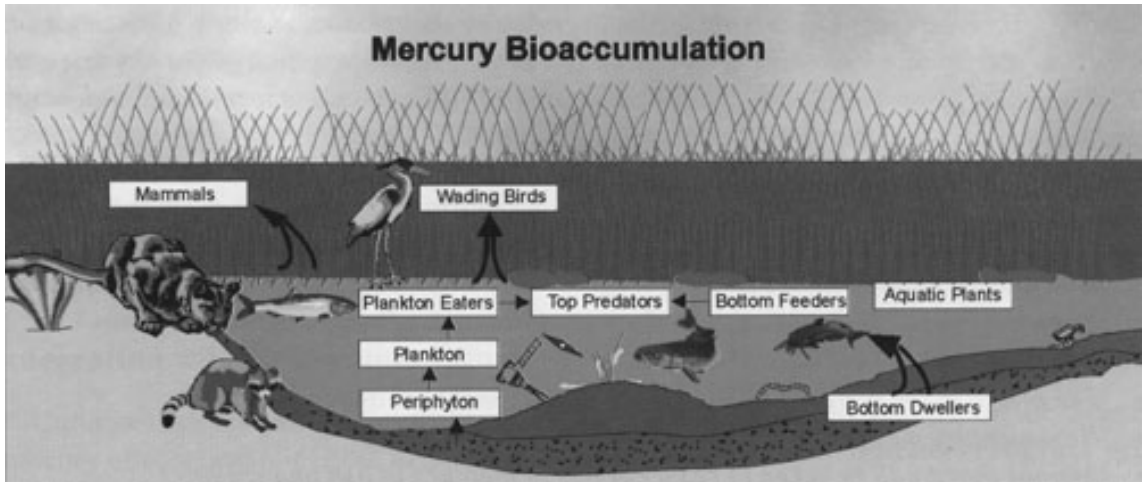
Intangible Costs

Costs go beyond mere remediation dollars. Other relevant factors include:

- Long term effect of cleaning short of background
- Reproductive Losses
- Impacts on the Tourism Industry
- Loss of Habitat
- Loss of Beneficial Uses

Bioaccumulation Potential

- Many contaminants in sediment bioaccumulate, increasing health risks for the public.
- EPA data indicate the concentration of a PCB compound in selected species varied from 60 to ***340,000 times*** the concentration of the chemical in the water.
- Of all mammals, humans are among the slowest to excrete and eliminate PCBs, and there is no method known that can speed up the process.



Sediment Contamination and Beneficial Uses

The Basin Plan designates 12 beneficial uses for San Diego Bay, all of which may be affected by contaminated bay bottom sediments, including:

- Human consumption of fish and shellfish.
- Commercial and sport fishing
- Water recreation
- Benthic community
- Wildlife consumption of aquatic organisms

Limitations on Infeasibility Defense

"Any such alternative cleanup level may not unreasonably affect beneficial uses and must comply with all applicable Water Quality Control Plans and Policies."

-Craig M. Wilson
Office of Chief Counsel

Natural Attenuation

Resolution 92-49 allows for consideration of the adverse impacts of any cleanup itself, as well as the possibility of natural attenuation.

However…

Natural Attenuation Won't Work!

- The estimated time for a naturally forming sediment cap to be considered environmentally protective is unreasonable.
- Exposure to contamination will persist until the cap is formed.
- Human health risk issues will not be directly addressed.
- Contaminants may migrate to other areas of the Bay.

(SDRWQCB Staff Report, June 2001)

Statutory Mandate

The Water Quality Control Plan for the San Diego Basin (Basin Plan) states that "cleanup levels cannot result in water quality less than that prescribed in the Basin Plan and the policies adopted by the State and Regional Board." The cleanup "must be consistent with *maximum benefit to the people of the state*."

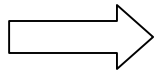
"Maximum Benefit"

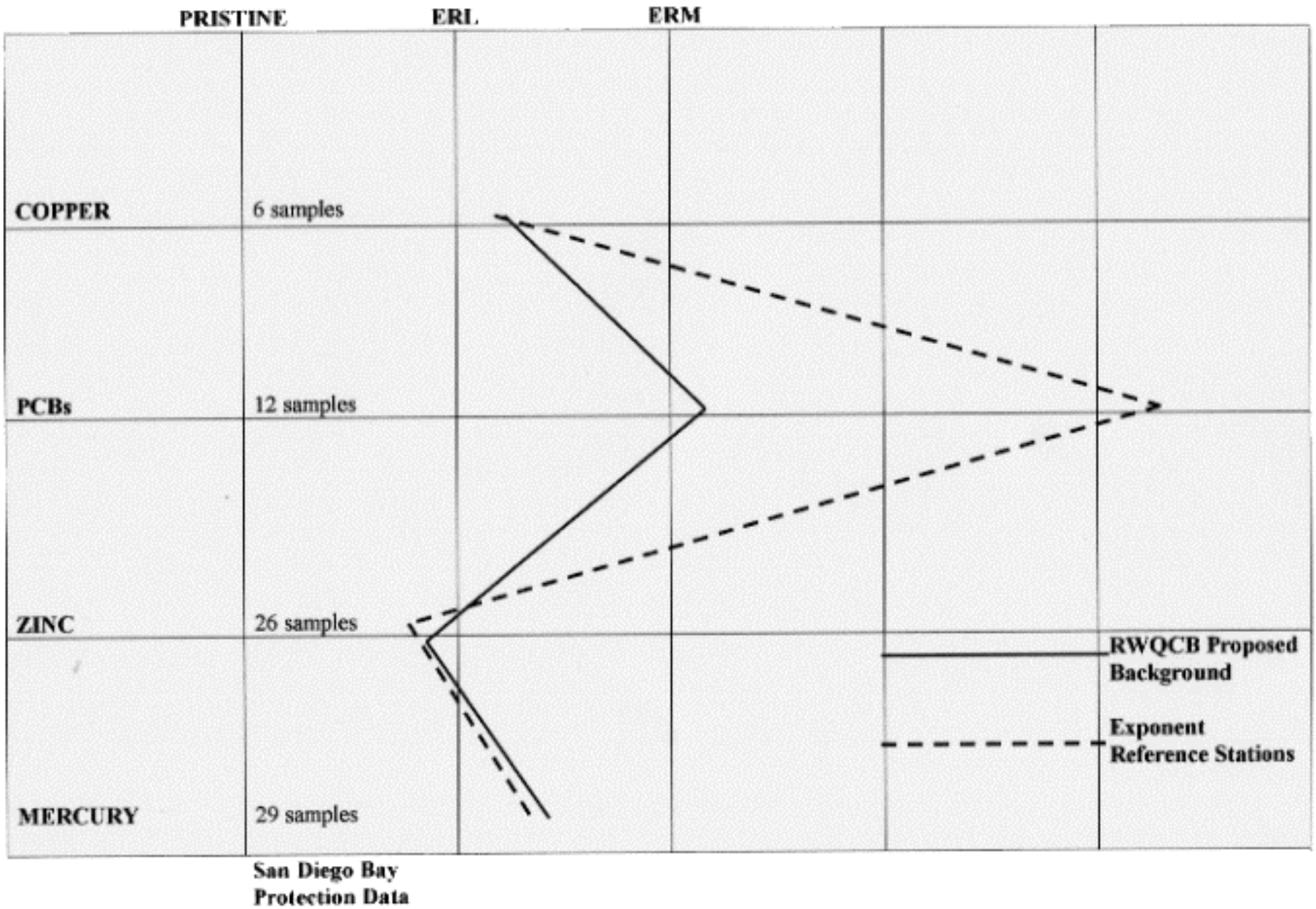
- The state board has determined through Resolution 92-49 that cleanup to background levels provides the maximum benefit to the citizens and visitors of San Diego.

