

CALFED Bay-Delta Program Approach To Impact Analysis

Introduction

This report summarizes the approach the CALFED Bay-Delta Program (CALFED) will use to determine the impacts of alternatives. The report is divided into sections, each of which describes the assessment methods that will be used to assess changes in each resource area. Each section discusses, in general terms, the types of effects that CALFED alternatives are likely to have on the resource being discussed, lists the changes to that resource that will be used to measure impacts of the alternatives and provides brief discussions of the methods CALFED proposes to use to conduct the programmatic impact analysis. The relationships between the analysis of the various resource areas are described briefly at the end of each section.

Background

The CALFED Bay-Delta Program (CALFED) began in June 1995 as a collaborative effort to address a declining ecosystem, uncertain water supplies, imperiled water quality, and unstable levees in California's Bay-Delta region, where the San Francisco Bay meets the Sacramento/San Joaquin River Delta.

CALFED has divided its work into three phases. During Phase I, from June 1995 to September 1996, CALFED identified the problems, developed a mission

statement and several guiding principles (the "solution principles"), and designed three programmatic alternatives as possible solutions to Bay-Delta problems. In Phase II, from June 1996 to fall 1998, CALFED will conduct a broad-based environmental review of the three programmatic alternatives and will identify the single preferred program. Upon completion of Phase II and during Phase III, the preferred alternative will be implemented.

Each of the three programmatic alternatives is designed to address Bay-Delta problems comprehensively. The alternatives share common program objectives that include water-use efficiency, ecosystem restoration, water quality protection, and levee system improvements. The alternatives include a range of water storage options and differing conveyance configurations. Alternative 1 uses the existing system of Delta channels, alternative 2 uses the existing system with significant channel modifications, and alternative 3 uses both the existing system with significant changes and an isolated facility.

The environmental changes associated with each CALFED programmatic alternative will be analyzed in a Programmatic Environmental Impact Report/ Environmental Impact Statement (EIR/EIS) during Phase II. The primary purpose of the Programmatic EIR/EIS is to

inform decision makers about the environmental consequences of the alternatives and to identify a preferred alternative. Changes in resources, such as air quality, recreation, and cultural resources, will be analyzed to distinguish relative detrimental and beneficial impacts of each alternative.

Programmatic Impact Analysis and Assessment Methods

Impact analyses are used to assess the potential beneficial and detrimental impacts of each alternative by evaluating important changes to resources. Assessment methods are the tools that will be used to evaluate these important changes. The results will be used in the programmatic impact analysis to determine the effects of CALFED actions, components, and alternatives.

Assessment methods may include:

- qualitative descriptions: general narratives or written hypotheses, assembled from existing information, that provide a reasonable scientific basis for predicting environmental impacts and benefits;
- quantitative indices: quantitative estimates that provide a relative measurement of impacts and benefits; and
- models: series of interacting or complex relationships, variables, and weighting factors that provide a quantitative measurement of impacts and benefits.

Qualitative descriptions based on existing studies, historical data, and expert opinion will be used when no specific quantitative method exists, when the relationships between program actions and assessment variables are not easily quantifiable or well known, or when the available data is insufficient for more complex analysis.

In many cases, potential changes to resources are complex or difficult to measure. In these situations, impacts will be analyzed by measuring changes to related elements known as assessment variables. The results of the analyses of changes to individual assessment variables might be combined to determine the overall affect on the resource category. Table 1 lists the resource categories, assessment variables to be evaluated, and related information to be measured for use in the Programmatic EIR/EIS.

CALFED staff has discussed potential assessment methods with resource experts from agency and stakeholder groups. Feedback from these experts and subsequent communication on a variety of resource categories have helped form the programmatic assessment process to be used in the Programmatic EIR/EIS.

The remainder of this document provides a summary of the proposed assessment methods that will be used for many of the resource categories.

CALFED Bay-Delta Program
Early Impact Analysis
For the Programmatic EIR/EIS

Draft

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Early impact analysis is possible for items marked with an ✓. Many of these categories will be revisited to evaluate operational based impacts once the alternatives are complete.

