Overview of Mine Remediation in the Bay-Delta Ecosystem

Revisiting the Mercury Strategy for the Bay-Delta Ecosystem

January 2016

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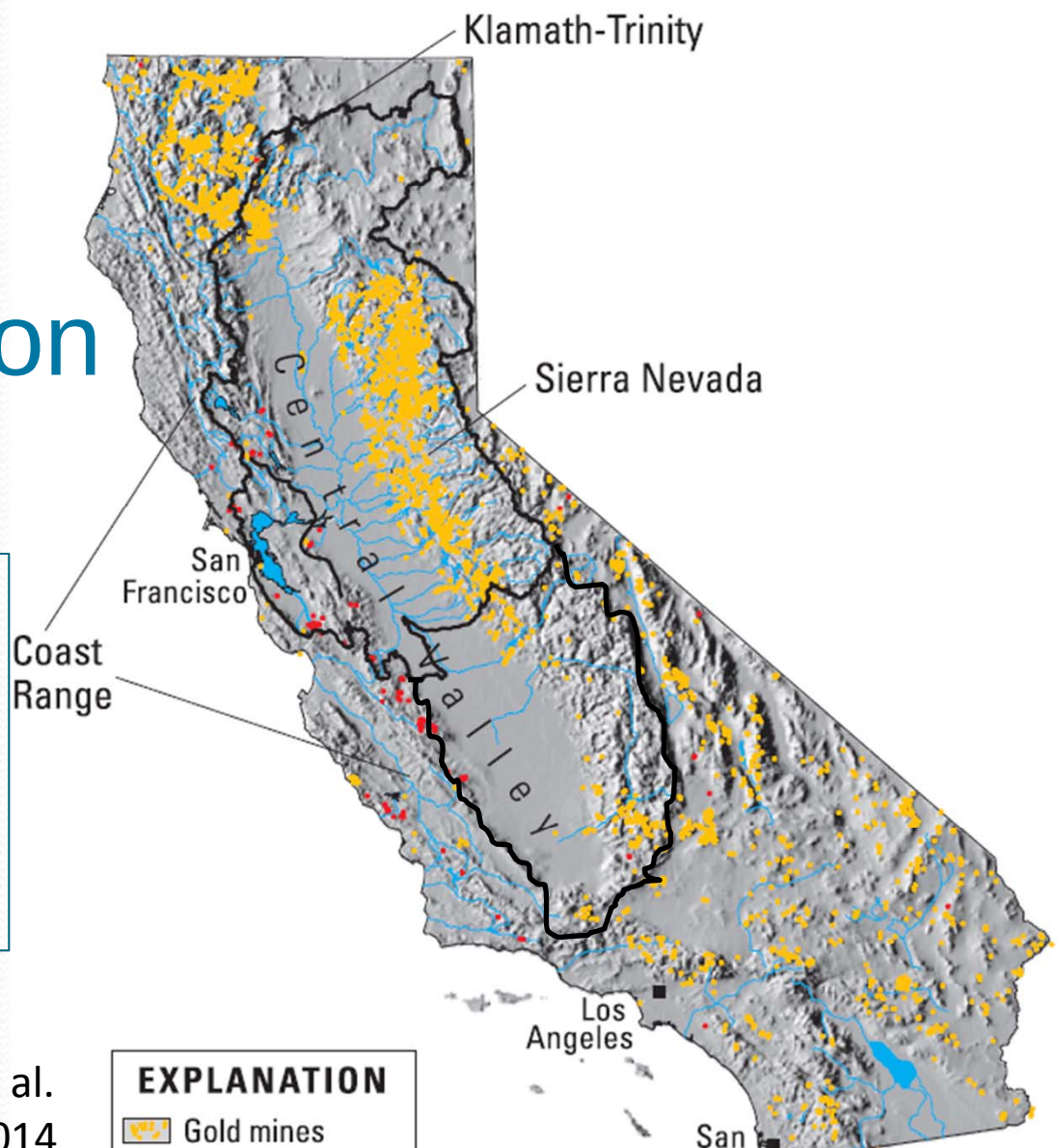
Summary: Overview of ne Remediation