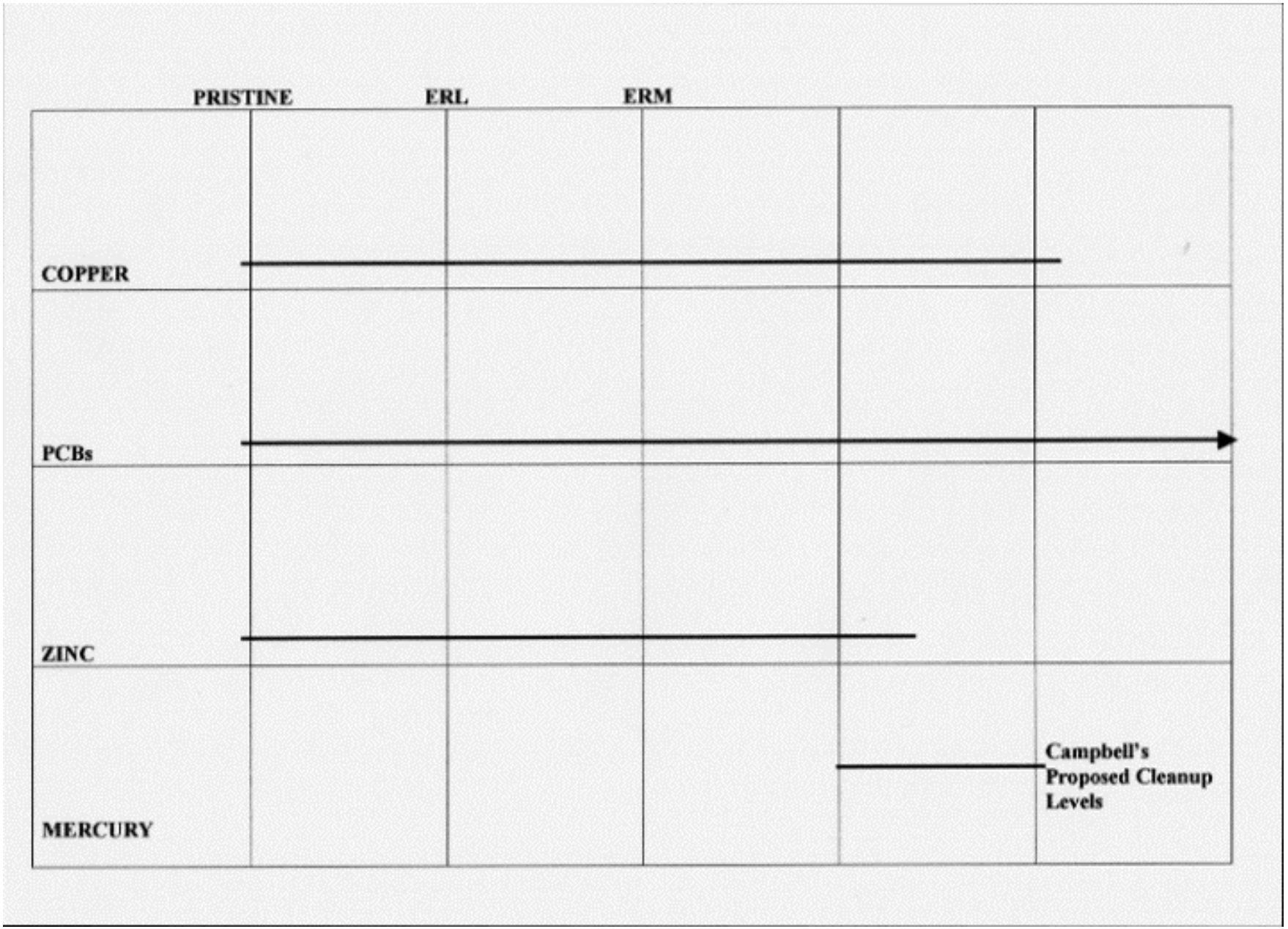
- Cleanup to background is possible technologically, and the costs of such cleanup is appropriate considering the benefits gained.

Insufficiency of Alternative Background Levels

- AET, ERM, and ERL **DO NOT** account for bioaccumulation
- AET, ERM, and ERL **DO NOT** protect the maximum benefit of the Bay's beneficial uses
- AET, ERM, and ERL **DO NOT**, therefore, meet the 92-49 requirement that "all demands being made and to be made on the waters" must be considered in setting a cleanup level



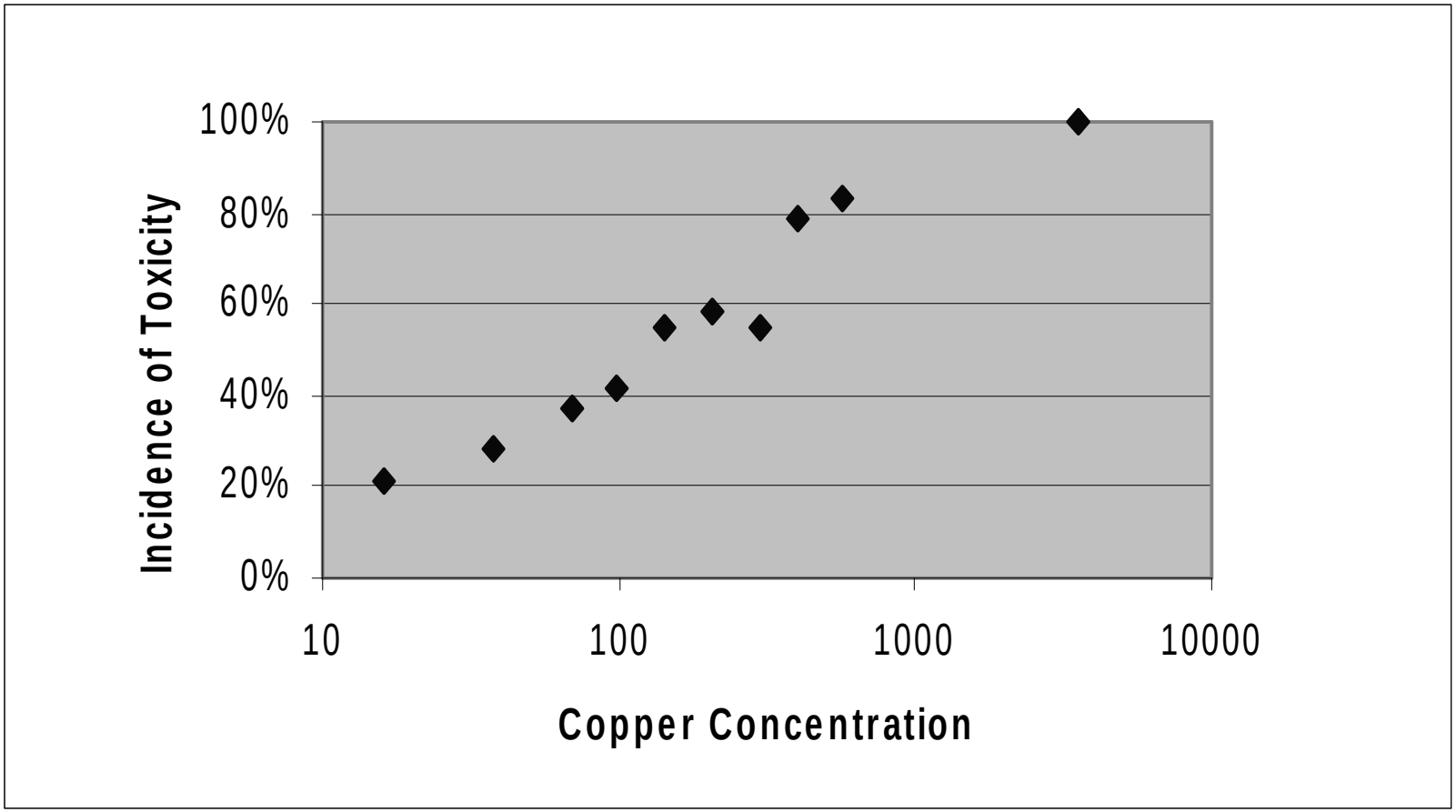

PRISTINE
ERL
ERM
COPPER
6 samples
PCBs
12 samples
ZINC
26 samples
MERCURY
29 samples
RWQCB Proposed Background
Exponent Reference Stations
San Diego Bay Protection Data


PRISTINE
ERL
ERM
COPPER
PCBs
ZINC
MERCURY
Campbell's
Proposed Cleanup
Levels

BPTC Statewide Data - 588 samples (247 Toxic (42%), 341 Not Toxic)

Copper Range (ppm)	# of Samples	Range average	% of Samples Toxic	Avg. % Survival	
0 - 25	**61**	**16.2**	**21%**	**79%**	
25 – 50	**147**	**38.1**	**28%**	**69%**	**ERL -34**
50 – 75	**104**	**70**	**37%**	**66%**	
75 – 125	**112**	**99.5**	**42%**	**69%**	
125 – 175	**58**	**143.5**	**55%**	**60%**	
175 – 250	**31**	**206**	**58%**	**62%**	
250 – 350	**31**	**297.6**	**55%**	**65%**	**ERM-270**
350 – 500	**34**	**404.68**	**79%**	**46%**	
500 – 700	**6**	**565**	**83%**	**44%**	
¬ 700	**4**	**3525.7**	**100%**	**22%**	**Proposed Cleanup - 810**

