



**REPORT OF THE TECHNICAL
ADVISORY COMMITTEE FOR
ABANDONED MINES**

OCTOBER 1994

PREPARED FOR THE

**STATE WATER RESOURCES CONTROL BOARD
CALIFORNIA ENVIRONMENTAL PROTECTION AGENCY**

ABANDONED MINES TAC REPORT CLARIFICATION STATEMENT

After completing the TAC report in October, 1994, discussion indicated that the approach and some recommendations needed explanation to ensure a thorough understanding of the report by the public and the Board. The following therefore presents this clarification.

1. Abandoned Mines vs. Active Mines

While the TAC was charged to review the effects of water pollution from abandoned mines, it did not limit itself to the "abandoned" classification and addresses both existing and potential discharge. Although the TAC recognized that a myriad of laws impose regulatory requirements on existing mining operations, there is a potential for an active mine to become abandoned due to inadequate reclamation bonding, unforeseen discharge problems, or other complications. Active mining is therefore considered in places within this report. *(insert this statement on p.4, following the definition of abandoned mines)*

2. Support for Article 7, Chapter 15 Update

The TAC recommends that current regulations be updated to require better test methods to predict acid mine drainage. We want to avoid situations where acid mine drainage occurs at an active mine but was not anticipated in the initial reclamation bonding, and where the owner does not have additional resources. Better pre-project assessment of acid mine drainage potential would assist in both setting appropriate reclamation bonds and designing mine closure strategies for use upon cessation of mining. The TAC recognized that this recommendation does not address the issue of current drainage problems at abandoned mines. *(add as an explanation bullet to p.22, Recommendation 3)*

3. Improving Funding

The TAC recognized early in its work that the lack of funding is a key impediment to cleanup of abandoned mines. Of primary consideration in the funding issue is the recognition that abandoned mines should be given appropriate prioritization relative to other non-point and point sources. Available or future cleanup moneys could be directed towards abandoned mines instead of other targets when greater benefit to water quality in a watershed could be achieved by cleaning up abandoned mines.

In addition, other sources of funding or incentives for cleanup should be sought, including but not limited to:

- 0 Use water quality environmental litigation moneys {i.e., C & A funds} to cleanup abandoned mine sites.
- 0 Cash contribution of moneys from downstream dischargers for cleaning up upstream abandoned mines in lieu of downstream treatment.
- 0 Federal grant funds for clean water purposes.
- 0 Forfeited closure bonds which could be applied to highest priority sites.
- 0 Take funds and staff out of existing Regional Board regulatory programs and use them for cleanup and abatement of abandoned mine sites.

(insert at top of bullet on p.23, Recommendation 4)

4. **Makeup of Multi-Agency Oversight Committee**

The TAC recognized that the State Board, Regional Boards, and other agencies must consolidate their efforts on this issue to more efficiently and effectively manage the limited resources available. Coordination of effort and expertise on abandoned mines is therefore recommended via a multi-agency oversight committee. While politically accountable policy makers, such as cabinet level or similar appointees would presumably be involved, the TAC is primarily concerned that such a committee include appropriate technical expertise. The proposed makeup of technical expertise proposed by the TAC is meant to augment, not supplant, the policy makers on such a committee. In addition, the TAC recognized that the task force of existing staff is meant simply to coordinate existing activities, and not expand its functions without policy review and approval. (*insert at top of Recommendation Explanation, p. 21*)

The Abandoned Mines Technical Advisory Committee's

Report on Abandoned Mines

Submitted to

The State Water Resources Control Board

Executive Summary

The Abandoned Mines Technical Advisory Committee spent 6 months discussing the issues surrounding abandoned mines, past cleanup efforts, and desired future courses of action. The committee agreed that supporting scientific evidence is needed to determine and document the role of abandoned mines in causing regional pollution, as this would strengthen the case for cleaning up abandoned mines. Localized impacts of abandoned mine related pollution are obvious and for, the most part, well documented. The committee also agreed that a Nonpoint Source Program for promoting, coordinating, and procuring funding for abandoned mine cleanup projects is embryonic at this time, and thus is not yet capable of meeting identified critical needs for an effective cleanup effort. Consequently, our recommendations, also found in Section 6 of the report, are aimed at providing:

- Criteria and a method for determining which abandoned mines should receive the highest cleanup priority, which abandoned mines should receive a lesser priority, and which abandoned mines do not need any cleanup efforts directed at them at all.
- Stable funding sources that provide sufficient financial resources to ensure both that a state-wide program actually results in cleanups and that technology selection is not limited strictly by available funding.
- A mechanism for limiting liability exposure for those public and private entities that choose to cleanup abandoned mines voluntarily.
- Cleanup objectives that realistically reflect the difficulties in imposing technological controls on long-abandoned mine sites with limited funds, given the persistent nature of pollution caused by acid-generating, abandoned mine sites and the beneficial use potential of the impacted watercourse.
- Scientific documentation of the regional effects of metal loading from acid-generating abandoned mines.