2003 Hg Strategy

Progress

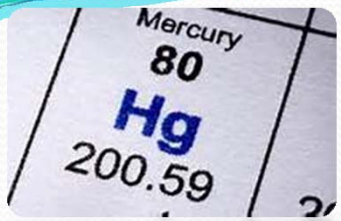
Challenges



C.N. Alpers et al.
USGS 2005-3014

Outline

Core Components 2003 Hg Strategy



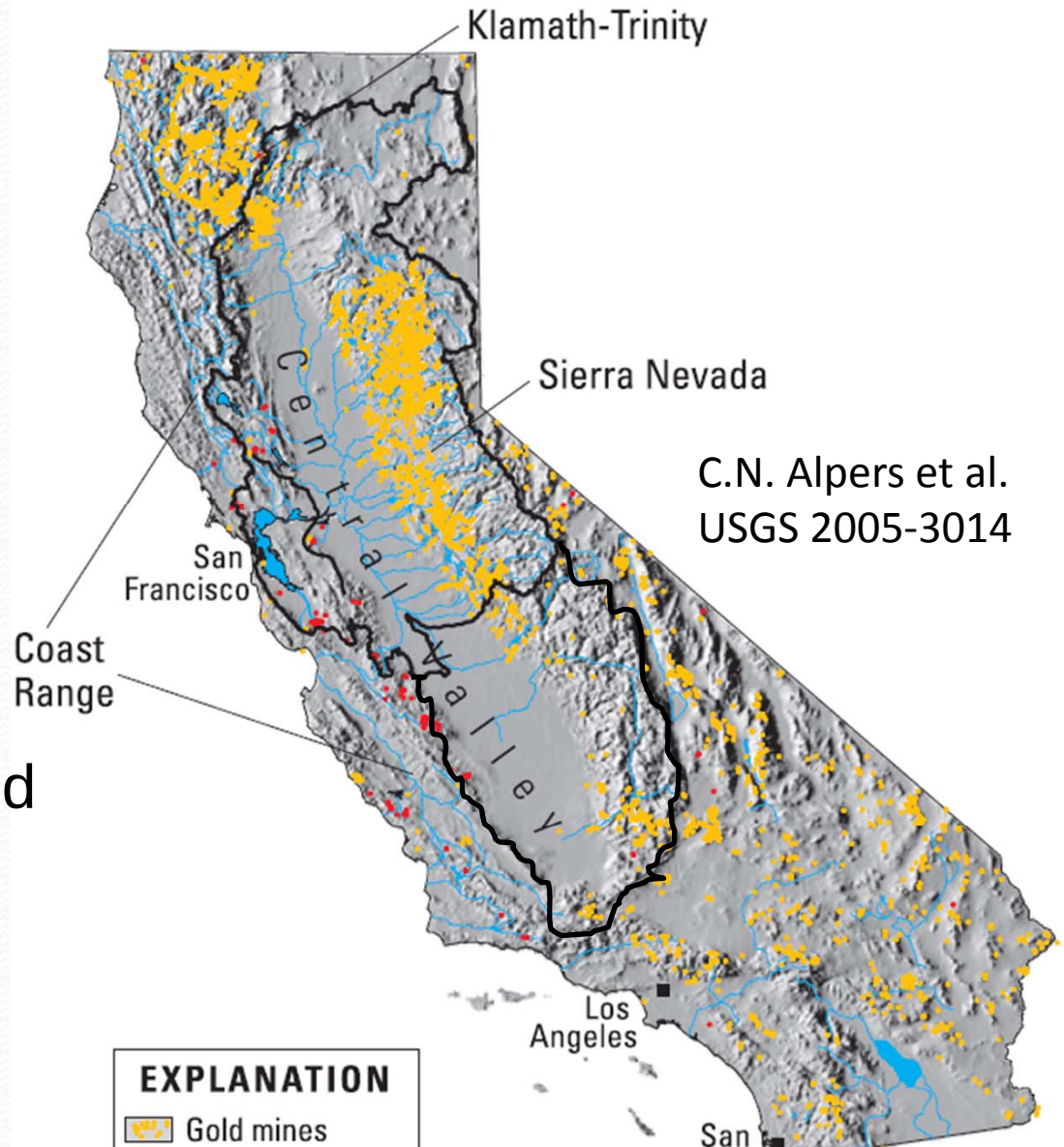
1) Identify (locations and methods)
2) Prioritize
3) Pilot test
4) Implement (remediate)
5) Measure performance

Where might mine remediation enable measurable and timely fish MeHg reductions?

Identify locations and methods)

entory Hg-contaminated
liments

aluate susceptibility
mobilization by erosion



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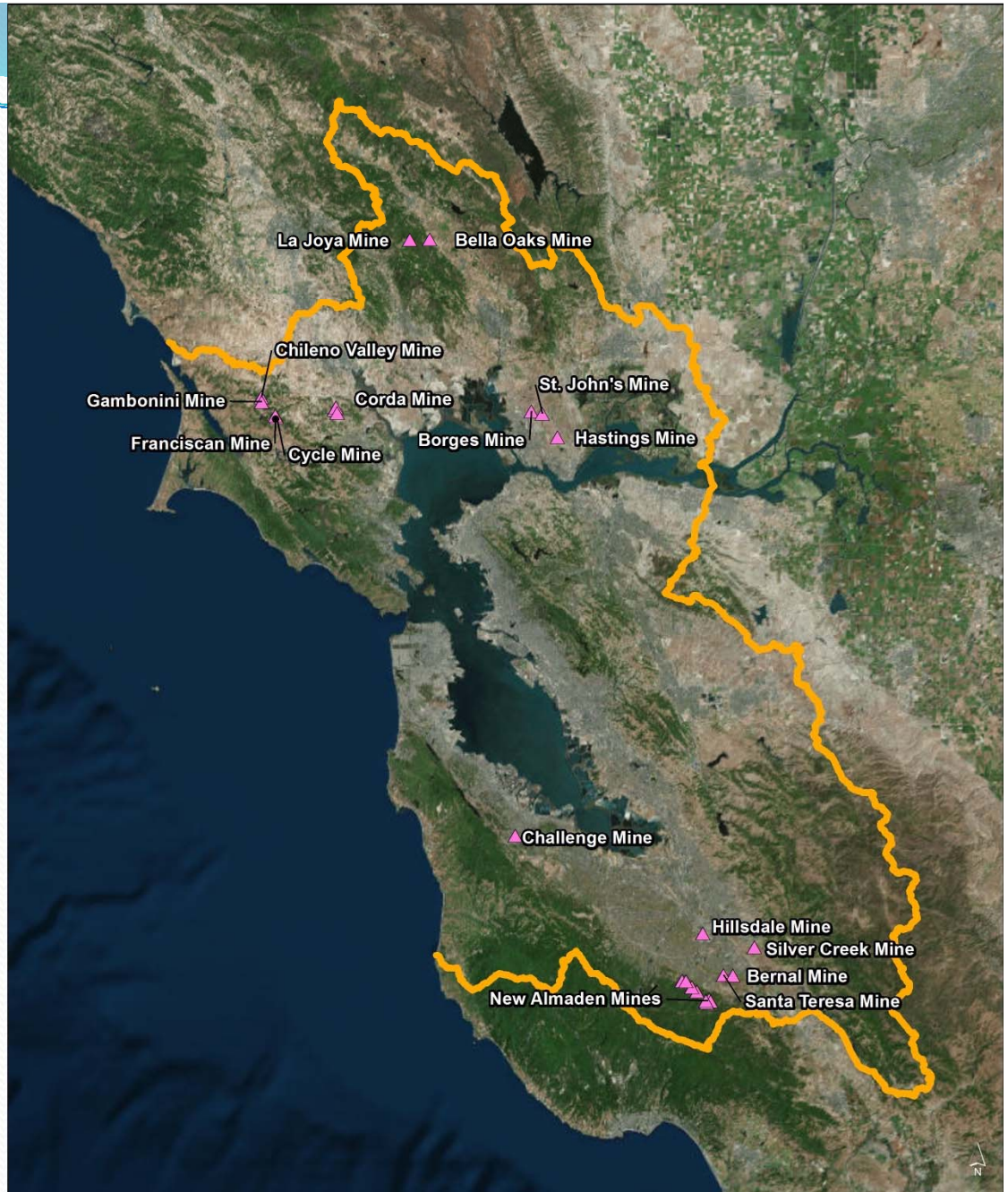
USGS 2005-3014

ventory:
n Francisco Bay
ter Board



Prioritize

Transport:

Fate:

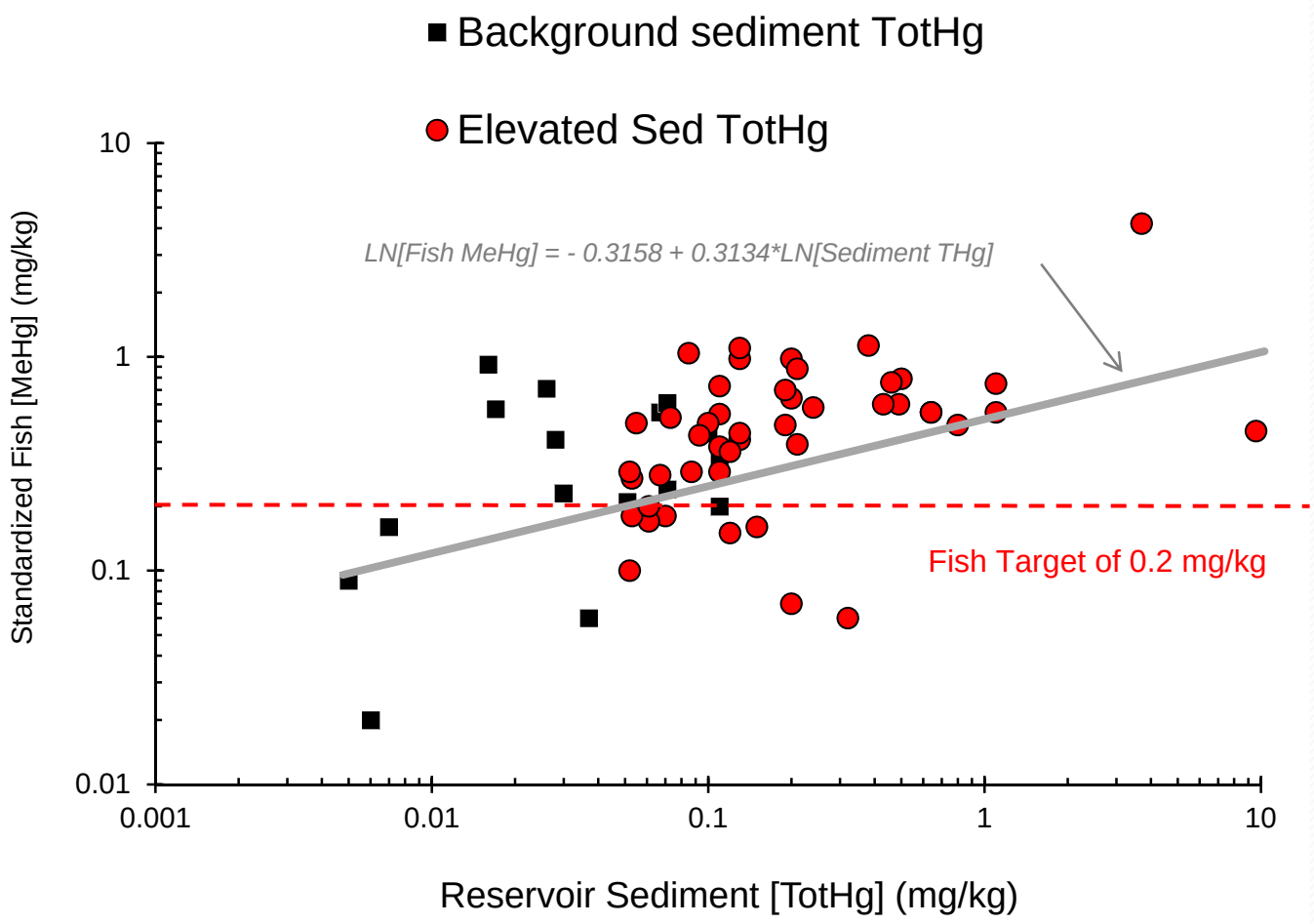
Feasibility:

Where might mine remediation enable measurable (20%) **and** timely (10 years) fish MeHg reductions?

ansport potential and Hg mass

ine site discharges large mass Hg

Fate: High reservoir sediment Hg



Prioritize

Transport: Mine site discharges large mass and high concentration of Hg

Fate: High reservoir sediment Hg compared to background

Feasibility:

- Mine sites localized to a relatively small watershed area
- Mines near reservoirs (e.g., within 10 km)

Where might mine remediation enable measurable (20%) **and** timely (10 years) fish MeHg reductions?

ilot test

Implement pilot remediation projects

→ full-scale

mplement (remediate)