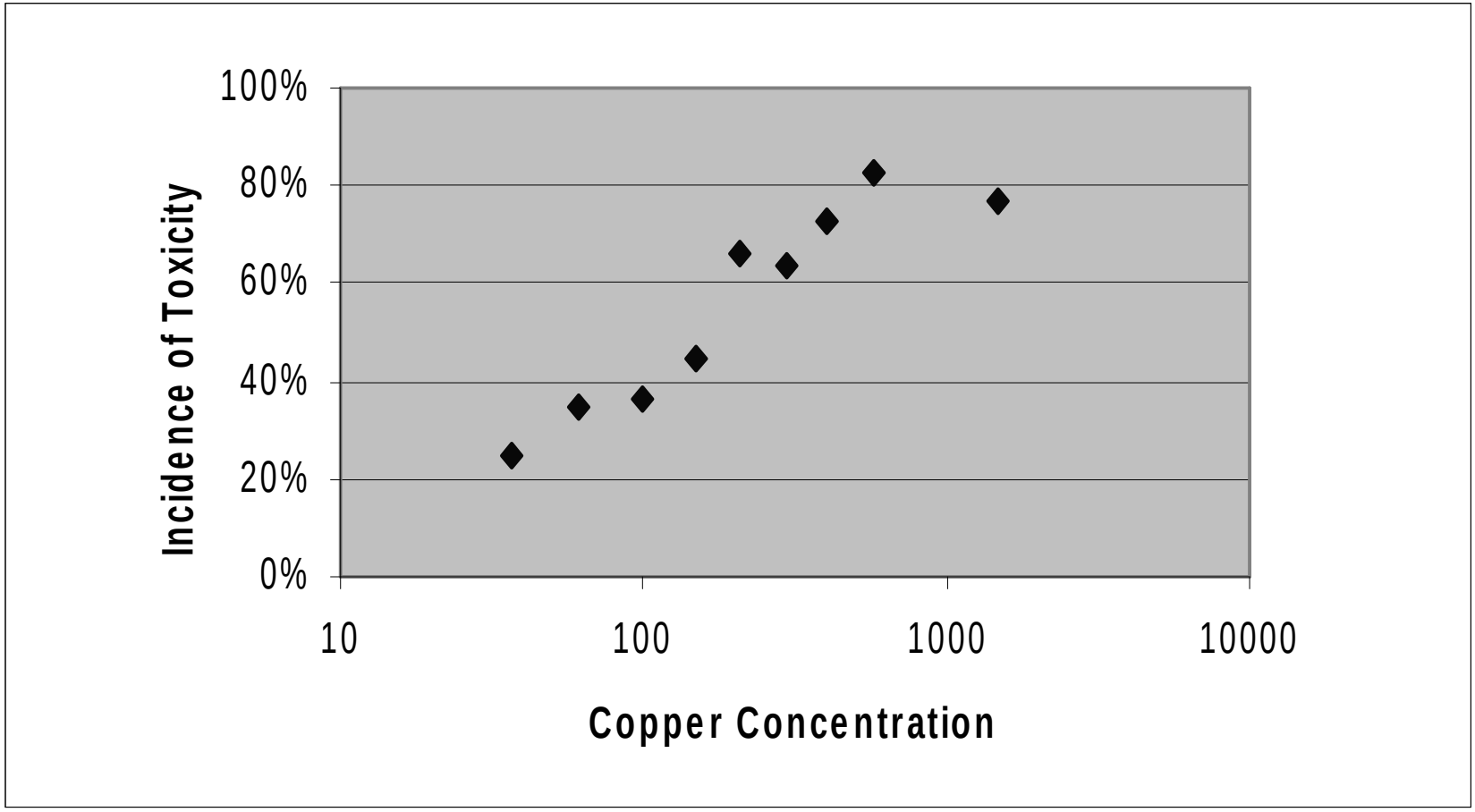
BPTC Statewide Data: Copper



NOAA National BEDS Database - 3191 samples (719 Toxic (23%), 2472 Not Toxic)

Copper Range (ppm)	# of Sampes	Range average	% of Samples Toxic	Avg. % Survival	
0 - 25	**1604**	**9.4**	**6%**	**94%**	
25 - 50	**545**	**36.4**	**25%**	**85%**	**ERL -34**
50 - 75	**275**	**61**	**35%**	**80%**	
75 - 125	**313**	**98.1**	**36%**	**77%**	
125 - 175	**155**	**147.7**	**45%**	**74%**	
175 - 250	**102**	**209**	**66%**	**64%**	
250 - 350	**63**	**294.4**	**64%**	**68%**	**ERM-270**
350 - 500	**49**	**400.7**	**73%**	**62%**	
500 - 700	**23**	**576.3**	**83%**	**49%**	
> 700	**31**	**1475**	**77%**	**48%**	**Proposed Cleanup - 810**

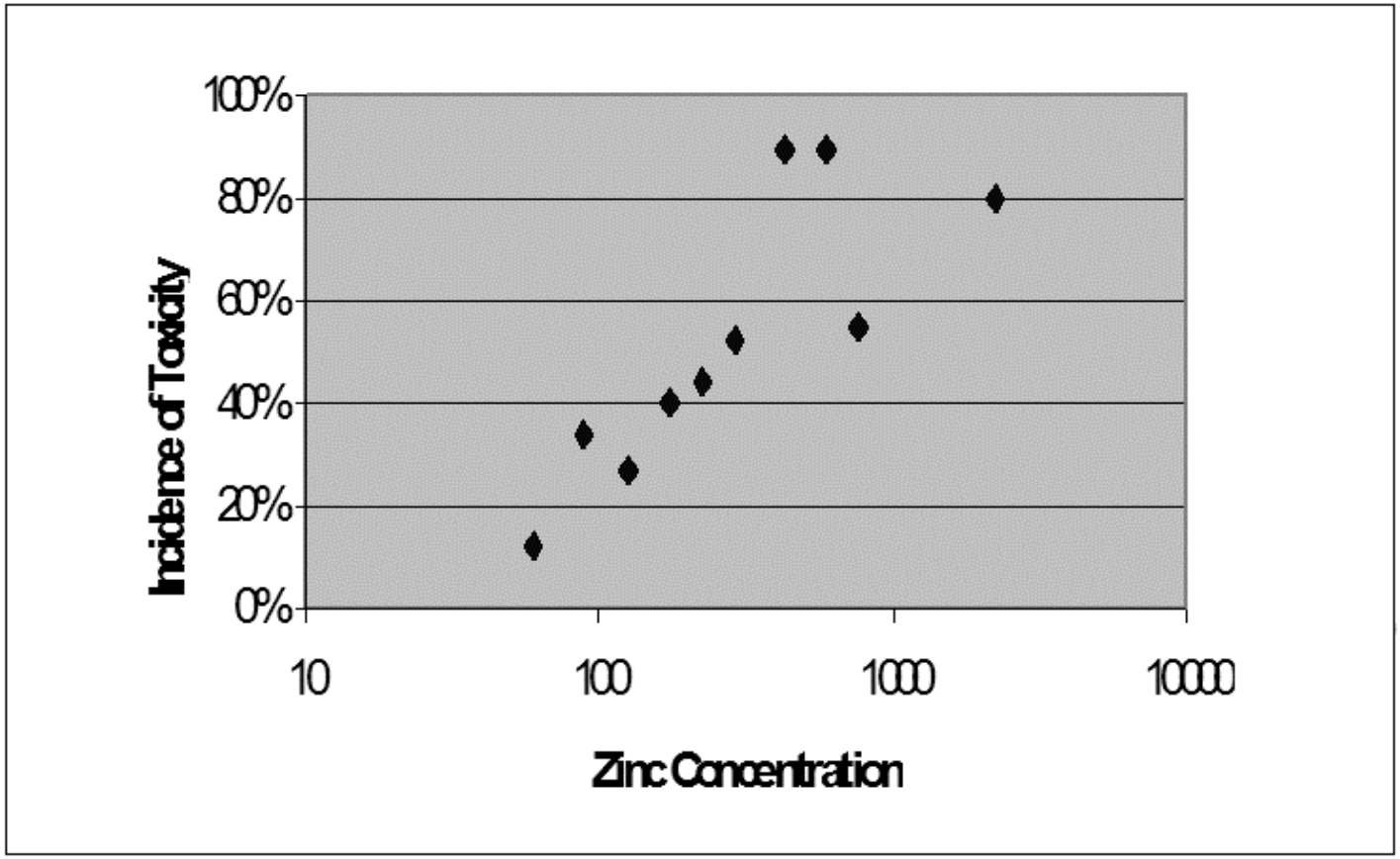
NOAA National BEDS: Copper



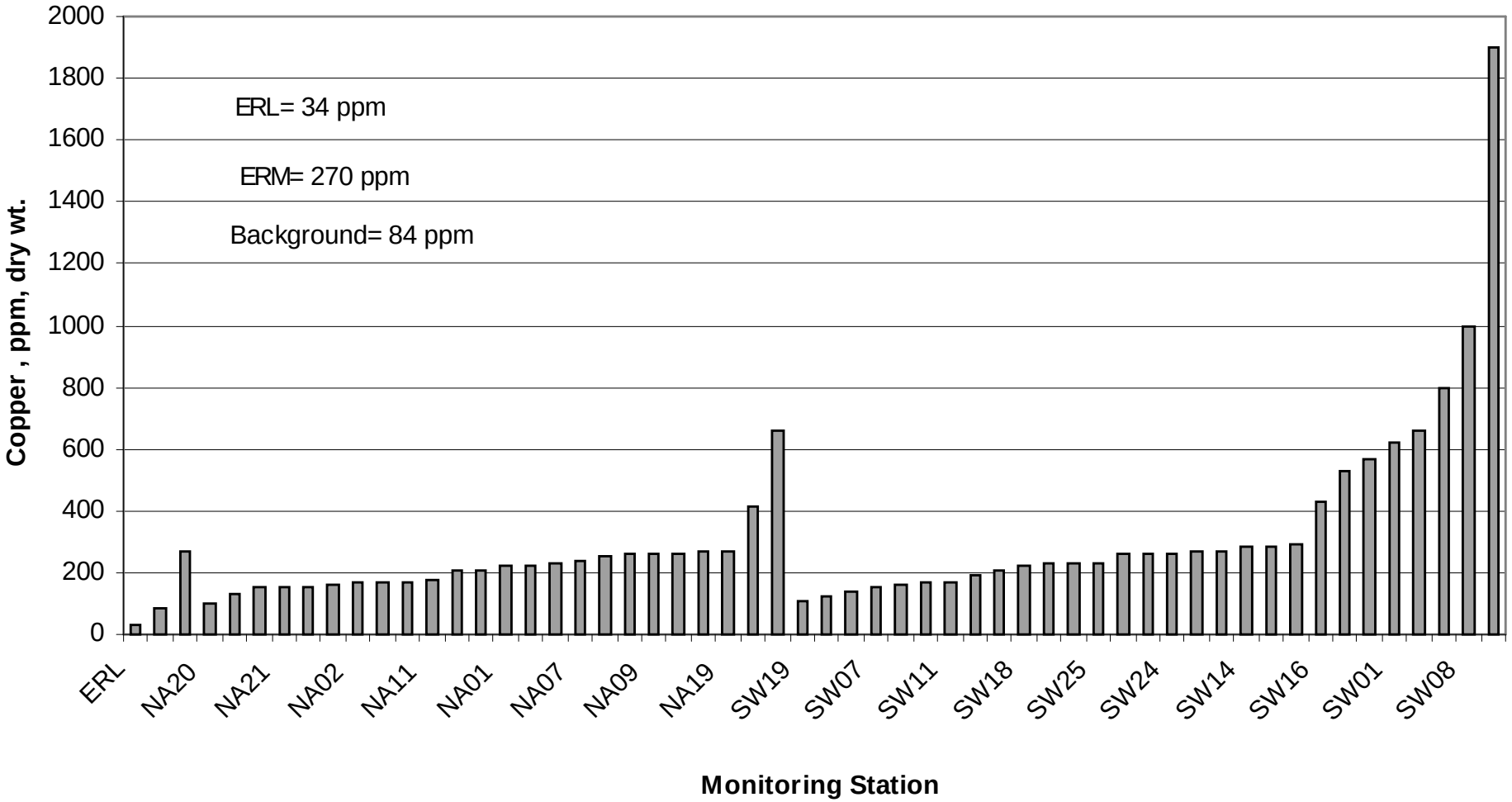
BPTC Statewide Data - 592 samples (248 Toxic (42%), 344 Not Toxic)