Recommendations

1. Recommend that the SWRCB promote [to Cal/EPA] the formation of a multi-agency [state, research, industry, environmental, and federal] policy oversight committee on abandoned mines. The committee would be politically accountable for monitoring the effectiveness of abatement projects, pursuing funding, establishing criteria for prioritizing, deciding priorities, and concurring on abatement projects in an effort to unify and consolidate our abandoned mine abatement expertise.

2. Recommend that the SWRCB approve a taskforce of State Board, Regional Board, and Office of Mine Reclamation staff to work on abandoned mines.
3. Recommend that the Board support the proposed update to the agency's mining regulations {Article 7, Chapter 15} including an update of bonding requirements for active mines.
4. Recommend that the Board support state and federal legislation aimed at improving funding for cleanup, providing incentives for cleanups, and providing relief from unobtainable low contaminant concentration cleanup standards.

INTRODUCTION

Background

The Abandoned Mines Technical Advisory Committee [TAC] is one of several committees formed as a result of the Coastal Zone Reauthorization Act. These groups were assigned the task of developing interest-based recommendations for improving their respective existing Nonpoint Source Pollution Control Programs. A formal Nonpoint Source Pollution Control Program for abandoned mines doesn't exist even though Nonpoint Sources funds are sometimes used to support projects aimed at abating pollution from abandoned mines. Consequently, several recommendations presented later in the report are aimed at building the foundation of a formal abandoned mine Nonpoint Source Pollution Control Program.

Forming the committees was an attempt to bring together all groups [stakeholders] that have an interest in cleaning up specific pollution sources. Committees were directed to find the best pollution management schemes by open, unfettered discussions of interests and options. Except for the Abandoned Mines TAC, a thread common to every other committee was that there was one or more stakeholders, usually landowners, who would have to modify "business as usual" land management procedures. These modifications were supposed to result in a "win-win situation" where nonpoint source pollution was reduced by self-benefitting, voluntary actions by a single or small group of stakeholders. The alternative to voluntary actions by these stakeholders usually would be formal regulation. The task facing the Abandoned Mines TAC, however, was different because abandoned mine pollution cannot be linked to an attendant current land use [e.g, nitrate loading from confined animal facilities and dairies]; thus, threats of regulation are relatively hollow because there is often no party to regulate. Thus, abandoned mine pollution control is basically a series of individual, site-specific reclamation projects, not a program directed at finding better ways to conduct an activity. The committee, therefore,

felt that reducing abandoned mine pollution depends more on the concerted actions of all stakeholders rather than a small group. This is important to consider when reviewing the report because the stakeholders actively participating were rather limited. The committee was dominated by land managing and regulatory agencies and research interests. Industry participation was spotty, and environmental stakeholder participation was by correspondence only.

Definition of abandoned mines for this study

Federal and State agencies have differing definitions of abandoned mines. These differences reflect the different charges and legal authority of the respective agencies. The Committee decided to both list several existing definitions as examples and provide a working definition for this report.

- U.S. Bureau of Mines' [USBM] definition.

"An area representing unreclaimed inactive or abandoned mining or exploration activity. A site may include: adits, shafts, pits, dumps, tailings, structures, roads, exploration, and other associated mining and exploration related features and disturbances:

- Bureau of Land Management's [BLM] definition of abandoned site:

"An unreclaimed site for which BLM never had regulatory authority."

- BLM's definition of inactive site:

"An unreclaimed site for which BLM had regulatory authority."

- Working definition of abandoned mine:

"Previously mined areas and associated waste units, processing plants, and other facilities that have not been reclaimed to a beneficial end use."

SECTION 1. The Water Quality Goal

The State Water Resources Control Board (SWRCB) has under various efforts to manage the quality of the State's water the ultimate goals as stated in the various statutes that for the SWRCB's authority and responsibilities. These are fairly general and pragmatic; for example, the goal Water Code section 13000 "to attain the highest water quality that is reasonable, considering all demands being made...and the total values involved...". Similar

Water Pollution Control Act, U.S. Codes Title A3, Section 1251, aims, among other goals, to restore and maintain chemical, physical and biological integrity of the Nation's waters by eliminating the discharge of pollutants. It is fruitful to consider how these general goals should be applied to the case of abandoned and inactive mines. First, agreement must be reached on what is the highest water quality that is reasonable. This requires some consideration on what natural conditions may have been before mining, to serve as a general guide in restoring chemical, physical, and biological integrity. Second, the total values involved must be weighed, recognizing that abandoned mines are inherently costly to cleanup, and that the State's fiscal resources are limited. Cleanup objectives and water quality goals must, therefore, be established individually for each abandoned mine restoration project. These site-specific goals will differ depending on the magnitude of the pollution problem, cleanup technology, and cost of abatement in the context of varying levels of controls.