I. PHYSICAL ENVIRONMENT

A. Surface-Water Hydrology

Important Changes to be Evaluated

Volume of flow

Timing of flow

Related Information to be Measured

Rainfall

Snowmelt

Groundwater discharge

Direct runoff

Evapotranspiration from program features (soil moisture, vegetation [e.g., terrestrial, agricultural crops, riparian, wetlands], open-water area)

Seasonal weather pattern variation

B. Groundwater Hydrology

Important Changes to be Evaluated

Groundwater supply

Conjunctive use supply

Related Information to be Measured

Basin storage capacity

Groundwater recharge

Groundwater withdrawals

C. Riverine Hydraulics

Important Changes to be Evaluated

Depth, width, and velocity

Related Information to be Measured

Slope of water surface and channel bed
Channel or floodplain roughness (resistance)
Water viscosity
Hydrographs
Channel geometry
Instream and bank erosion: channel loss; riparian loss
(e.g., from channel migration, recreation, wind,
current); gravel loss; conveyance loss
Sediment movement
Channel geomorphology

D. Water Management Facilities and Operations

Important Changes to be Evaluated

Reservoir storage volumes, releases, and spills

Related Information to be Measured

Capacity
Elevation
Runoff
Flood control storage
Diversion targets
Instream targets

Instream flow targets, deficits, and surpluses

Instream targets
Runoff
Storage
Diversion targets
Transport

Diversions/exports targets, deficits, and surpluses

Runoff
Diversion targets
Diversion limits
Reservoir storage
Groundwater pumping

Agricultural drainage volumes

Rainfall
Irrigation
Soils
Drainage facilities

Water Use Efficiency

Urban water use efficiency and conservation measures
Agriculture water use efficiency and conservation measures
Diverted environmental water use efficiency and conservation measures

Remaining opportunities for water management

Spills/surplus outflow
Unused conveyance
Carryover storage
Urban stormwater drainage volumes

E. Bay-Delta Hydrodynamics

Important Changes to be Evaluated

Delta outflow

Delta inflows
Channel depletions
Exports

X2 location

Outflow
Tidal mixing

Channel flows at key Delta locations

Delta inflows
Channel depletions
Exports
River diversions
Transport

Water entrainment in diversions/exports

Delta inflows
Channel depletions
Exports
River diversions

F. Flood Control System

Important Changes to be Evaluated

Hazards to the levee system

Related Information to be Measured

Overtopping failure (flood stage elevation)
Mass failure (potential for erosion, stability, seepage, and seismic failure)

Changes in flood location, depth or duration

Flood modeling

Relative risk of levee failure

Hazards (potential failures)

✓Levee improvements (projected nonproject levees)

✓Levee design standards and guidelines

Seismicity (risk of levee failure during a seismic event)

Levee structural integrity

G. Water Quality

Important Changes to be Evaluated

✓Ecosystem Water Quality

✓Urban Water Quality

Related Information to be Measured

Metals:

Cadmium

Copper

Mercury

Selenium

Zinc

Organics/Pesticides

Carbofuran

Chlordane

Chlorpyrifos

DDT

Diazinon

Polychlorinated bipheyls (PCBs)

Toxaphene

Ammonia

Dissolved oxygen

Salinity (total dissolved solids [TDS],
electroconductivity [EC])

Temperature

Turbidity/Transparency

Bromide

Nutrients

Pathogens

Salinity

Total organic carbon (TOC)

Turbidity

Viruses

✓ Agricultural Water Qua

Boron
Chloride
Nutrients
pH
Salinity
Sodium adsorption ratio (SAR)
Turbidity
Temperature