Zinc Range (ppm)	# of Samples	Range average	% of Samples Toxic	Avg. % Survival	
0 - 75	**33**	**60.2**	**12%**	**85%**	
75 - 100	**47**	**89.3**	**34%**	**72%**	
100 - 150	**118**	**126.1**	**27%**	**69%**	**ERL - 150**
150 - 200	**95**	**172.7**	**40%**	**69%**	
200 - 250	**77**	**222**	**44%**	**69%**	
250 - 350	**83**	**288.9**	**52%**	**65%**	
350 - 500	**31**	**432**	**90%**	**57%**	**ERM - 410**
500 - 700	**21**	**586.8**	**90%**	**46%**	
700 - 900	**11**	**765.6**	**55%**	**59%**	**Proposed Cleanup - 820**
> 900	**10**	**2229.6**	**80%**	**36%**	

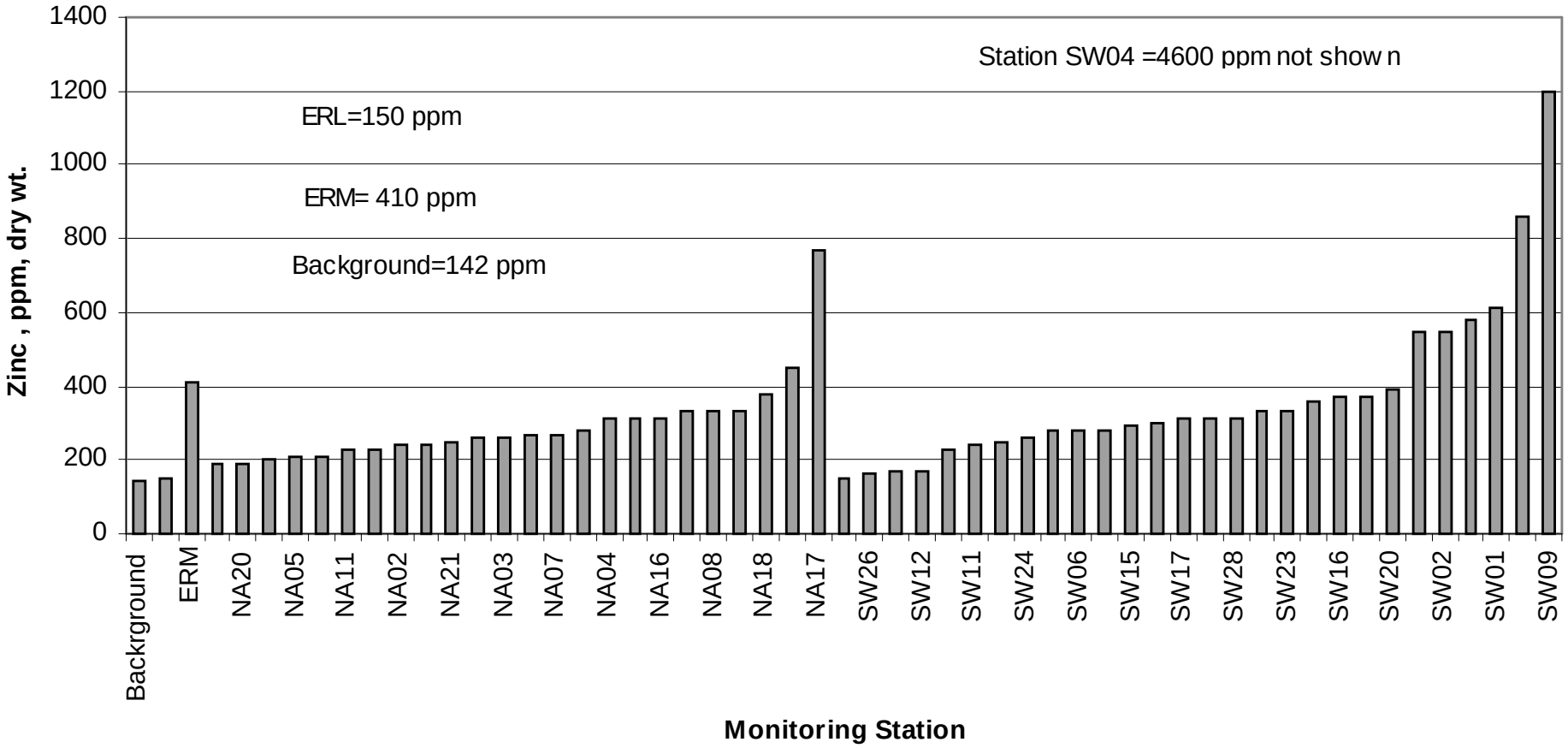
BPTC Statewide Data: Zinc



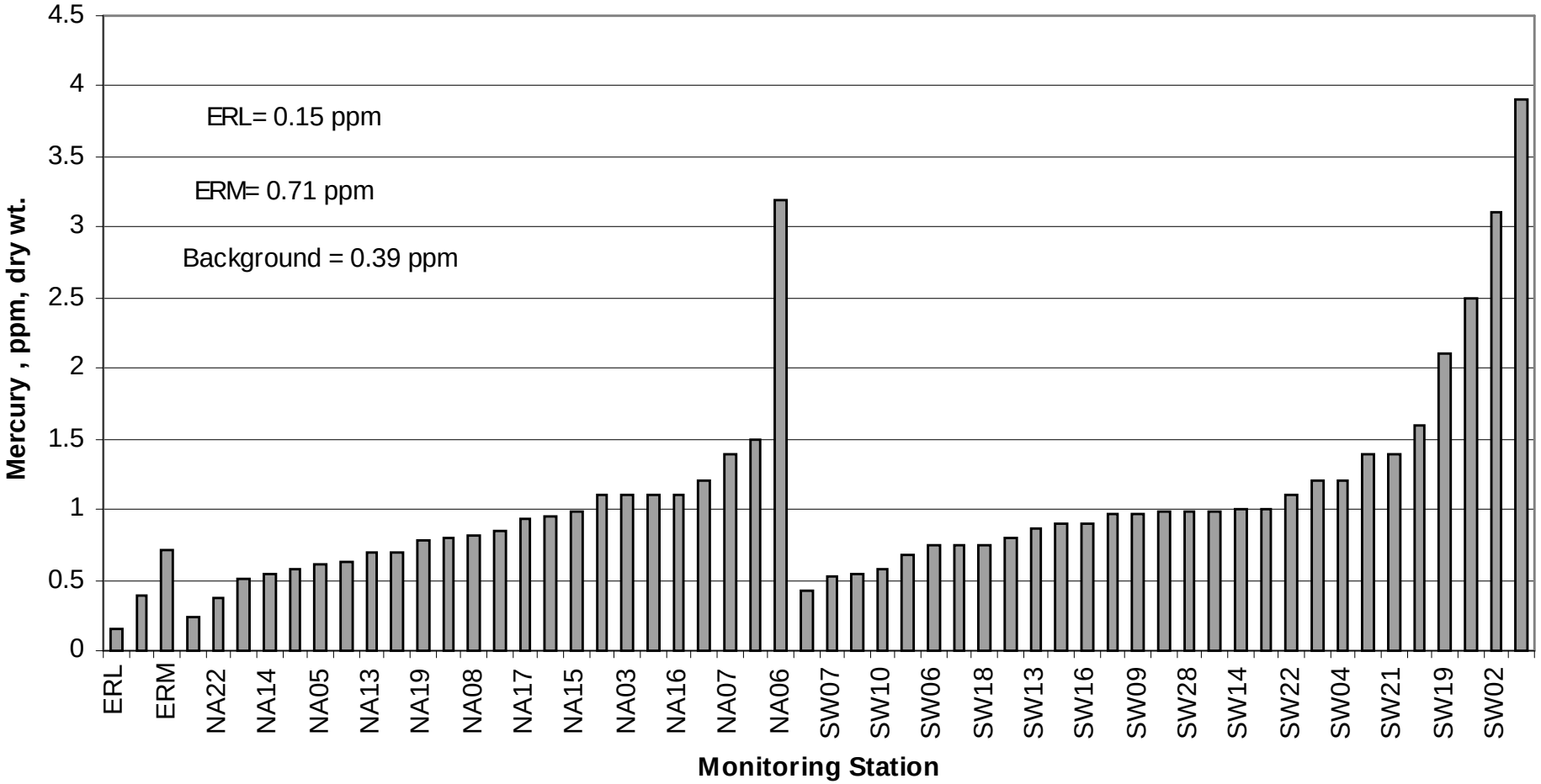
Copper Sediment Concentration at Monitoring Stations Compared With ERL, ERM , & Background Values