Ideally, the ultimate goal of remediating contaminated water, regardless of contaminant type, is restoration of natural pre-mining conditions of surface water and groundwater quality and beneficial uses. Where natural, background conditions are unknown, as is the case for most waters impacted by abandoned mines in California, published generic standards (Basin Plans, regulatory limits, etc.) might be applied to protect designated beneficial uses. However, when these generic standards represent metal concentrations in water and sediments lower than levels representing background concentrations prior to mining, it may be impractical or even impossible to reach these levels. Therefore, one of the first tasks in remediating abandoned mines should be to determine background concentrations for each constituent at the site to be remediated. The complexity of mineralization and hydrologic setting make each deposit unique. However, there are well known mineral deposit types that share many common features [e.g., Cu-Zn massive sulfides, Au-As quartz veins, Hg-As-Sb-Au hot springs, etc.] so that some general guidelines for background concentrations could be established for each deposit type. This approach would require field studies at mineralized, unmined areas in California and elsewhere, as well as computations using available geochemical modeling programs.

In many cases, however, great expenditures would be needed to achieve this goal and results would remain somewhat uncertain. As an alternative to restoring background conditions in these cases, such degraded water system could be evaluated individually with regard to beneficial uses to all biological receptors and the risks posed to those receptors by the mine-derived contaminants. Transport pathways and the relationship of cumulative downstream impacts and the abandoned mine sources would also need to be verified and evaluated. Remediation benefits would be balanced against cost with tasks prioritized and executed accordingly. It may take decades or even centuries to restore quasi-natural conditions, but a phased remediation

over that period should achieve the goal faster than nature alone could.

Reclamation goals must be established pragmatically, to ensure that the best possible improvement in overall basin water quality is achieved for a given expenditure. All interested parties must be willing to accept that this may not necessarily achieve background conditions.

Site-specific examples of water quality goals for abandoned mines in Shasta County exemplify this strategy:

Iron Mountain Mine

- Reduce overall metal loading to the Sacramento River/Delta.
- Meet basin plan objectives for Cu, Zn, and Cd at Keswick Dam near Redding.
- Improve water quality conditions in Spring, Boulder, and Slickrock Creeks downstream of the mine and accomplish some level of beneficial use restoration in these streams.

Mammoth Mine

- Meet basin plan metal objectives in Shasta Lake at the confluence of Little Backbone Creek.
- Eliminate fish-kills in Shasta Lake at the confluence of Little Backbone Creek.
- Improve water quality and restore some beneficial uses in Little Backbone Creek [e.g., recreational and aesthetic uses].

Balakala Mine

- Meet basin plan metal objectives in Shasta Lake at the confluence of West Squaw Creek.
- Eliminate fish kills in Shasta Lake at the confluence of West Squaw Creek.
- Improve water quality and restore some beneficial uses in West Squaw Creek [e.g., recreational and aesthetic uses].

Greenhorn Mine

- Reduce metals loading from the site and improve water quality conditions in Willow Creek downstream of the mine to a level that would allow for the protection and restoration of aquatic life in the stream.
- Reduce overall metal loading to the Sacramento River.

SECTION 2. The Problem Statement

California has a rich history of mining. Unfortunately, mines that now lie abandoned and untended, produce a wide range of environmental problems: severe local water quality degradation; unquantified degradation in downstream areas; and pose a serious threat to public health and the environment. Because of their severe affect on water quality, abandoned mines that are of the greatest concern to the SWRCB are those that release highly acidic mine water from abandoned mine workings and mine waste left over from the mining operations. Many abandoned mines, however, cause environmental and safety concerns even though they are not producing acid waters. Several abandoned mercury mines in the state release mercury in quantities that are either toxic to aquatic life or bio-accumulate in the aquatic food chain. Other abandoned mines are problems simply because of the amount of erosion from untended waste rock piles; for example, the Atlas Asbestos Mine and Coalinga Mill, in Fresno County., are federal Superfund Sites because of the hazard posed by airborne asbestos fibers. After much discussion, however, our committee agreed that, because of the known high costs of abating pollution by acid generating mines, technical and bureaucratic impediments to effective cleanups, and time constraints, the focus of this report would be on degradation caused by acid-generating mines.

Acid-Rock Drainage

Acid-rock drainage is caused by a natural, bio-chemical phenomenon, the oxidation of pyrite and other sulfide minerals in the presence of oxygen and water. Under natural conditions oxidation rate is usually low because the amount of pyrite and the availability of either oxygen or water is limited. Consequently, the natural pollutant load is also relatively low and usually can be assimilated by the local environment. Mining, however, can increase the oxidation rate by many orders-of-magnitude because it sets up conditions conducive to pyrite oxidation by both exposing large amounts of pyritic minerals to oxygen and water and by creating favorable flowpaths for oxygen, water, and wastes. Under such conditions, the local environment is overwhelmed by the pollutant load. Today, active mines minimize the effects of acid mine water by carefully managing water at the site and, if need be, by treating acid mine waters to comply with discharge standards. None of these measures can be employed at abandoned mines, however, without incurring great cost and responsibility for long-term maintenance.