910-B-00-001

Region 8
Denver, CO

Region 9
San Francisco, CA

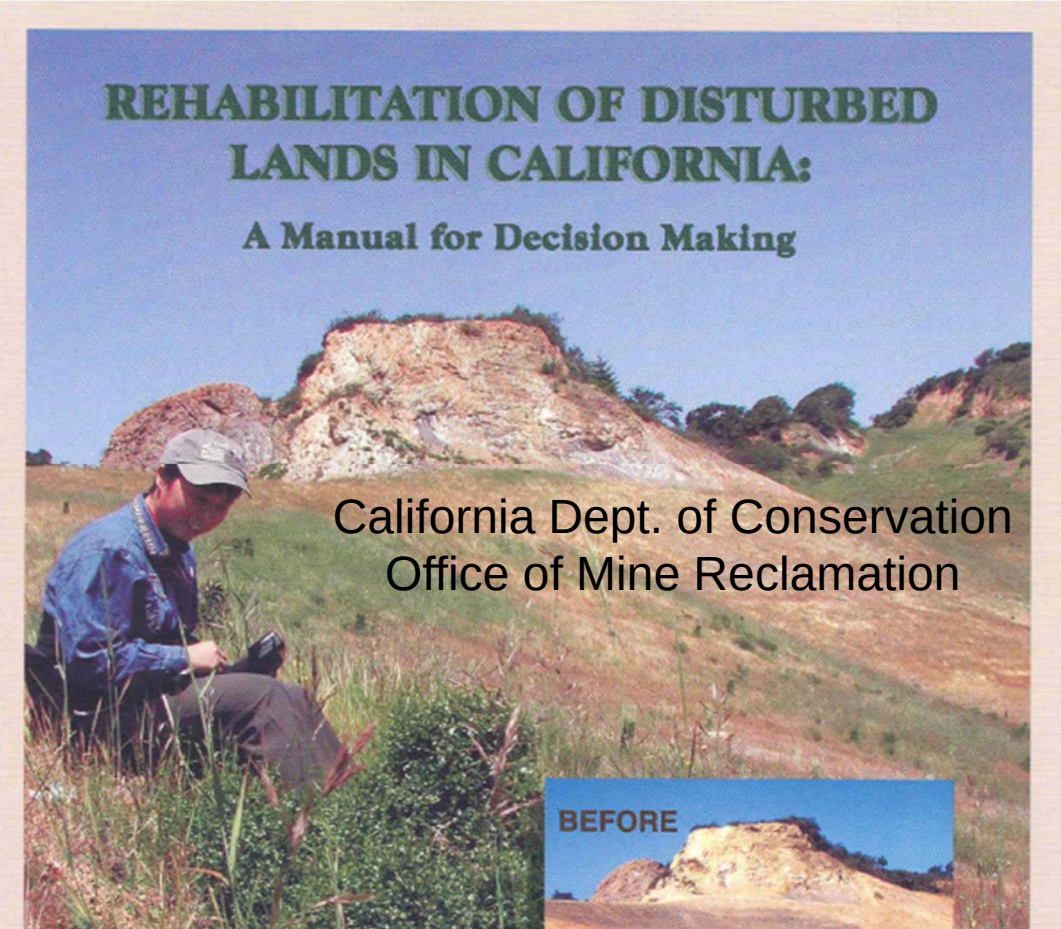
Region 10
Seattle, WA

EPA

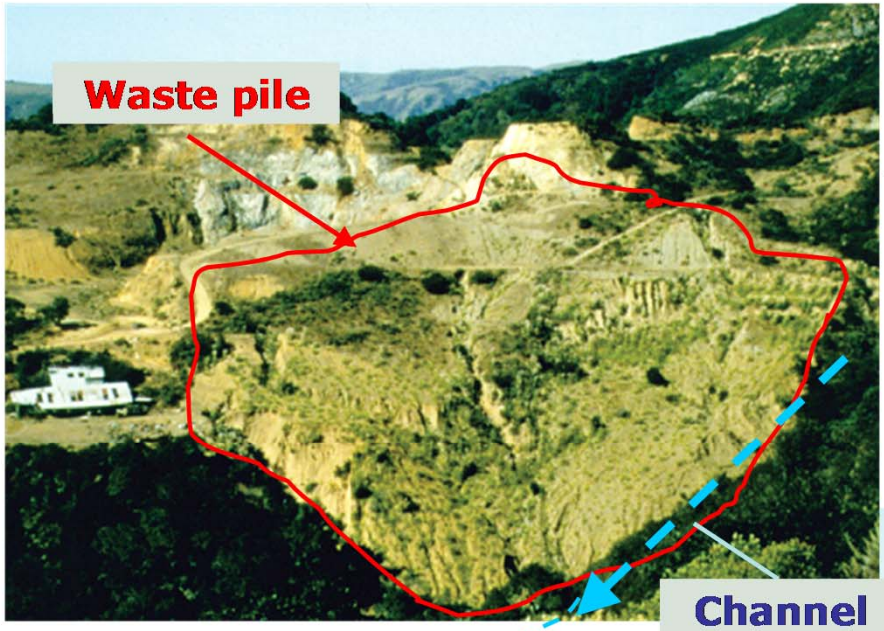
August 2000

ABANDONED MINE SITE CHARACTERIZATION and CLEANUP HANDBOOK

mplement (remediate)



easure performance



← Before

After →

Sample Location

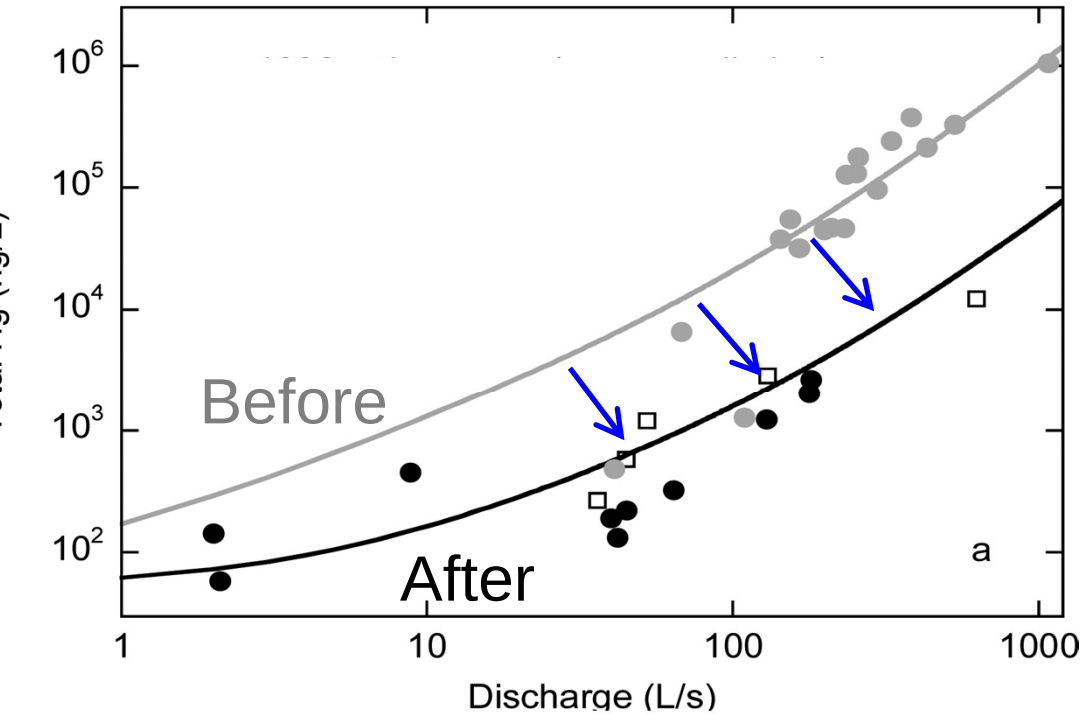
>90% Hg
55 – 60% Sediment
Load Reduction