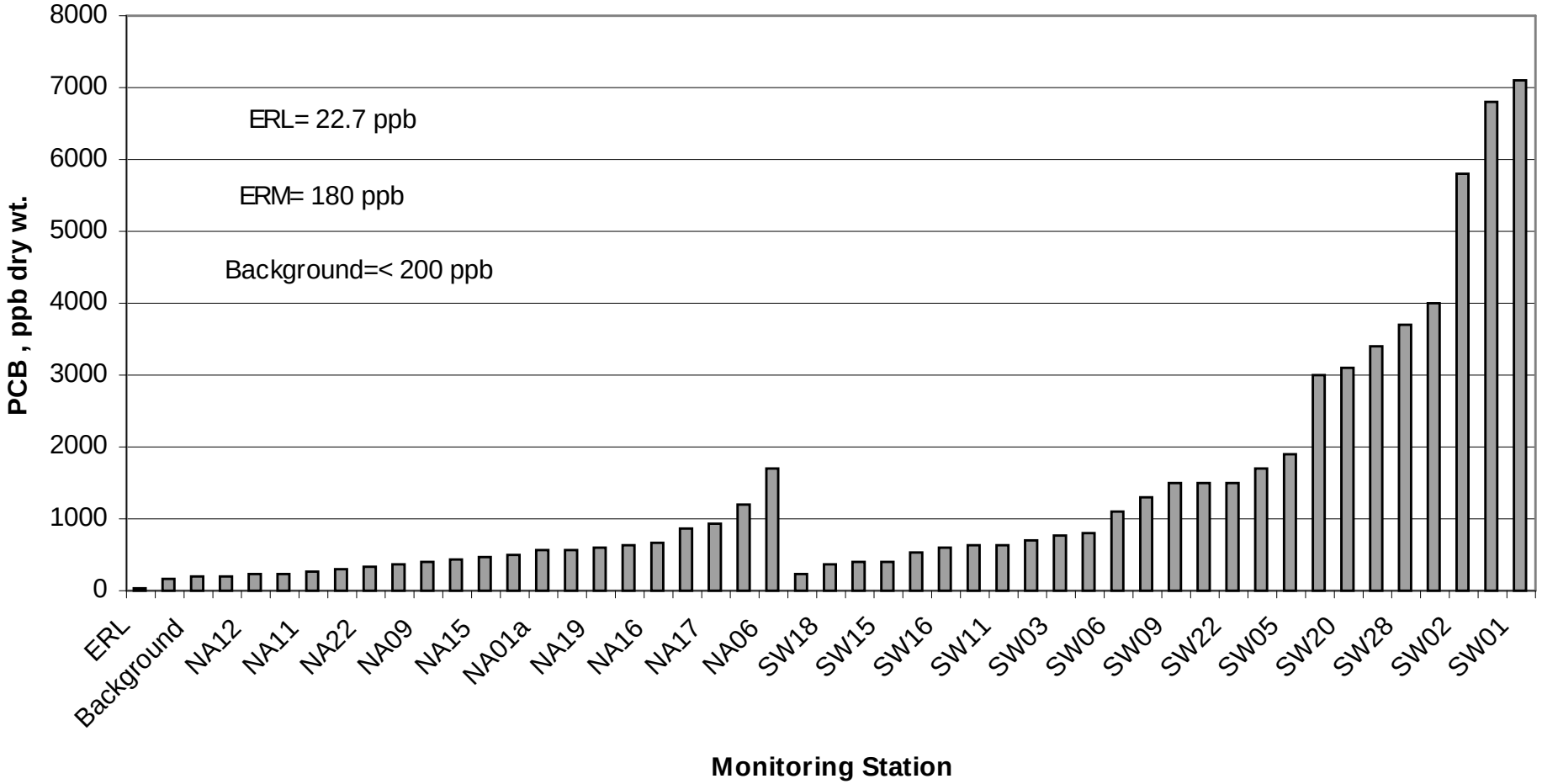
Zinc Sediment Concentration at Shipyard Monitoring Stations Compared With ERL, ERM, & Proposed Background Values



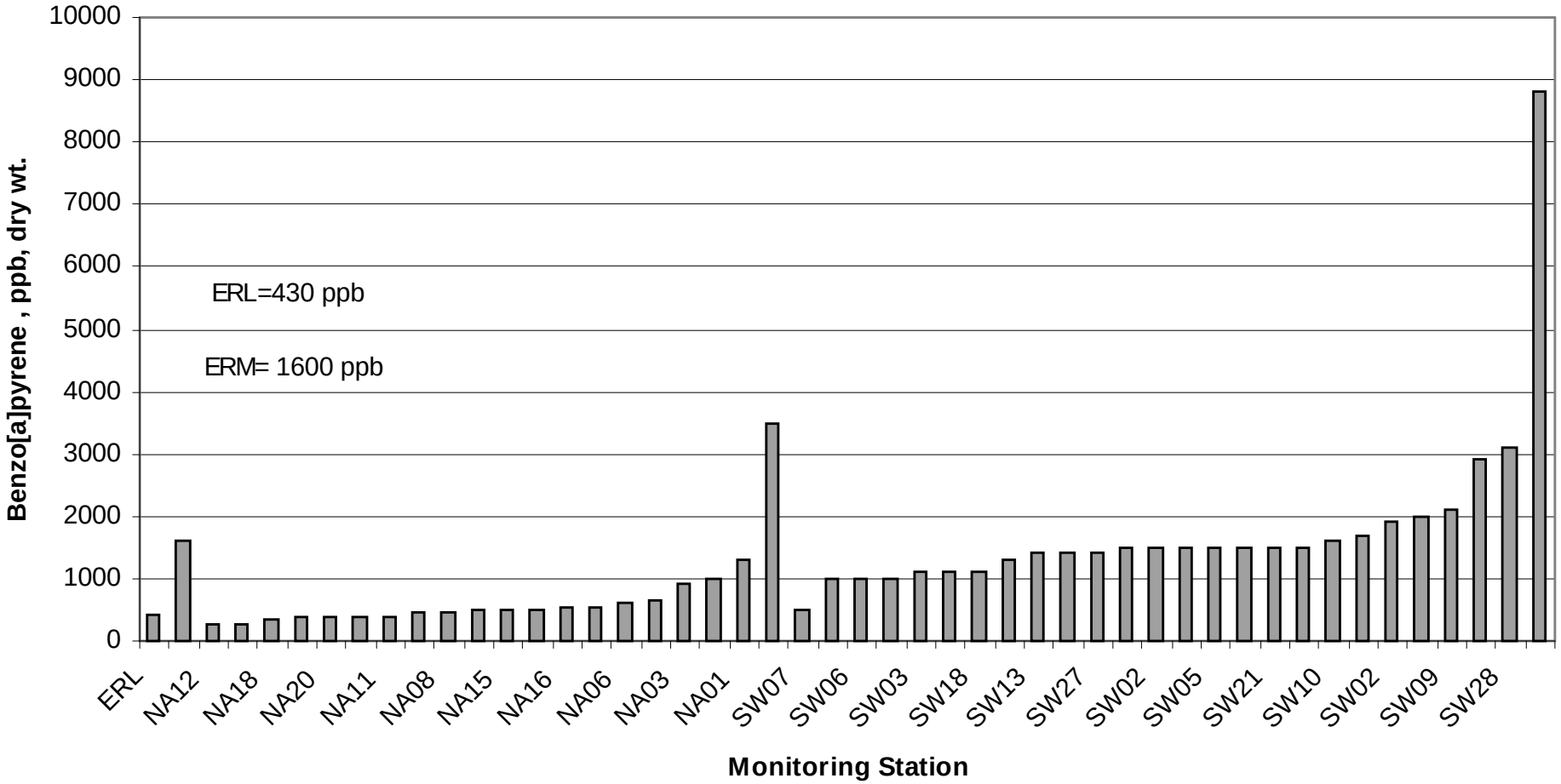
Mercury Sediment Concentration at Shipyard Monitoring Stations Compared With ERL, ERM, & Proposed Background Values