Acidic and metal-laden mine water can poison fish and wildlife. Acidic, metal-laden waters may both discharge from abandoned mine tunnels and percolate through the sometimes large volumes of waste rock, tailings, and overburden which remain on site. Technologies for managing water moving through these materials, preventing acid generation, and preventing trace metal release are not well developed and, in most cases, are insufficient to provide the needed degree of control.

Water Quality Problems - fate and transport in rivers

A significant flux of metals from abandoned and inactive mines enters waters of the state [e.g., USEPA estimates that Iron Mountain Mine discharges about 1 ton of copper and zinc a day to the Sacramento River watershed]. Localized impacts are generally well documented; however, the fate and transport of these metals downstream and their effects on biota far from abandoned mines remain relatively unknown. An improved understanding of metal distribution and transport behavior in small river systems as well as large rivers such as the Sacramento River is critical for effective management of mass emissions on a basin-wide scale. The transport, speciation, and bio-availability of metals in dissolved and suspended forms must be quantified as a function of distance downstream from mine drainages so that informed decisions can be made with regard to prioritization of source-control remediation measures at abandoned mine sites in the context of the potential benefits to downstream users.

Water Quality Problems - effects on groundwater

Groundwater quality may also be affected adversely by pollution from abandoned mine sites [e.g., seepage of acid-mine waters from plugged abandoned mines and contaminated water from abandoned, unlined waste impoundments]. Current abatement measures such as flooding abandoned mine workings by plugging or installing evaporation ponds for acid mine water may actually exacerbate adverse impacts to groundwater quality because resulting changes in hydraulic gradient may cause highly acidic mine water to flow to groundwater. Additionally, the geologic processes that cause mineralization frequently result in the fracturing and faulting of bedrock. Such fractures and faults may act as ready conduits for contaminated ground water from an abandoned mine. As groundwater from abandoned mines flows along fractures and faults it may degrade water supply springs, wells, creeks, and marine environments some distance away. Water which fills abandoned, open-pit gold and base metal mines [e.g., Berkeley Pit, Butte, Montana] that penetrate the water table often becomes severely degraded. Such pits sometimes become large, acidic lakes that pollute regional aquifers after mining has ceased.

An aquifer may become polluted if it is recharged by a reservoir already polluted by acidic mine water, and wells near such reservoirs may draw contaminated water via underflow. Plants may uptake metals in areas where groundwater, polluted by acidic-mine water, is used for irrigation. Abandoned mines may serve as an upstream source of contaminated sediment to marine bays and estuaries where the sediment degrades water drawn by shallow, shoreline municipal drinking water supply wells [after desalination]. Most of these scenarios exist or are suspected to exist in California's Central Coast Region, but the degree and extent of actual groundwater impact is unknown in most cases.

Water Quality Problems - background concentrations

It may be both financially impractical and technically impossible to restore metal concentrations in water and sediment to levels lower than those representing background concentrations prior to mining. Therefore, a logical approach to setting water-quality goals for the remediation of abandoned and inactive mines should involve an effort to determine background concentrations for each metal in each area subject to remediation using a method similar to that described in the second paragraph of Section 1.

Limited funding for cleanup

Funding for cleaning up abandoned mines in California is limited. Many western states have Abandoned Mined Land (AML) clean-up programs funded pursuant to the federal Surface Mining Control and Reclamation Act (SMCRA). SMCRA, in effect, set a precedent by imposing a royalty on current coal producers, the royalty is used to reclaim abandoned coal, and in some states, metal mines. Because California has no coal production subject to SMCRA, the state does not qualify for AML funds. While limited funding is available through various programs (e.g., Cleanup and Abatement funds), no funding is specifically ear-marked for abandoned mine cleanup. Lack of coal derived funds has precluded the establishment of a state AML program similar to those that exist in states such as Wyoming and Montana.

Mines that are currently owned and operated are actively regulated by a number of agencies, and are not part of the problem discussed above. Even though SMCRA set a precedent, however, the modern hardrock mining industry has generally opposed additional taxes and royalties to solve a problem that they regard as society's rather than solely their burden. Mines that are abandoned and have no responsible party for cleanup of the site are the focus of control efforts. There is no systematic, statewide approach to abandoned mine management. Typically, sites are addressed case-by-case, and control of water exiting from abandoned mine tunnels has been the focus of abatement efforts. Because there may be no responsible party, other funding sources must be explored.

Institutional Barriers

A number of institutional and technological barriers have prevented aggressive efforts to cleanup abandoned mine sites. New awareness of the degree of environmental damage caused by abandoned mines, however, has prompted numerous agencies to move aggressively to overcome these barriers.