Erosion Control

mbonini Mercury Mine

lifornia Coast Range

ool: Rating Curves



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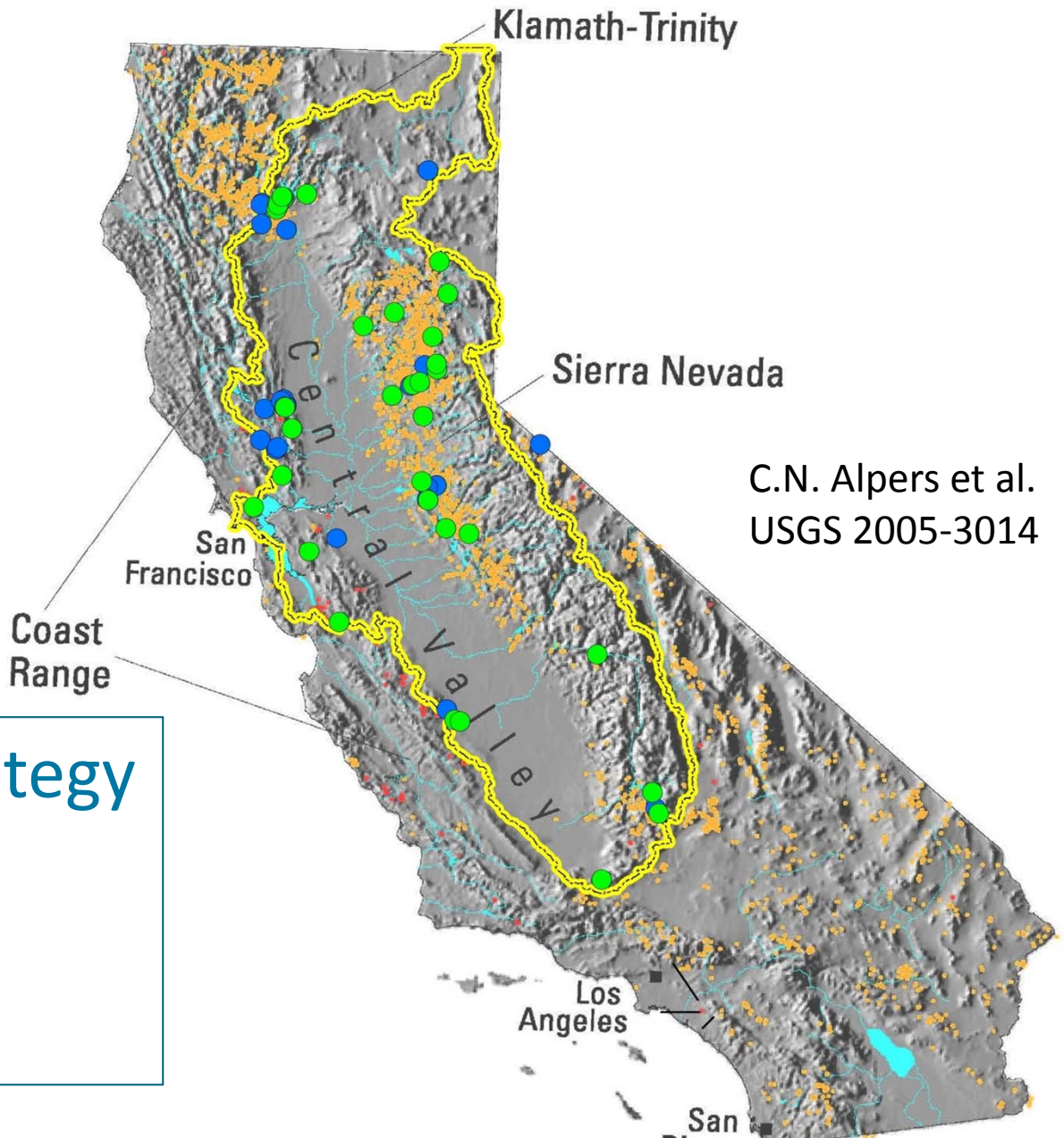
Quantifying Remediation Effectiveness under Variable External