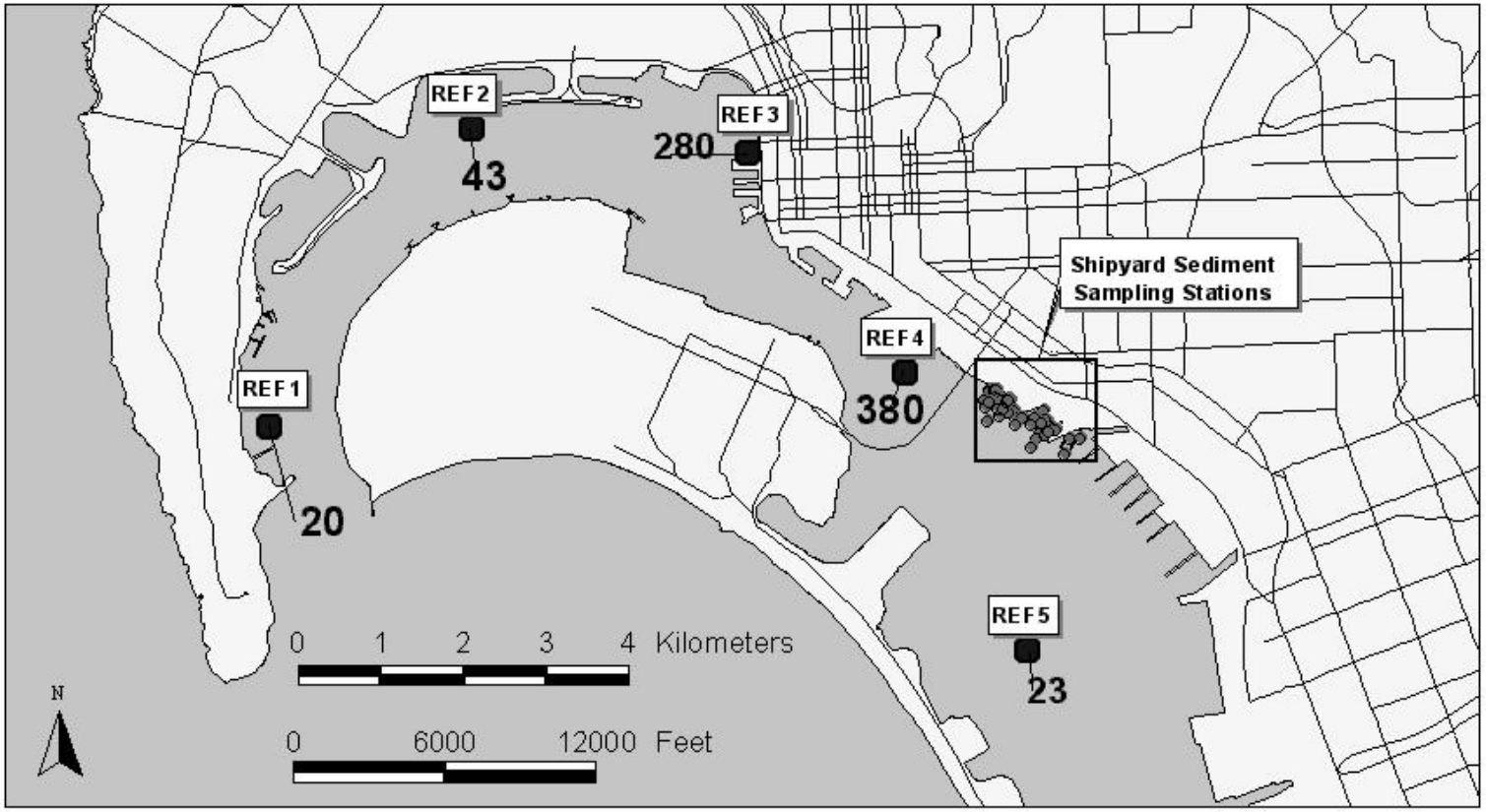


PCB Sediment Concentration at Shipyard Monitoring Stations Compared with ERL, ERM,& Proposed Background Values



Benzo[a]pyrene Sediment Concentration at Shipyard Monitoring Stations Compared with ERL & ERM





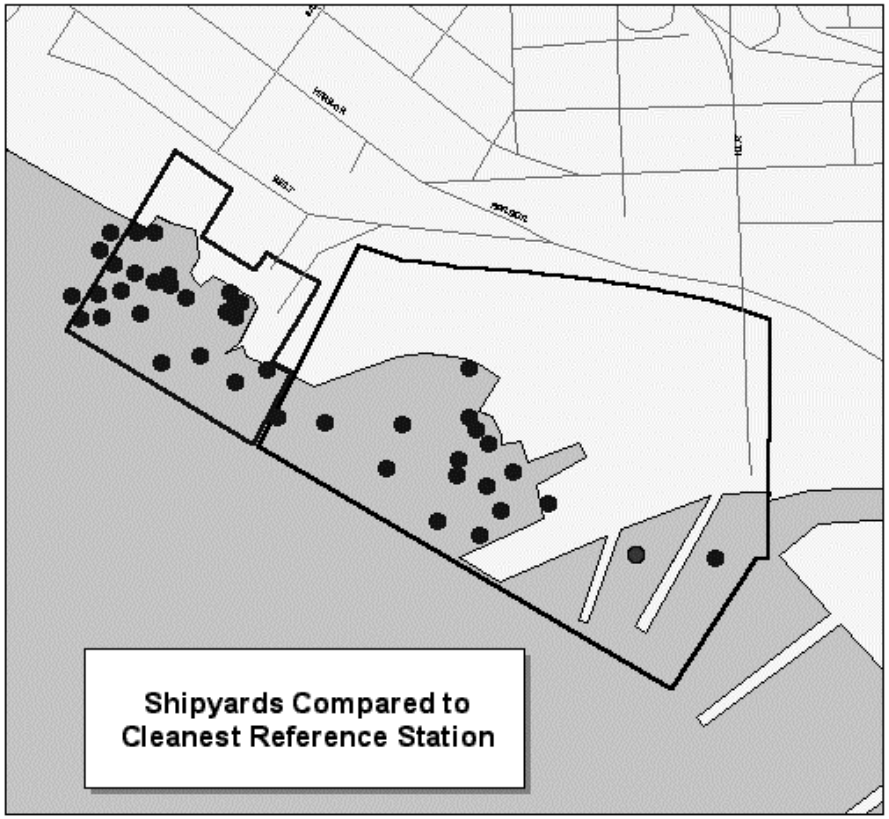
- Reference Stations

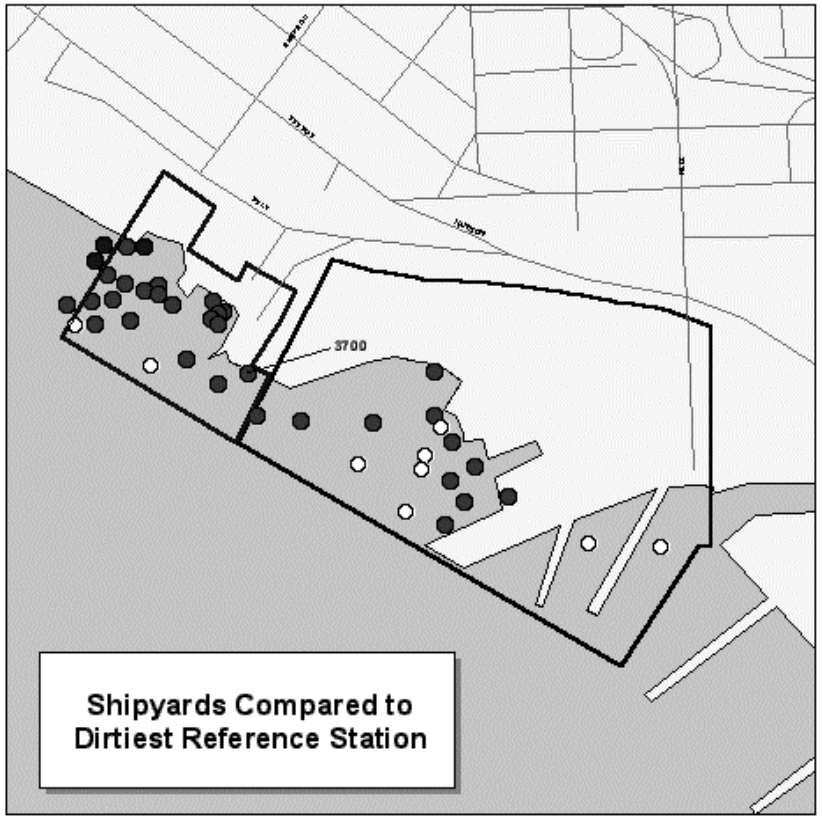
Background PCB Level = <200 ppb

PCBs at Reference Stations, Compared to Background

Environmental Health Coalition, 2002.
Source: Exponent, Inc., 2002.

We thank Washington Department of Ecology for the use and support of the publicly available sediment quality information system SEDQUAL.





PCB Reference Level at 20 ppb

- at or below reference
- up to 10 x reference
- 10 - 355 x reference

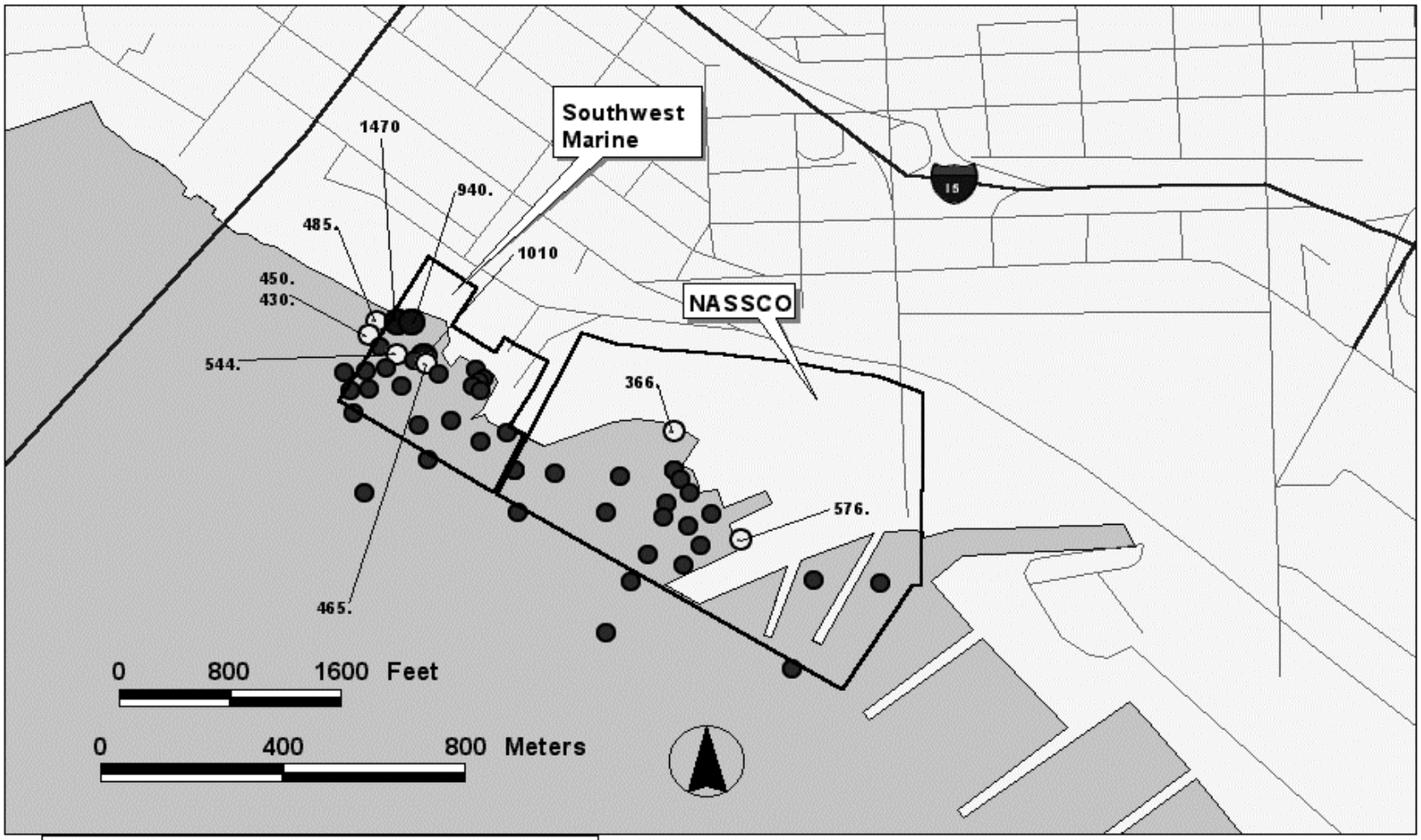
SW Marine Leasehold
NASSCO leasehold

PCB Reference Level at 380 ppb

- below background
- up to 10 x reference
- 10 - 19 x reference

SW Marine Leasehold
NASSCO Leasehold

EHC, 2002.