SECTION 3. Stakeholders and Interests

Note that the SWRCB and the RWQCBs appear in the Stakeholder tables as both regulatory agencies and property owners, land administrators. It is this dual role which has led to

substantial effort and expense by the SWRCB and RWQCBs to meet Basin Plan standards at these sites. An effort should be made to avoid such a dual role in the future by developing a mechanism for limiting the liability of the entities that cleanup abandoned mines as "good samaritans".

Worksheet

Nonpoint source Pollution Management Program State Water Resources Control Board

Identify Stakeholders

Stakeholder	Stakeholder Interest
Current mine owners and operators	<ul style="list-style-type: none"> ● Identify parties financially responsible for cleanups. ● Potential liability for actions such as giving advise. ● May want to donate expertise for cleanup efforts. ● May want operations and reclamation regulations streamlined.
Industry organizations such as the California Mining Association	<ul style="list-style-type: none"> ● Want the case for cleanup supported by data. ● View cleanups as financial opportunities. ● View cleanups as an opportunity for environmental credits. ● Do not want new regulations, legislation, or recommendations that would increase liability for operators.
Current Property owners and land administrators e.g., BLM, U. S. Forest Service, SWRCB (Leviathan Mine), RWQCB (Penn Mine)	<ul style="list-style-type: none"> ● Identify parties financial responsible for cleanups. ● Maintaining good land use. ● Safeguarding the public's health and safety. ● Abating environmental concerns. ● Gaining good public relations via successful cleanup projects. ● Tradeoffs with other future land use. ● Preserving historical and environmental resources. ● Conflicting perspectives.
Regulators e.g., SWRCB, RWQCB, USEPA	<ul style="list-style-type: none"> ● Maintaining and improving water quality [beneficial uses]. ● Protection from liability. ● Safeguarding the public's health and safety. ● Maintaining and restoring environmental diversity [wildlife]. ● Gaining good public relations via successful cleanup projects. ● Having the means to find responsible parties. ● Having streamlined regulations. ● Encouraging cleanups.

Proximate landowners and local communities	<ul style="list-style-type: none"> ● Maintaining property values. ● Having clean drinking water. ● Having minimal health and safety threats from the sites. ● Minimizing public nuisance aspects of the sites.
Environmental Groups	<ul style="list-style-type: none"> ● Having the case for cleanup supported by data. ● Resource protection ● Having the public's health and safety protected. ● Maintaining and restoring environmental diversity [wildlife]. ● Empowerment by having a role in decision making.
Private consultants	<ul style="list-style-type: none"> ● View cleanups as financial opportunities. ● Protection from liability. ● Good public relations and altruism.
State and federal entities that have a consulting role e.g., United States Geological Survey, Universities	<ul style="list-style-type: none"> ● Want research dollars and mines as test bed sites. ● Alternative funding. ● Technology transfer. ● Information and consulting sources.
Lawyers	<ul style="list-style-type: none"> ● Having streamlined regulations. ● Financial opportunity.
Potential responsible parties	<ul style="list-style-type: none"> ● Minimize financial burden. ● Identify other PRP's.

As illustrated in the following table, the "Stakeholders" had a few conflicting interest.

Stakeholder, Interest Compatibility Table

Interest	Common	Compatible	Conflicting
Protection from liability when cleaning up sites or assisting in cleanup efforts	<ul style="list-style-type: none"> ● Current mine owners and operators ● Industry organizations ● Current property owners and land administrators ● Regulators ● Proximate landowners and local communities ● Environmental groups ● Private consultants ● State and Federal consultants ● Lawyers 	<ul style="list-style-type: none"> ● Industry organizations 	<ul style="list-style-type: none"> ● Potentially responsible parties
Protection from liability when cleaning up sites or assisting in cleanup efforts	<ul style="list-style-type: none"> ● Current mine owners and operators ● Industry organizations ● Current property owners and land administrators ● Regulators ● Private consultants ● State and Federal consultants 	<ul style="list-style-type: none"> ● Potentially responsible parties ● Proximate landowners and local communities ● Environmental groups 	<ul style="list-style-type: none"> ● Lawyers
Streamlining of regulations	<ul style="list-style-type: none"> ● Current mine owners and operators ● Industry organizations ● Current property owners and land administrators ● Regulators ● Private consultants ● Potentially responsible parties ● Lawyers 	<ul style="list-style-type: none"> ● Proximate landowners and local communities ● Environmental groups ● State and Federal consultants 	
Financial/work/research opportunity from cleanups	<ul style="list-style-type: none"> ● Industry organizations ● Private consultants ● State and Federal consultants ● Lawyers 	<ul style="list-style-type: none"> ● Current mine owners and operators ● Current property owners and land administrators ● Regulators ● Proximate landowners and local communities ● Environmental groups 	<ul style="list-style-type: none"> ● Potentially responsible parties