erformance measure:
3,000 kg Hg contained

erformance measures – needed

losing



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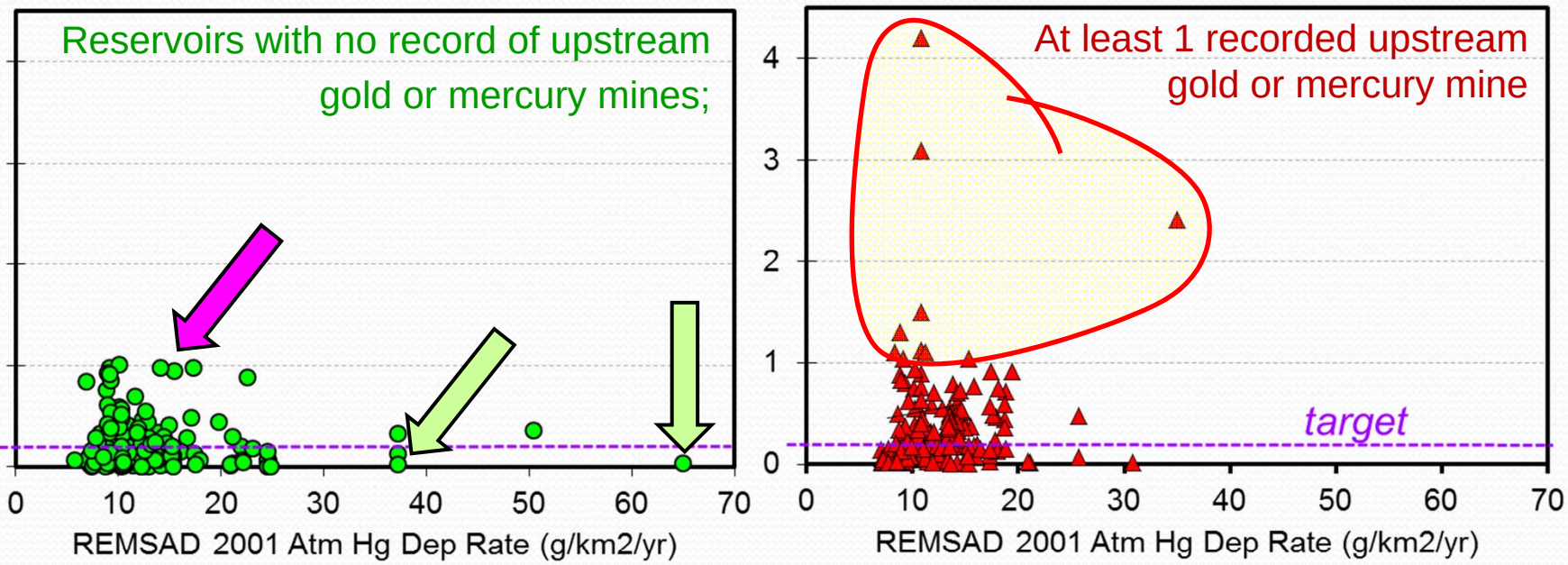
2003 Hg Strategy

Challenges

Progress

Reservoir fish MeHg compared to
odeled 2001 atmospheric Hg deposition rate



- Can have high fish MeHg but low atm dep and no mines
- Can have low fish MeHg but very high atm Hg dep
- Very highest fish MeHg associated with extensive Hg mining

OC

oritizing Remediation

Prioritize and Rank AML Problems or Sites?

Risk

- Rank based on risk to human health and environment
- Ranks sites relative to each other

Transparency

- Transparent & explainable rationale

Limited Resources

- Apply limited government resources strategically
- Focus resources on highest risk sites
- Build future budget requests
- Leverage funding sources

Collaboration

- Remediate more of highest priorities
- Clean up more quickly

fornia Abandoned Mine Prioritization Tool

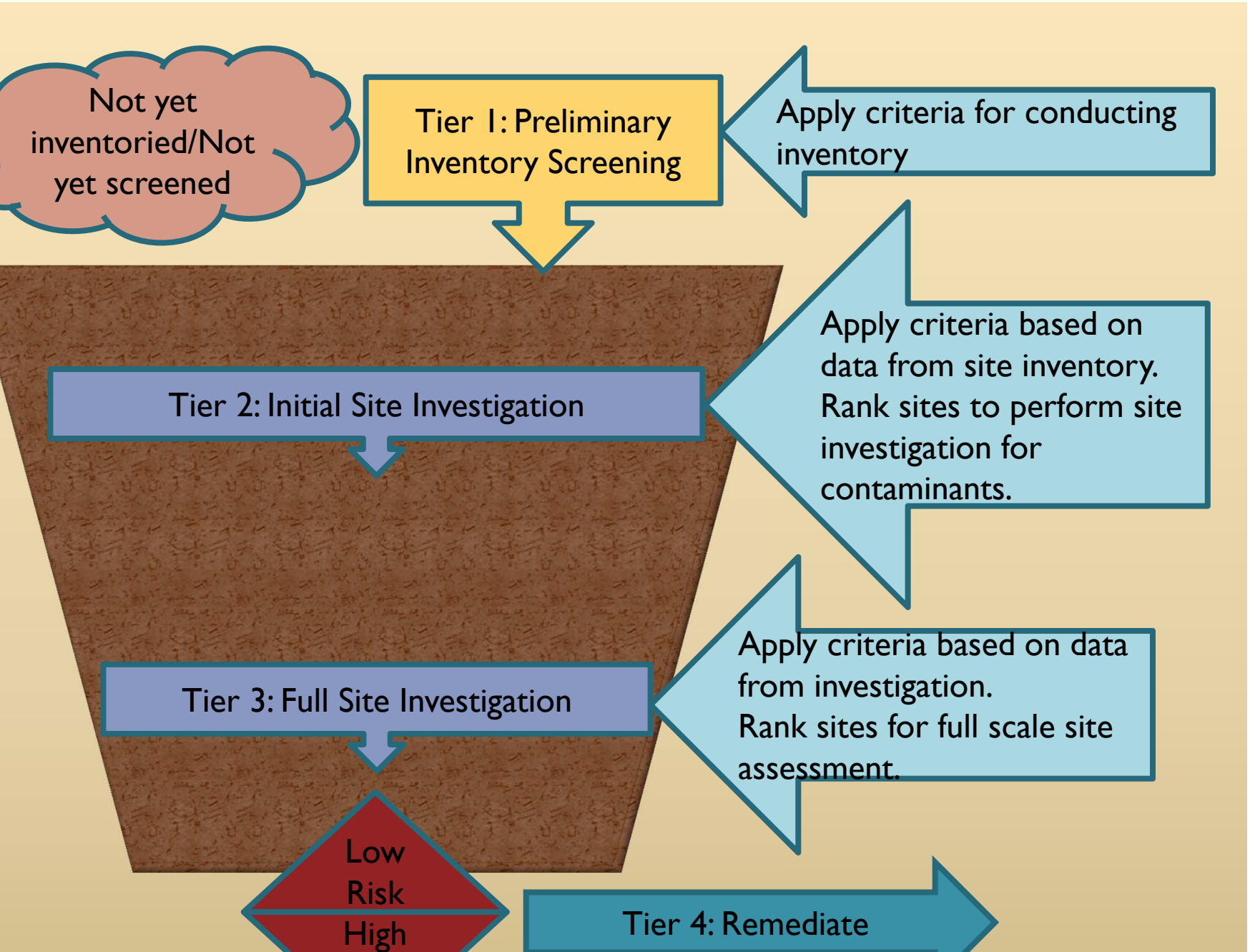
ulti-agency effort coordinated by DOC with CAMLAG

AMPT Project goals:

- Help identify where to perform new inventories of abandoned mine lands
- Select mines sites that should be assessed for potential environmental contamination
- Identify which sites should be considered for cleanup or closure.

vo Phase approach

- Phase 1 – Planning
  - Develop a uniform set of attributes for transparent and consistent application across agencies in the state.
  - Develop an integrated business process with CAMLAG agencies
  - Develop numerical scores and weights to be used in development of an algorithm.
- Phase 2 – Implementation
  - Develop algorithm to allow for statewide ranking of abandoned mine sites for management action.
  - Develop computer based spatial modeling tool.