Copper Levels in Parts per Million

- 93 - 299
- 299 - 576
- 940 - 1470

Approximate leasehold boundaries for shipyards

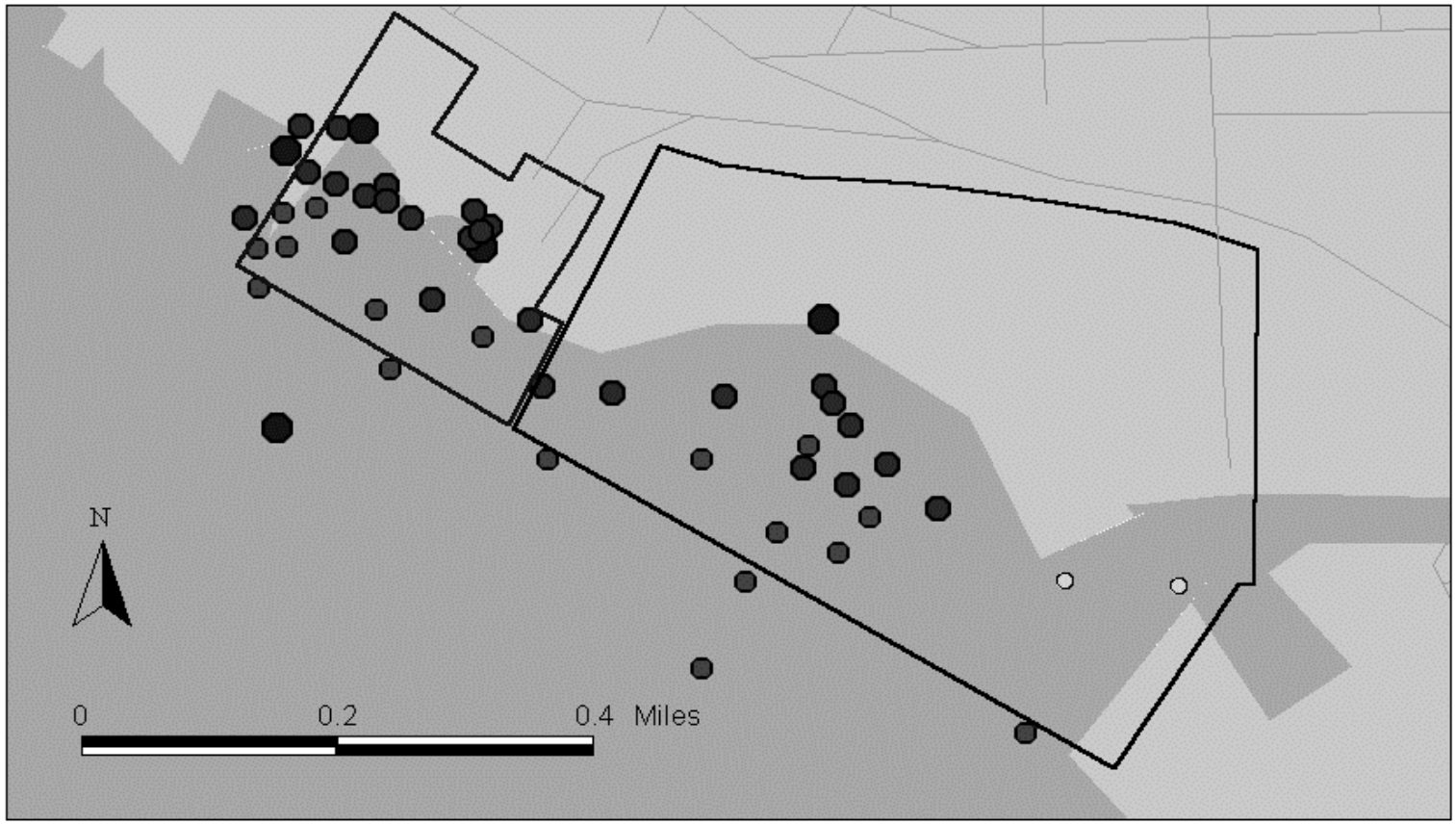
Proposed Background Sediment Copper Level = 84 ppm

RWQCB, 3/6/02.

Copper Levels at Shipyards Compared to Background

Environmental Health Coalition, 2002.
Source: Exponent, Inc., 2002.

We thank Washington Department of Ecology for the use and support of the publicly available sediment quality information system SEDQUAL.

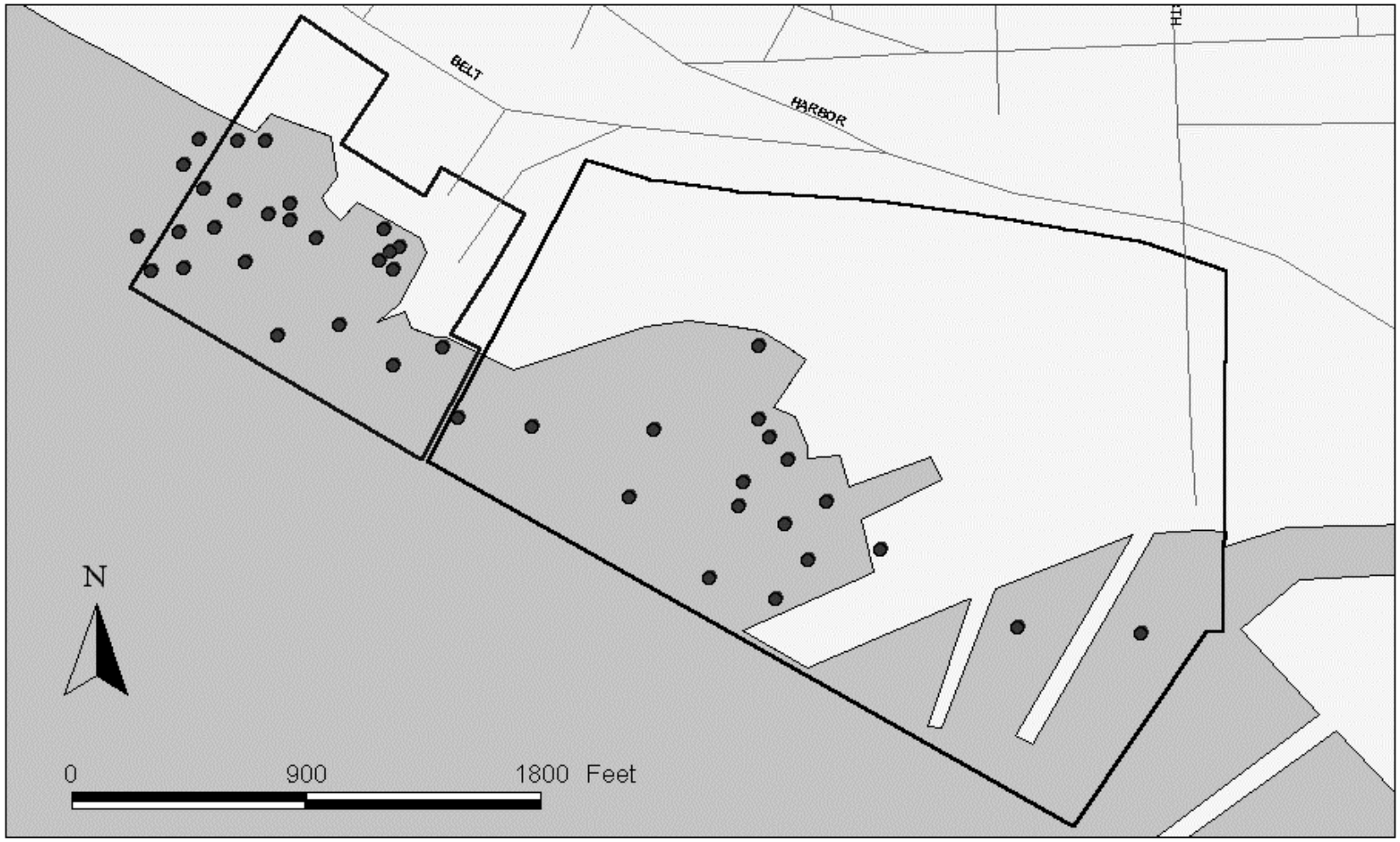


Shipyard Mercury, ppm
- 0 - 0.39
- 0.4 - 0.79
- 0.8 - 1.59
- 1.6 - 3.9

SW Marine Leasehold
NASSCO Leasehold

Mercury at Shipyard Stations

Source: Exponent, 2002.
EHC, 2002.



