DEFINING PROGRAM OBJECTIVES

Sediment Quality Objectives

Section 13391.5. (d) defines sediment quality objectives as that level of a constituent in sediment which is established with an adequate margin of safety for the reasonable protection of beneficial uses or prevention of nuisances. Section 13393(b) also states that sediment quality objectives shall be based on scientific information including, but not limited to, chemical monitoring, bioassays, or established modeling procedures, and shall provide adequate protection for the most sensitive aquatic organisms.

Identification of Appropriate Beneficial Uses

This program will concentrate on developing objectives that protect two beneficial uses; aquatic life and human health. As described in the May 2003 Workplan, the process to develop sediment quality objectives that are protective of human health is extremely complex and the limited time frame and resources of this program are not sufficient to address all of the issues. The SWRCB will focus on developing objectives to protect aquatic life and to evaluate appropriate methodologies for the derivation of bioaccumulation-based objectives in the future. This evaluation will include an , assessment of modeling approaches to predict the uptake and trophic transfer of sediment associated contaminants.

AQUATIC LIFE

Selection of Surrogate or Indicator of Aquatic Life Protection

Benthic invertebrates will be used as the surrogate or indicator for aquatic life protection. Benthic invertebrates are considered a very good indicator of overall aquatic community health for the following reasons:

1) Sensitivity

Benthic invertebrates typically spend at least one or all life stages in direct contact with bottom sediments. This long term exposure scenario allows for even chronic sublethal toxic effects to cause subtle changes in community structure. These changes in community can then be quantified along pollution gradients.

2) Biological Relevance

Benthic invertebrates are an important component of the food web for fish and birds. Many immature fish develop in bay and estuaries by feeding primarily on benthic invertebrates. Therefore a change in benthic community can significantly affect higher trophic levels as well.

3) Applicability

Spatially, pollutant exposure can be directly linked to the benthic community within a specific area unlike other potential biological indicators such as fish and birds.

4) Ease of Implementation

Benthic communities are used by many state and federal agencies to evaluate the effects associated with impaired sediments, and assessing the effectiveness of mitigation actions Existing data and assessment tools have been developed for many water bodies

throughout the nation. While variability is always a factor when evaluating biological communities, compared to other indicators, the analysis of benthic community data does not rely on complex food web fate and transport studies and models to link a pollutant or stressor to a specific region or trophic level.

Limitations Associated with Benthic Communities
While the use of benthic communities has many advantages and its utility is widely accepted, there are limitations which include:

- Changes in benthic communities associated with non-pollutant related factors such as habitat alteration, changes in temperature and salinity and the introduction of non-indigenous species can be significant

- Response due to chemical stressors in organisms from the same species is also variable.

- Benthic communities do not respond to transient stressors at a scale that can be quantified,

- The ability for some organisms to become tolerant of some pollutants over time.

- Lastly, the special training and experience required to identify species or perform toxicity tests in order to ensure that results are representative and accurately reflect actual conditions at the sampling point.

Quantifying Health of Benthic Communities
The most common tool used to assess and quantify the health of benthic communities are community measures such as richness and abundance. Multiple metrics can be combined into a single index for ease of use and greater sensitivity to pollutant stressors. These indexes are typically validated using a variety of clean and impaired sites to assess the performance under different conditions. More sophisticated indexes have been developed by SCCWRP and others that are capable of delineating more subtle changes in pollutant loading and community response. These include multivariate indexes that are based upon on the mean distribution of a large number of species along a well defined pollution gradient.

Another tool commonly used is the sediment toxicity test that utilizes benthic invertebrates and other aquatic organisms to quantify the potential effects of pollutants in sediments. These tests are typically performed and the endpoints such as lethality or growth inhibition are compared with a reference test. These tests are conducted within a laboratory where other variables that could affect the organism response can be controlled.

These tools are effective at assessing whether benthic communities are being protected however they are less effective at indicating a specific cause of impairment. Other tools and combinations of tools may be used to identify specific stressors.

AQUATIC LIFE PROTECTION

The goal of this program is to develop sediment quality objectives that protect benthic communities from impairment due to pollutant related stress or toxicity. USEPA's document titled Estuarine and Coastal Marine Waters: Bioassessment and Biocriteria Technical Guidance (2000) describes an approach for establishing non-impaired conditions based on biological integrity. The highest level of integrity a benthic community could potentially achieve would be that state where optimal conditions occur and sediment and water quality are in a pristine state. This condition is considered an ideal state that is unlikely to occur under natural conditions.

A lower level of integrity can be defined in terms of a reference condition that represents the highest level attainable within a specific region or water body. The benthic communities that are present under this reference condition can be used as a baseline to define protection. Benthic communities considered impaired or degraded would fall outside the range of integrity that extends from the reference condition up to the ideal or non-attainable pristine condition.

In support of this goal, the SWRCB must develop appropriate endpoints, quantitative tools and supporting methods that also account for natural variability associated with biological indicators and the technical limitations associated with the current state of understanding and knowledge.