Interest	Common	Compatible	Conflicting
Environmental credit opportunity	<ul style="list-style-type: none"> ● Current mine owners and operators ● Industry organizations 	<ul style="list-style-type: none"> ● Current property owners and land administrators ● Regulators ● Proximate landowners and local communities ● Environmental groups ● Private consultants ● State and federal consultants ● Lawyers ● Potential responsible parties 	
Public relations/altruism opportunity	<ul style="list-style-type: none"> ● Current property owners and land administrators ● Regulators ● Proximate landowners and local communities ● Environmental groups ● Private consultants ● State and federal consultants ● Lawyers ● Potential responsible parties 	<ul style="list-style-type: none"> ● Environmental groups 	
Reliable data to support case for cleanup	<ul style="list-style-type: none"> ● Industry organizations ● Regulators ● Environmental groups ● State and federal consultants ● Lawyers 	<ul style="list-style-type: none"> ● Current mine owners and operators ● Current property owners and land administrators ● Regulators ● Proximate landowners and local communities ● Private consultants 	
Safeguarding public health and safety	<ul style="list-style-type: none"> ● Current property owners and land administrators ● Regulators ● Proximate landowners and local communities ● Environmental groups 	<ul style="list-style-type: none"> ● Current mine owners and operators ● State and federal consultants ● Lawyers ● Industry organizations ● Private consultants ● Potentially responsible parties 	

Interest	Common	Compatible	Conflicting
Preserving and restoring environmental and wildlife diversity	<ul style="list-style-type: none"> ● Current property owners and land administrators ● Regulators ● Proximate landowners and local communities ● Environmental groups 	<ul style="list-style-type: none"> ● Current mine owners and operators ● State and federal consultants ● Lawyers ● Industry organizations ● Private consultants ● Potentially responsible parties 	
Preserving historical resources	<ul style="list-style-type: none"> ● Current property owners and land administrators ● Regulators 	<ul style="list-style-type: none"> ● Current mine owners and operators ● Industry organizations ● Private consultants ● State and Federal consultants ● Proximate landowners and local communities ● Environmental groups ● State and Federal consultants 	
Maintaining and anticipating beneficial uses of land, water, and other natural resources	<ul style="list-style-type: none"> ● Current property owners and land administrators ● Regulators ● Proximate landowners and local communities ● Environmental groups 	<ul style="list-style-type: none"> ● Current mine owners and operators ● Industry organizations ● Private consultants ● State and Federal consultants ● Lawyers ● State and Federal consultants ● Potentially responsible parties 	
Maintaining property values	<ul style="list-style-type: none"> ● Current property owners and land administrators ● Proximate landowners and local communities 	<ul style="list-style-type: none"> ● Current mine owners and operators ● Industry organizations ● Private consultants ● State and Federal consultants ● Lawyers ● State and Federal consultants ● Potentially responsible parties ● Regulators ● Environmental groups 	

Interest	Common	Compatible	Conflicting
<p>Miscellaneous</p> <ul style="list-style-type: none"> ● Encouraging cleanups ● Minimizing public nuisance ● Empowerment by having a role in decision making ● Technology transfer justify existence ● Information and consulting sources ● Recycling/remining 	<ul style="list-style-type: none"> ● Proximate landowners and local communities ● Current mine owners and operators ● Industry organizations ● State and Federal consultants ● State and Federal consultants ● Potentially responsible parties ● Regulators ● Environmental groups 	<ul style="list-style-type: none"> ● Practically all stakeholders 	

SECTION 4. Options

Options were identified as a result of free-flowing discussions of the perceived universe of ideas which could result in abating pollution from abandoned mine. All ideas were considered, and they were not held to bureaucratic and other constraints. The interest-based method of problem solving relies on the unfettered flow of ideas to arrive at "elegant" solutions to previously intractable problems; ideas serve as "options". All options put forward during the committee meetings are listed in no particular order. Their need for implementation was also discussed during our meetings and subsequently coded as high [H], medium [M], or low [L].

Options

1. Recycle and extract metals from acid-rock drainage {ARD} and employ metal recycle and extraction technology, [L]:
2. Levy taxes or royalty on producers or consumers, [M]:
3&4. Form a multi-agency advisory group and committee, [H]:
5. Improve technology exchange among interests, [L]:
6. Use abandoned mine sites as test beds, [L]:
7. Inform the public about the what's, where's, and how's of abandoned mine pollution, [L]:
8. Reconsider unobtainable cleanup standards, [H]:
9. Provide for alternative site uses e.g., alkali waste repository, [L]:
10. Study ARD abatement technology including source control, [M]:
11. Promote passive treatment technology, [L]:
12. Promote revegetation, [H]:
13. Form dedicated abandoned mine specialty groups at the Regional Water Quality Control Boards. [M]:
14. Form an "abandoned mines" agency, [M]:
15. Answer questions about regional pollution from abandoned mines, [H]:
16. Support R & D into low cost, low maintenance, effective, abandoned mine pollution abatement technology. [M]:
17. Address acute local pollution problems immediately. [M]:

18. Provide "incentives" [e.g., inkind services, tax credits] for cleanups, [H]:
19. Pool cleanup funds, [H]:
20. Identify potential responsible parties, who can pay, more effectively, [M]:
21. Develop an environmental credit system for cleanups, [H]:
22. Limit liability for those who cleanup and provide an accountable system of checks, balances, and oversight to warrant a limiting of liability, [H]:
23. Update State Board's mining regulations {Article 7, Chapter 15}, [L]:
24. Streamline regulations, eliminate duplication and overlap, and improve consistency internally and among agencies [L]:
25. Competing Interests: Focus on historic preservation and endangered species in making decisions about cleaning up abandoned mine sites [L].