Not yet inventoried/Not yet screened
Tier 1: Preliminary Inventory Screening
Apply criteria for conducting inventory
Tier 2: Initial Site Investigation
Apply criteria based on data from site inventory. Rank sites to perform site investigation for contaminants.
Tier 3: Full Site Investigation
Apply criteria based on data from investigation. Rank sites for full scale site assessment.
Low Risk
High
Tier 4: Remediate

riteria Examples

Chemical Hazard

- Type of Contaminants
- Threat to human health, environment
- Type of mine/ore processing
- Stability and Mobility
- Water quality indicators
- Population, Access, Exposure

- Physical Safety Hazard
  - Number, Condition of openings (shafts, adits)
  - High walls
  - Threat to safety of people or animals
  - Stability (openings, structures, waste piles, mill tailings)
  - Population, Access, Exposure

TSC

Waterboar | Abandoned Mine Lands A | Abandoned Mine Lands

www.dtsc.ca.gov/SiteCleanup/Abandoned_Mine_Lands.cfm

Outlook Web App | BizFlow | CalATERS | CIWQS | Track-IT | Waterboard | R2 website | CalTravelStore | Waternet | Statewide Mercury ... | Other bookmark

Abandoned Mine Lands

- Additional Resources
- Contact Information
- Back to Abandoned Mine Lands
- Brownfields

Related Links:

- U.S. Environmental Protection Agency
- U.S. Geological Survey
- U.S. Department of Agriculture Forest Service
- U.S. Bureau of Land Management
- Abandoned Mine Lands Forum
- Sierra Nevada Conservancy
- State Water Resources Control Board
- California State Parks
- Sierra Fund

Abandoned Mine Lands

California's Abandoned Mines: The Golden State's Environmental Legacy

Since the days of the gold rush of 1849, California's mountains, valleys and deserts have been a source of precious metals and other minerals. California's complex and diverse geology produces more than 700 mineral commodities, making California one of the nation's most mineral-rich states. However, the mining and mineral-processing practices of the past were not subject to today's environmental standards and have resulted in the discharge of millions of tons of waste rock and mill tailings to the land and waters of California. The unrecovered minerals and metals — most commonly arsenic, lead and mercury — in waste rock and mill tailings are released into the environment through natural processes over time, causing a threat to human health and the environment.

ABANDONED MINE LANDS PROBLEM

More than a century and a half of mining in California has created an estimated 47,000 abandoned mine land (AML) sites. Historical mining and ore processing at these AML sites have resulted in the generation and disposal of millions of tons of mine wastes to the land and waters of California. Learn more about AML problems.

DTSC'S ABANDONED MINE LANDS INITIATIVES

DTSC addresses AML sites through a variety of programs and activities. Learn more about these initiatives.

DTSC'S HAZARD ASSESSMENT AND REMEDIATION PROCESS

TSC

Waterboar | Abandoned Mine Lands A | www.dtsc.ca.gov/SiteClear

www.dtsc.ca.gov/SiteCleanup/Resources.cfm

Outlook Web App | BizFlow | CalATERS | CIWQS | Track-IT | Waterboard | R2 website | CalTravelStore | Waternet | Statewide Mercury ... | Other bookmark

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Abandoned Mine Lands Additional Resources

Library and Multimedia

- "Abandoned Mine Lands Preliminary Assessment Handbook": This handbook provides basic information for conducting an initial investigation of AML sites and aids in the identification of mining features, constituents of concern and potential health risks.
- "Abandoned Mine Lands Site Discovery Process": This document explains how AML sites are identified and brought under DTSC's and the AML Initiative Team's oversight.
- DTSC's EnviroStor: DTSC's database of regulated sites.
- **Maps:** Map of AML sites in California.

Guidance Documents:

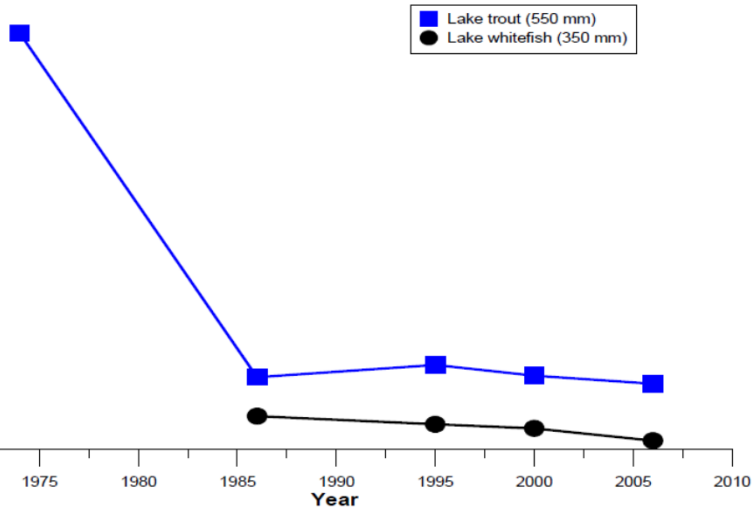
Guidance from agencies involved with AML issues.

- Abandoned Mine Land Inventory and Hazard Assessment (U.S. Department of the Interior, Bureau of Mines, May, 1994) Part A & Part B
- Risk Management Criteria for Metals at BLM Sites (U.S. Department of the Interior, Bureau of Land Management, October 2004)
- Abandoned Mine Site Characterization and Cleanup Handbook (U.S. Environmental Protection Agency, August 2000)

nup.pdf | MercuryStrategy_Dra....p... | Show all downloads...