H. Geomorphology and Soils

Important Changes to be Evaluated

✓ Surface soil erosion

✓ Soil salinity

Subsidence caused by peat oxidation

Subsidence caused by groundwater withdrawals

Related Information to be Measured

Agricultural soil loss

Wind

Stormwater

Soil geology

Applied EC

Agricultural drainage

Peat content

Soil moisture

Ground disturbance and tilling practices

Groundwater levels

Aquifer clay content

I. Air Quality

Important Changes to be Evaluated

✓ Ozone

✓ Carbon monoxide

✓ Particulate matter

Related Information to be Measured

Construction activities

Agricultural operations

Pump operations

Construction activities

Agricultural operations

Pump operations

Construction activities

Agricultural operations

Pump operations

Wind and soil conditions

J. Noise

Important Changes to be Evaluated

- ✓ Short-term construction noise
- ✓ Noise from aquatic recreation (i.e., boating)
- ✓ Noise from terrestrial recreation (i.e., hunting)
- ✓ Noise from facilities operation

K. Traffic and Navigation

Important Changes to be Evaluated

- ✓ Navigation
- ✓ Railways
- ✓ Ferries
- ✓ Airports
- ✓ Roadways

II. BIOLOGICAL ENVIRONMENT

A. Fisheries and Aquatic Ecosystem

Important Changes to be Evaluated

- ✓ Habitat

Related Information to be Measured

Flow including instream flow, net channel flow, tidal flow, estuarine salinity
Temperature
Substrate
Physical Habitat
Water Quality including agricultural salinity, thermal pollution, Dissolved oxygen, nutrient availability, toxicants, transparency
Species interactions including predation, competition, disease, exotic plants

✓Foodweb support

Flow including instream flow, net channel flow, tidal flow, estuarine salinity

Reservoir Elevation

Temperature

Substrate Habitat

Physical Habitat

Water quality including agricultural salinity, thermal pollution, dissolved oxygen, nutrient availability, toxicants, transparency

Species Interactions including predation, competition, disease, exotic plants.

Access

Flow including instream flow, net channel flow, tidal flow, estuarine salinity

Reservoir Elevation

Temperature

Physical Habitat

Barriers

Water Quality including agricultural salinity, thermal pollution, dissolved oxygen, nutrient availability, toxicants, transparency

Species Interactions including predation, competition, disease, exotic plants.

✓Artificial Production

Water Temperature Condition

Flow including instream flow, net channel flow, tidal flow, estuarine salinity

Reservoir Elevation

Temperature

Barriers

Water Quality including agricultural salinity, thermal pollution, dissolved oxygen, nutrient availability, toxicants, transparency

Species Interactions including predation competition, disease, exotic plants.

✓Diversion

Physical Habitat
Diversion

Species Interactions including predation competition,
disease, exotic plants.

Water Surface Level

Flow including instream flow, net channel flow, tidal
flow, estuarine salinity

Reservoir Elevation
Substrate
Physical Habitat

Species Interactions including predation competition,
disease, exotic plants

✓Toxicant Concentration

Flow including instream flow, net channel flow, tidal
flow, estuarine salinity

Reservoir Elevation

Water Quality including agricultural salinity, thermal
pollution, dissolved oxygen, nutrient availability,
toxicants, transparency

Species Interactions including predation competition,
disease, exotic plants

✓Fishing

Fishing including timing, location, method, and rate

Species Interactions including predation
competition, disease, exotic plants

✓Predation

Physical Habitat
Barriers
Artificial Production

Species Interactions including predation competition,
disease, exotic plants

B. Vegetation and Wildlife

Important Changes to be Evaluated

- ✓ Area and condition of habitat

- ✓ Area of agricultural land use providing habitat value

- ✓ Agricultural operations and land use practices on habitat values

- ✓ Connection and orientation of habitats

- ✓ Changes in non indigenous/introduced species populations

- ✓ Changes in ecological processes that sustain habitats

Related Information to be Measured

Open water and tidal wetlands
Saline, brackish and freshwater wetlands
Riparian and riverine habitats
Upland habitats

C. Special Status Species

Important Changes to be Evaluated

- ✓ Number of known populations of special-status species (✓terrestrial only)

- ✓ Area and condition of habitat occupied by special-status species(✓terrestrial only)

