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organic and inorganic toxicants, bacteria, and viruses.

From an agricultural perspective, the effects of turbidity on plants and soils include the formation of crusts at the soil surface (which inhibits water infiltration and aeration, impedes seedling emergence, and hinders leaching of saline soils), and the formation of films on plant leaves (which blocks sunlight and reduces photosynthesis and marketability). High colloidal content in water used for sprinkler irrigation can result in deposition of films on leafy vegetable crops such as lettuce, which affects marketability and management. Settleable matter in the water can prematurely decrease reservoir capacity, and increase maintenance requirements on delivery canals due to siltation. Turbidity also increases wear on pumping facilities. As agricultural lands in the Sacramento and San Joaquin valleys continue to be irrigated with low-volume irrigation systems like drip and micro-sprinkle, clogging, maintenance, and on-farm water management (e.g., filtration) requirements will need to be considered when selecting a new system or evaluating water supply. Filtration and maintenance requirements for turbid water for low-volume irrigation can be costly and may make the water unusable.

3.2.2 Loadings of Parameters (or Constituents) of Concern

~~[This section is currently being rewritten. It remains unchanged from its September 2, 1997, version.]~~

Sources of water quality parameters of concern in the Delta and its tributaries include:

- drainage from inactive and abandoned mines that introduce metals such as cadmium, copper, zinc, and mercury; active mines also
- stormwater inflows and urban runoff that may contribute metals, selenium, turbidity, pathogens, organic carbon, nutrients, pesticides, petroleum, and other chemical residues;
- municipal and industrial discharges that may contribute salts, metals, trace elements, nutrients, pathogens, chemical residues, oil and grease, and turbidity;
- agricultural tail-water, or return flows, that may contribute salts, nutrients, pesticide residues, pathogens, and turbidity; ~~and;~~ and organic carbon
- subsurface agricultural drainage that may contribute salts, selenium and other trace elements, nutrients, and pesticides (including some fungicides); and,
- atmospheric deposition that may contribute metals, pesticides, and some organics. also nutrients
- timber harvesting, dairies, road construction are other significant sources, also boat discharges

Where information was available, estimated loadings for parameters of concern were developed. These estimates are shown in Tables 3.6 to 3.154. Source loadings ~~are~~ originate primarily ~~due to either~~ from agricultural drainage, ~~or~~ mine drainage, wastewater discharges, and urban runoff. or They may be modified by flow regulation. These tables ~~illustrate~~ provide the quantitative results of the analysis of the relative loadings of ~~parameters~~ consituents from four of the five CALFED study regions (~~e.g~~ i.e., the Bay, Delta, San Joaquin, and

Which region was left out and why?

Sacramento regions). ~~Note, in the graphs accompanying each table, zero values do not indicate zero loads, but rather a lack of information (as depicted in the tables).~~ Additional information that was used in compiling these tables can be found in ~~Attachment B~~ Attachment C.

Is this paragraph redundant w/ previous paragraph?

Load estimates were made for four regions;; the Sacramento River Basin, the San Joaquin River Basin, the Delta, and the Bay Region. The Sacramento River Basin estimates were further subdivided into loads generated above and below the three major dams, Shasta, Oroville, and ~~Nimbus~~ Folsom.

Load estimates ~~will be~~ were used to help evaluate ~~determine~~ the relative importance of different ~~parameter of concern~~ sources and the potential effectiveness of CALFED water quality actions. For example, it may be determined that municipal and industrial wastewater treatment plants contribute less than 5 percent of the copper discharges to the Delta. It is apparent from the copper loading estimates that additional measures to reduce copper from this source are unlikely to ~~greatly~~ significantly affect copper concentrations in the Delta.

Analytical Approach and Organization of Information

Considerable information on pollutants discharged to the Sacramento River Basin, the San Joaquin River Basin, the Delta, and the Bay Region, as well as ~~and~~ pollutant concentrations found in various water bodies, is available, but it is not found in a single ~~d~~repository. Developing a ~~comprehensive picture~~ estimates of pollutant loadings involvesd compilation of potentially relevant data from published and unpublished sources, review of the data by the CALFED water quality team and, in many cases, further ~~manipulation~~adjustment of the data ~~into the form of~~ to provide the most realistic load estimates possible.