EHC, 2002.

Station Locations for PCB, PCT, and PAH Sampling

Brief Summary

EVALUATION OF PHASE I BENTHIC MACROINVERTEBRATE DATA AND SEDIMENT PROFILE IMAGING SURVEY

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SAN DIEGO STATE UNIVERSITY
CONSULTANT IN MARINE ECOLOGY

For details, see:

Ford, R.F. 2002. Evaluation of phase 1 benthic macro-invertebrate, data and sediment profile imaging survey for the NASSCO and southwest marine sediment investigation in San Diego bay. Report prepared for San Diego Bay Council, may 8, 2002.

Problems With Reference Stations

1. The most serious flaw is the inadequacy of the reference stations used thus far.

- Essential criteria for selecting reference stations are their physical and ecological similarity to the shipyard sites and their lack of significant sediment chemical contamination.

3. None of the existing reference sites is similar enough to the shipyard stations in physical and ecological characteristics to meet the first criterion.

Problems With Reference Stations

- Unfortunately, Exponent also did not consider these physical factors in their phase I analyses.
- There is evidence of PCB contamination in the sediments at stations 3-5, indicating that these sites are unsuitable.
- The reference stations are in different parts of the bay, producing a gradient of ecological conditions in the data that makes analysis difficult.

Problems With Reference Stations

7. Exponent must conduct additional sampling to find good, uncontaminated reference sites in the central S.D. Bay area that meet these criteria.

8. One cannot do this by picking reference sites from maps of previous studies and then selecting a subset that most closely resemble the shipyard sites.

9. Adequate, new reference stations must be established before the study continues.

Problem With Shipyard Sampling Stations

1. Relatively few shipyard stations were located close inshore, where higher concentrations of sediment contaminants may be present.

2. As a result, there is sampling bias favoring sites in deeper water, located farther away from the sources of contamination.

3. Additional inshore shipyard stations should be used.

Pooling Of Reference Station Data

- Exponent pooled reference station data for invertebrates and did not use data from individual reference stations for statistical comparisons.

- This is a questionable approach.

Pooling Of Reference Station Data

- Given the deficiencies of the reference stations, pooling of their data only compounds the problem and may cause bias.

- The data from each reference station should be employed separately in the statistical analyses.

Questionable Deletion of Reference Station Data

1. Exponent did not use any invertebrate data from station 4 because a dominant invader species (Tanaid) was present.

2. Data for dominant echinoderms also were deleted for station 1.

Questionable Deletion Of Reference Station Data

3. To exclude these data from stations 1 and 4 because they influence the pooled results makes little sense.

4. For example, a common invader species, the Japanese mussel *musculista,* was dominant at many stations. It causes serious ecological effects, yet exponent did not delete data for stations where it was found.

Questionable Deletion Of Reference Station Data

5. Data should not be deleted. Reliable reference stations will help reduce this problem.

Critical Need For Evaluation Of Species-specific Abundances And Presence-absence Data

1. While valuable, use of the six "benthic metrics" and other quantitative measures gives a false impression that they are the only ones needed to evaluate effects.

2. Exponent did almost no evaluations concerning presence/absence of individual species and species-specific abundances.

Critical Need For Evaluation Of Species-specific Abundances And Presence-absence Data

3. These additional lines of evidence must be used and compared statistically between shipyard and reference stations.

4. Several related questions must be answered in order to understand the specific ecological differences among station sites and what produced them:

Critical Need For Evaluation Of Species-specific Abundances And Presence-Absence Data

A. What species occurred at both the shipyard and reference stations?

B. What species were present in samples only at reference stations or only at shipyard stations?

C. How did the abundances of the individual species differ among the reference and shipyard stations?

Critical Need For Evaluation Of Species-specific Abundances And Presence-Absence Data

D. Most important: from what is known about the sensitivity of species to chemical contaminants, were the observed differences in presence and abundance of individual species caused by exposure to known concentrations of sediment contaminants?

Critical Need For Evaluation Of Species-specific Abundances And Presence-Absence Data

5. Example tabulations: of the 25 amphipod species identified from the reference stations:

   A. Seven (28%) were not found in any samples from the southwest marine stations.

   - Four others (16%) of the 25 were present in samples taken at only one or two of the SWM shipyard stations, indicating that they were uncommon there.

   - In contrast, five amphipod species present in samples taken at the southwest marine sites were not found in any of the reference station samples

Critical Need For Evaluation Of Species-specific Abundances And Presence-Absence Data

6. Both presence-absence comparisons and comparisons of species-specific abundance data between shipyard and reference stations must be analyzed for major invertebrate groups.

7. The following groups are recommended:

Polychaete Worms
Zoantherid Chidarians *(Edwardsia californica)*
Amphipod Crustaceans
Ostracod Crustaceans
Isopod Crustaceans
Holothuroid Echinoderms
Bivalve Molluscs
Decapod Crustaceans
Tanaid Crustaceans
Ophiuroid Echinoderms
Gastropod Molluscs

PROBLEMS WITH SEDIMENT PROFILE IMAGING

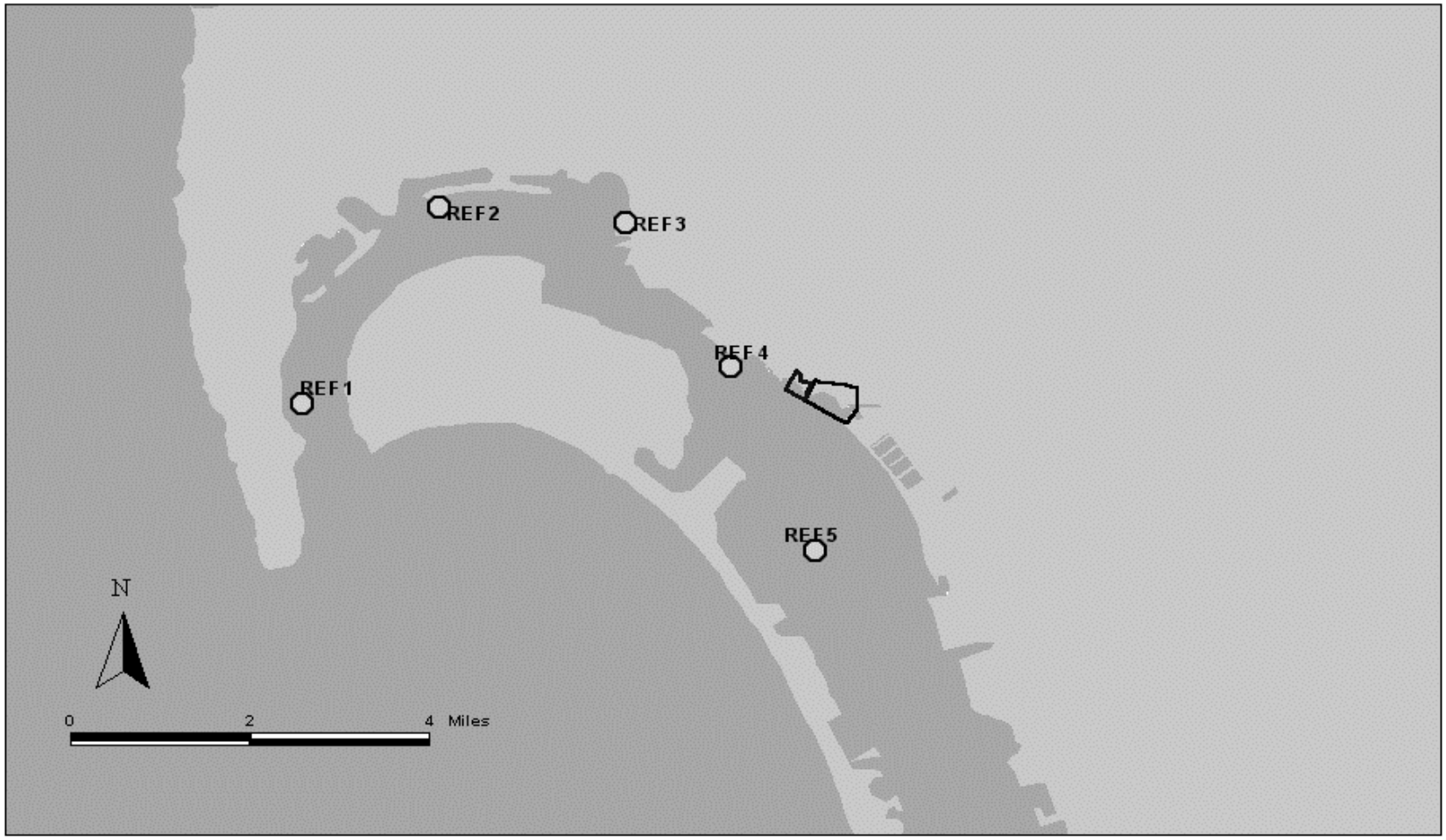
- The SPI technique requires "major perturbations" of the sediment to show effects (recent dredging, excess organic matter from sewage or other effluent, etc).

- Yet chemical contamination of the sediment may not produce major successional changes of invertebrates, because it's effects are often more subtle.

Problems With Sediment Profile Imaging

- Phase III assemblages are commonly present despite chemical contamination.

- This substantially reduces the effectiveness of SPI for evaluating invertebrate assemblages in the study.



Reference Stations
SW Marine Leasehold
NASSCO Leasehold

Reference Station Locations for PCB, PCT, and PCB Sampling

EHC, 2002.

"You get what you ask for."

-Bruce Reznik, Executive Director, San Diego BayKeeper

"You only want to do the dredging once."

-David Mulliken, 2001 SD Union-Tribune