III. ECONOMICS AND SOCIAL ENVIRONMENT

A. Land Use

Important Changes to be Evaluated

- ✓ Acres in agricultural use

- ✓ Acres in open space and habitat use

✓Acres in developed use

✓Indian trust assets

B. Agricultural Economics

Important Changes to be Evaluated

✓Value of agricultural production

✓Cost of production

✓Agricultural net income

✓Cost of water supply variability

✓Costs of water agricultural water use efficiency

Related Information to be Measured

Acres in production

Crop prices

Crop choices

Crop yield

Cost of surface water used

Groundwater costs

Production costs

Acres in agricultural production

Crop revenue

Production costs

Water transfers

Certainty in water supply and cost

Indirect/third-party impacts

Irrigation efficiency and costs

C. Municipal and Industrial Water Supply Economics

Important Changes to be Evaluated

Cost of water supply

Cost of water shortage

Cost of treatment

Cost of urban water use efficiency

Related Information to be Measured

Surface-water supply and distribution

Groundwater pumping costs

Alternative water supplies and cost

Water transfer costs

Infrastructure costs for water conveyance and distribution

Water supplies

Consumer willingness to pay and demand elasticity

Quality of water supply

Constraints to treatment

D. Flood Control Economics

Important Changes to be Evaluated

Potential flood damage and resources at risk

Existing and planned property values
Existing and planned utility and
infrastructure values
Distribution of values lost from levee failure
Natural resource values (including protected species)
Cost of repair and rehabilitation of facilities after
levee failure
Maintenance of Delta water quality
Values of resources at risk
Cost of flood damage protection

E. Fish, Wildlife, and Recreation Economics

Important Changes to be Evaluated

- ✓ Recreation-related spending
- ✓ Recreation benefits
- ✓ Commercial fishing harvest values
- ✓ Recreation employment and net income

Related Information to be Measured

Recreation use and opportunity
Distance traveled to recreation area
Value of recreation resource
Recreation use and opportunity
Income
Catch

F. Regional Economics

Important Changes to be Evaluated

- ✓ Income
- ✓ Employment

Related Information to be Measured

Agricultural income
Recreational expenditure
Commercial fishing income
Municipal and industrial water expenditure
Indirect income (i.e., third-party effects)
Agricultural
Recreation-related
Commercial fishing
Municipal and industrial water expenditure
Indirect employment (i.e., third-party effects)

✓Fiscal conditions

Property tax revenues
Sales tax revenues
Public costs/costs of actions
Indirect (i.e., third-party) fiscal effects

G. Power Production and Energy

Important Changes to be Evaluated

Quantity and value of energy produced

Quantity and cost of energy consumed

Related Information to be Measured

Reservoir elevation
Reservoir releases
Seasonal power value

Groundwater pumping
Surface-water pumping
Seasonal power costs

H. Recreation Resources

Important Changes to be Evaluated

✓Recreation opportunities

✓Recreation use

Related Information to be Measured

Resource conditions and availability

Regional population and demographics
Demand for recreation resources

I. Visual Resources

Important Changes to be Evaluated

✓Visual quality

Viewer sensitivity

J. Cultural Resources

Important Changes to be Evaluated

✓Risk to prehistoric sites

✓Risk to historic sites

Related Information to be Measured

Acreage of ground disturbance from
construction

Distribution of culturally sensitive land forms
Locations of known sites

Association of historic sites with land
conditions

Locations of known sites

K. Public Health and Environmental Hazards

Important Changes to be Evaluated

- ✓ Area of mosquito breeding habitat
- ✓ Area of habitat that supports other disease vector populations
- ✓ Risk of contact between humans and vector populations
- ✓ Risk of hazardous material and waste upset (construction and operation)

Related Information to be Measured

Known hazardous material sites

L. Utilities and Public Services

Important Changes to be Evaluated

- Electrical supply and use
- ✓ Water conveyance
 - ✓ Transportation facilities (e.g., roads, railroads, and ferry)
 - ✓ Deep water ship channels and shipping ports
 - ✓ Natural gas fields and storage reservoirs
 - ✓ Underground pipelines
 - ✓ Communications facilities
 - ✓ Police, fire, and emergency services

M. Social Well-Being

Important Changes to be Evaluated

- ✓ Community stability
- ✓ Environmental justice

Related Information to be Measured

Demographics
Regional economics

Demographics
Regional economics