Pollutant load estimates are difficult to make for large geographical areas because data are always limited and many assumptions ~~have to~~ must be made. The approach used here was to try to make fairly complete load estimates for the various ~~parameters~~ constituents, even if fairly gross assumptions ~~have to be made. The load estimates will then be progressively refined as additional data are acquired and analyses completed~~ are required.

The ~~following analytical report includes a number of~~ results of the analysis are summarized in nine separate sections which address~~ing~~ each key ~~parameter~~ constituent of concern. Each section ~~consists of~~ contains a tabular ~~and graphical~~ summary of loading data and a series of notes. ~~The~~ Additional notes (see Attachment C) describe the data sources and any analyses undertaken to produce the load estimates.

Two approaches to load estimation were used, and where possible, their results were compared in the tabular~~and graphical~~ summaries. The first approach was to estimate the loads attributable to each of the major sources and then to sum the loads ~~up~~ to provide a total basin load. Major contaminant source categories include agricultural ~~stormwater~~ tailwater (surface) runoff and subsurface drainage, mine drainage, municipal and industrial wastewater discharges, and urban stormwater runoff. Loadings from these

sources are typically associated with discharges from outfalls and/or agricultural drains.

The second approach was to estimate the total pollutant emission from each basin ~~by calculating the load contained in water exiting the basin at its downstream end~~based on in-stream flows and water quality data. The loads calculated using the two approaches are not directly comparable because some of the pollutants discharged to waterways in a basin may be stored in sediments, reservoirs and biota, or transformed into other substances as a consequence of chemical reactions and biological activity. However, they do provide a means to check for order-of-magnitude reasonableness.

Limitations

Because of the many assumptions and simplifications involved in the load estimates, the results ~~need to~~ are only order-of-magnitudes estimates and they should be used with caution. Moreover, informational gaps precluded making estimates for all sources, including many that are considered to be major. The more important assumptions and simplifications are noted below.

Year-to-year variations

Most contaminant sources are affected by meteorological conditions. For example, ~~T~~ the total annual contaminant loads from agricultural and urban runoff depend on the volume of runoff, which can vary widely from year-to-year. Similarly, annual ~~M~~ mine drainage loads are ~~similarly~~ weather-dependent. Waste loads associated with municipal and industrial wastewater discharges are less affected by weather. The same may be true for waste loads in agricultural subsurface drainage, which probably depend more on irrigation rates than precipitation.

Because the data available to characterize contaminant loads ~~is~~are limited, ~~it was~~ they were not separately compiled for different meteorological conditions. Ideally, loads should be separately estimated for wet, normal, dry, and very dry years. Instead, data from different years, representing different meteorological conditions, were compiled to produce a single annual load estimate. ~~that may approximate "typical" conditions~~ Thus, they are not truly representative of actual conditions. Then why present them?

Seasonality of loadings

Most contaminant emissions vary seasonally. The initial load estimates contained in this report were made on an annual basis. ~~If the available data allows, later refinements may be made to the load estimates to account for seasonality~~ In cases where pollutant effects are seasonal, seasonal loads may be a more appropriate indicator than annual loads.

Background loads

The load estimates do not attempt to account for background loads. Many substances regarded as contaminants occur at low concentrations in waters not ~~m~~influenced by human activities. This is the case for metals and trace elements, salts, naturally-occurring organic substances and ~~plant~~ nutrients. ~~This~~ It does not apply to synthetic organics, including pesticides.

Table 3.6 Bromide Loading

Th~~e~~is lack of allowance for background loads probably does not greatly affect load estimates for relatively concentrated waste streams. If, for example, a city draws water from a river, uses it for municipal supply and discharges it back to the river ~~after~~following wastewater treatment, then the phosphorus load attributable to the municipal wastewater discharge is the load contained in the effluent less the background load contained in the source water. In this case, the background phosphorus concentration might be 0.05 mg/l while the concentration of phosphorus in the wastewater effluent would ~~be~~range from 5 ~~or~~to 10 mg/l. Thus ~~T~~the phosphorus load attributable to the municipal source would be similar, whether or not the background concentration ~~is allowed for~~was considered.

However, the ~~L~~lack of ~~an~~ adjustment for background loads can have ~~a~~ greater effects on loads attributable to dilute, but high-volume, waste streams. For example, copper concentrations in agricultural runoff may be estimated ~~to be~~at 0.01 mg/l, while copper concentrations in runoff from non-agricultural lands with similar soil chemistry characteristics may be 0.005 mg/l. ~~Not~~