We have reasons to be hopeful…

Source: Teck Cominco-Azimuth 2008 (Figure 4.6-1)



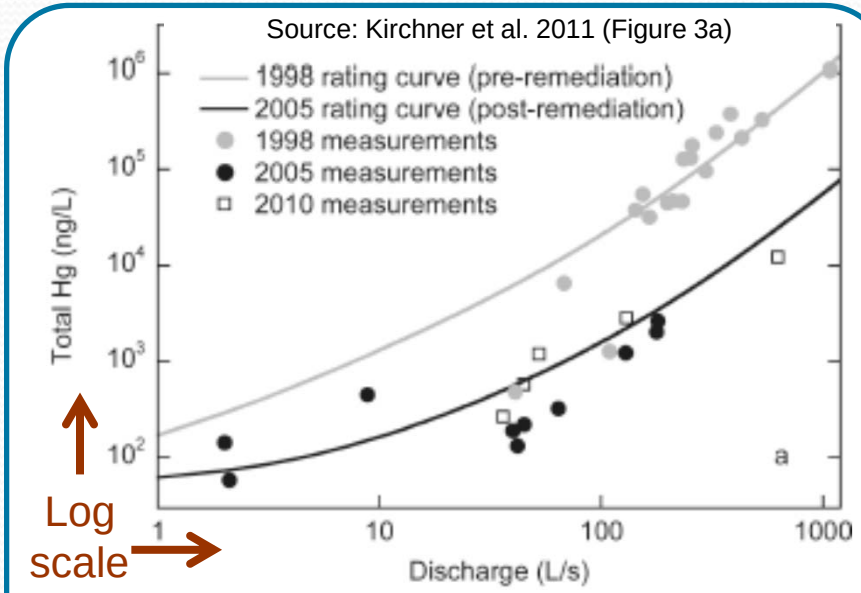
ke Pinchi Mercury Mine, BC

me waste capping & erosion control
ce 1975 mine closure; additional
nediation planned

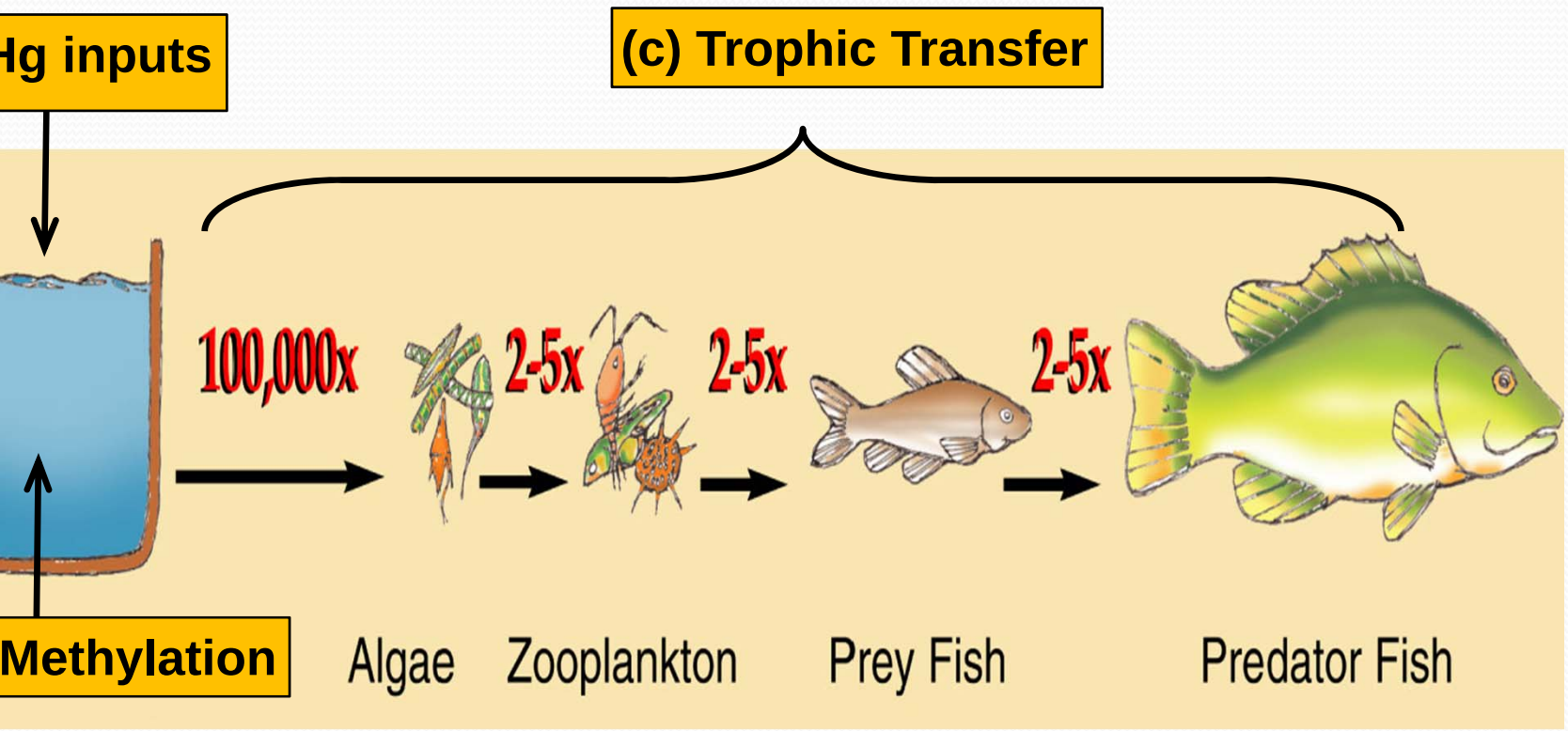
al dramatic fish MeHg reduction,
n modest reductions

ring indicate slow burial process –
large tributaries to provide

Source: Kirchner et al. 2011 (Figure 3a)



Gambonini Mercury Mine

- Largest Hg pollution source to Walker Creek & Tomales Bay
- Erosion control alone – *no capping!* **>90%** Hg load reductions & **>50%** sediment load reductions
- But we don't yet have fish MeHg data

mplified Hg Conceptual Model: Three Important Factors