SECTION 5. Evaluation of Options and Interests

The options identified above were evaluated and consolidated into the following reduced list of options. The option "short list" have the best potential to both meet stakeholder needs and water quality goals.

Options Table

Consolidated Options	Singular Options
1. Studies and Technology	<ul style="list-style-type: none"> ● Recycle and extract metals from acid-rock drainage {ARD}, [option 1]. ● Use abandoned mine sites as test beds, [option 6]. ● Study ARD abatement technology including source control, [option 10]. ● Answer questions about regional pollution from mines, [option 15]. ● Support R & D into low cost, low maintenance, effective, mine pollution abatement technology, [option 16].

Consolidated Options	Singular Options
2. Prioritizing Abatement Actions	<ul style="list-style-type: none"> ● Form a multi-agency advisory group and committee, [options 3 & 4]. ● Address acute local pollution problems immediately, [option 17].
3. Apply current technology	<ul style="list-style-type: none"> ● Employ metal recycle and extraction technology, [option 1]. ● Improve technology exchange among interests, [option 5]. ● Provide for alternative site uses e.g., alkali waste repository, [option 9]. ● Promote passive treatment technology, [option 11]. ● Promote revegetation [option 12].
4. Funding for Abatement Projects	<ul style="list-style-type: none"> ● Levy taxes or royalty on producers or consumers, [option 2] ● Provide "incentives" [e.g., inkind services, tax credits] for cleanups, [option 18]. ● Pool cleanup funds, [option 19]. ● Identify potential responsible parties, who can pay, more effectively, [option 20]. ● Develop an environmental credit system for cleanups, [option 21].

Consolidated Options	Singular Options
5. Legislative and regulatory	<ul style="list-style-type: none"> ● Reconsider unobtainable cleanup standards, [option 8]. ● Limit liability for those who cleanup and provide an accountable system of checks, balances, and oversight to warrant a limiting of liability, [option 22]. ● Form dedicated abandoned mine specialty groups at the Regional Water Boards, [option 13]. ● Form an "abandoned mines" agency, [option 14]. ● Update State Board's mining regulations {Article 7, Chapter 15}, [option 23] ● Streamline regulations, eliminate duplication and overlap, and improve consistency internally and among agencies [option 24].
6 Education and Communication	<ul style="list-style-type: none"> ● Inform the public about the what's, where, and how's of abandoned mine pollution, [option 7].
7. Competing Interests	<ul style="list-style-type: none"> ● Focus on historic preservation and endangered species in making decisions about cleaning up abandoned mine sites, [option 25].

SECTION 6. Recommendations

The following recommendations are, in effect, the selected management measures. All recommendations are alternatives to the Guidance Measures because there really are no existing Guidance Measures for abating acid-mine drainage. Consequently, a demonstration that they are as effective at preventing or removing nonpoint pollutants addressed by nonexistent Guidance Measures cannot really be performed. The same scenario exist for an analysis of the economic achievability of the recommendation.

Recommendations Table

Recommendation	Recommendation Explanation
<p>1. Recommend that the SWRCB promote [to Cal EPA] the formation of a multi-agency [state, research, industry, environmental, and federal] policy oversight committee on abandoned mines. The committee would include but not be limited to a geochemist, hydrogeologist, biologist, ecologist, engineering geologist, mineral processing engineer, and a mining engineer. The committee would be politically accountable for monitoring the effectiveness of abatement projects, pursuing funding, establishing criteria for prioritizing, deciding priorities, and concurring on abatement projects in an effort to unify and consolidate our abandoned mine abatement expertise.</p>	<p>The duties of the committee would incorporate the following options and option elements:</p> <ul style="list-style-type: none"> ● Interagency prioritization of target mine sites using information supplied by agency staff, [consolidated option 2]. ● Shared agency funding, [consolidated option 4]. <p>Additional tasks were assigned at the last abandoned mines TAC meeting.</p> <ul style="list-style-type: none"> ● Recommend a <u>state lead agency</u> for administering cleanups within 6 months of committee formation. ● Act as a <u>coordinator, liaison, and advisor</u> to the lead agency. ● Ensure adequate technical review of projects where liability is waived.

Recommendation	Recommendation Explanation
<p>2. Recommend that the SWRCB approve a taskforce of State Board, Regional Board, and Office of Mine Reclamation staff to work on abandoned mines.</p> <p>Normally, an agency does this by developing a specific "program". Currently, however, the SWRCB is in a downsizing mode, so probably the most realistic strategy would be to develop such a taskforce within the confines of the existing organization.</p>	<p>The duties of the Taskforce focus on coordinating the actions of staff who work on abandoned mines, and supporting the multi-agency oversight committee by providing information. Taskforce duties would include the following options and option elements:</p> <ul style="list-style-type: none"> ● Promoting studies and technology. [consolidated option 1]. ● Direct in-house, regional water quality investigations aimed at determining whether abandoned mines cause regional pollution. [consolidated option 1]. ● Apply current technology at abandoned mines selected for abatement work. [consolidated option 3]. ● Optimize the use of several "other" State and Regional Board funding sources. [consolidated option 4]. ● Develop a procedure that limits liability for those who cleanup and provide an accountable system of checks, balances, and oversight to warrant a limiting of liability, [consolidated option 5]. ● Develop the capability to find PRPs who can afford the costs of cleanups, [consolidated option 2]. ● Inform the public about the what's, where, and how's of mine pollution [option 6]. ● Develop a State and Regional Board mine target list, [option 2].
<p>3. Recommend that the Board support the proposed update to the agency's mining regulations {Article 7, Chapter 15} including an update of bonding requirements for active mines.</p> <p>Recent incidents such as the Summitville, Colorado mine failure demonstrate that current bonds are often too small to pay for reclamation. In the case of Summitville [and others], taxpayers pay for the cleanup.</p>	<ul style="list-style-type: none"> ● Although performed by a separate division at the SWRCB, it would take into account newer technology in an effort to minimize future problems [consolidated option 5].

Recommendation	Recommendation Explanation
<p>4. Recommend that the Board support state and federal legislation aimed at improving funding for cleanup, providing incentives for cleanups, and providing relief from unobtainable low contaminant concentration cleanup standards.</p>	<ul style="list-style-type: none"> ● Levy taxes or royalty on producers or consumers, [consolidated option 4]. ● Provide "incentives" [e.g., in-kind services, tax credits] for cleanups, [consolidated option 4]. ● Develop an environmental credit system for cleanups, [consolidated option 4]. ● Reconsider unobtainable cleanup standards, [consolidated option 5].

** The competing interests consolidated option [No. 7] did not enter into the recommendations because it seemed as if it described site specific issues.

SECTION 7. Current Program Summary

State Water Resources Control Board

There is no specific, comprehensive program at either a State or federal level for cleaning up abandoned and inactive non-coal mines. Rather, abandoned and inactive mine cleanups are carried out under a variety of State, federal, and local programs. A few mine cleanups have been carried out under the federal Superfund program, under the State's Chapter 15 program [which regulates discharges of waste to land], and the State's Surface Mining and Reclamation Program. Additionally, the county and federal land management agencies sometimes remove safety hazards at abandoned mine sites. However, there is no comprehensive program for cleaning up abandoned mines.

Department of Conservation

The Surface Mining and Reclamation Act (SMARA) requires that mined lands be reclaimed to a beneficial end use. The Department of Conservation's Office of Mine Reclamation (OMR) has oversight authority to those mines subject to SMARA. Any areas which have been disturbed by surface mining operations since 1976 are subject to the act. OMR employs a staff with technical expertise in mine reclamation. The program provides technical expertise in reclamation planning for proposed new mines as well as abandoned mines.

The Surface Mining and Reclamation Act of 1975 was amended in 1993 to establish a state abandoned minerals and mineral materials mine reclamation program. The program becomes effective upon receipt of funds under the Surface Mining Control and Reclamation Act or through amendments to the federal mining laws. No funding is currently provided through either source, but there is a potential for future funding if federal efforts to

reform the 1872 Mining Law are completed. The program would be administered by the director of the Department of Conservation. The program would provide for reclamation of abandoned mines including sealing, filling, grading, and revegetation. Prevention, abatement, treatment, and control of water pollution created by abandoned mine drainage would also be funded under the program.

SECTION 8. Implementing Recommendations

The recommendations extend beyond the problem statement in that they are applicable to water quality problems other than acid-mine drainage. Implementing the recommendations would provide the basis for a formal Nonpoint Source program for abandoned mines.

SECTION 9. Recommended Specific Program Changes

Implementing the recommendations would provide the basis for a formal Nonpoint Source program for abandoned mines. The recommendations address what the TAC found as the most serious impediments to a statewide abandoned mines reclamation program. These are:

1. Fragmentation of efforts and expertise among federal and state agencies including the State and Regional Water Quality Control Boards.
2. Inaction because of liability concerns.
3. Inaction because of lack of funding.
4. Poorly defined or unrealistic cleanup objectives.
5. Lack of information regarding the regional extent of the problem.
6. A need for better abatement technology.

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