SECTIONONE Introduction

1.1 PURPOSE OF THE REPORT

The purpose of this report is to identify the changes in the physical and chemical environments, and biological communities, of San Francisco Bay (the Bay) that may result from the runway reconfiguration alternatives under consideration for San Francisco International Airport (SFO). This report focuses on potential project-related changes in hydrodynamics, hydrology, aquatic sediments, water quality, and aquatic biotic communities. This report is not intended to represent a complete environmental impact assessment of the reconfiguration alternatives. Rather, it is intended to provide one scientific basis upon which such assessments may be developed for the Environmental Impact Report (EIR) and an Environmental Impact Statement (EIS) that are currently being prepared regarding the runway reconfiguration.

1.2 ORGANIZATION OF THE REPORT

The following portions of Section 1 of this report present a discussion of the relationship of the physical and chemical environments, and biological communities, that may be affected by the runway reconfiguration. A conceptual model is presented as part of this discussion to illustrate how the physical and chemical changes that may result from the construction of the reconfigured runways might affect biological communities in the Bay.

Section 2 of the report presents a description of the existing biological communities in and adjacent to those portions of the Bay most likely to be affected by the development of a new runway layout at SFO. This section includes discussions of the various habitat types found in this area of the Bay, descriptions of the existing planktonic, benthic, and plant communities, and descriptions of the fish, amphibians, reptiles, birds, and mammals known to exist in this portion of the Bay.

Some appendices, tables, and figures associated with Section 2 include data on locations that are not part of the assessment of potential changes to the Bay that is the subject of this report. These data were collected for the broader EIR and EIS assessment prior to the decision to prepare this report, or concern locations in the Bay that were under consideration earlier in the process, but which are no longer under consideration. Examples of such data include data on in-bay borrow areas no longer under consideration, data on the San Francisco Bar Ship Channel area, and data on upland biotic communities at potential fabrication sites. In preparing this report it was determined to be more efficient to leave unchanged such appendices, tables, and figures, even though they contain data not discussed in this report. We have noted where this has been done either in the text or through footnotes.

Section 3 of the report presents a description of the existing hydrodynamic, hydrologic, sediment, and water quality conditions in the Bay in the vicinity of SFO. These discussions address tides, circulation, waves, freshwater inflow, bathymetry, sea-level rise, sediment transport, sediment quality, water quality, and residence time. The purpose of this discussion is to identify the existing physical and chemical conditions that support the existing biological communities described in Section 2.

Section 4 presents a description of the runway reconfiguration alternatives under consideration in the EIR and EIS that may affect the physical and chemical conditions in The Bay described in

Section 3. This description does not include all the alternative methods to meet the need for and purpose of the runway reconfiguration that will be addressed in the EIR and EIS. Rather, this description focuses on those aspects of the construction and configuration of the runway alternatives that clearly have the potential to affect the existing physical conditions in the Bay. Included in this description are:

- Runway reconfiguration alternative BX-6 (Alternatives A-3 and BX-R are not included in this submittal)
- Two alternative types of runway platforms (all fill, fill/pile-supported hybrid)
- Potential in-bay dredging or borrow areas
- Potential in-bay dredged material placement areas
- Possible in-bay material rehandling basins
- Alternative types of dredging operations
- Alternative types of marine construction activities
- Projected construction schedules for each of the reconfiguration alternatives

Section 5 of this report presents a description of the changes in hydrodynamics, hydrology, sediments, and water quality that are projected to occur as a result of the construction on each of the runway reconfiguration alternatives. (Alternatives A-3 and BX-R are not included in this submittal.) This section begins with an extensive description of the assessment and modeling methodologies used to identify potential changes, including modeling scenarios, decision tree analyses, descriptions of models, model set-up and calibration, and assumptions regarding hydraulic conditions used in the analyses. This section then presents the results of the assessments and modeling for both final configuration of the alternatives (BX-6 only in this submittal), and the construction process for each. Projections are provided for changes in circulation, tidal elevations and phase, waves, sediment transport, water quality, and flooding.

Section 6 presents a discussion of the changes in the biological communities presented in Section 2 that are projected to result from the changes to physical and chemical conditions presented in Section 5. This discussion uses the conceptual model presented in below to explain the mechanisms by which physical and chemical changes resulting from the runway reconfiguration alternatives may affect future biological communities in the Bay.

Section 7 presents a summary of the findings of the analyses presented in the previous sections of the report.

1.3 CONCEPTUAL MODEL OF THE RELATIONSHIP BETWEEN THE PHYSICAL AND BIOLOGICAL ENVIRONMENTS

1.3.1 Purpose of the Model

The conceptual model presented in this report is not intended or designed to represent a comprehensive analysis of all the interactions of physical, chemical, and biological conditions

that operate within the Bay. Such a model is beyond the scope of the EIR and EIS processes. Rather, the model presented here is designed as a tool to help clarify for the reader the mechanisms and relationships that must be considered in assessing the potential changes in the physical, chemical, and biological conditions of the Bay that may result from each of the runway reconfiguration alternatives.

1.3.2 Design of the Model

1.3.2.1 Introduction

A graphic representation of the conceptual model is presented on Figure 1.3.2-1. As indicated, an underlying assumption of the model is that a defined number of key physical drivers control the physical and chemical environment of the Bay. These physical drivers control a set of physical and chemical conditions (biological drivers) that in turn control the biological communities that exist in the Bay - in concert with a variety of biological factors. An underlying assumption of this model is that the runway reconfiguration would result in changes to the physical structure of, and chemical input to, the Bay, which then would result in changes in the physical and chemical conditions, which would in turn result in changes in biological communities in the Bay.

1.3.2.2 Underlying Physical Drivers and Relationship to Biological Drivers

Five general sets of physical drivers have been defined for the model:

- Water constituents - including salt, contaminants, nutrients, and other organic and inorganic compounds
- Hydraulic drivers - including tides, wind, and freshwater inflow
- Structure and bathymetry - the basic existing shape of the Bay and structures within it (such as piers and groins)
- Physical characteristics of Bay sediments - primarily geologic characteristics
- Other physical conditions - such as noise, vibration, and human disturbance

These physical drivers work in combination to create or control the physical and chemical conditions that are biological drivers. The hydraulic drivers (tide, wind, inflow) combined with the physical bathymetry of the Bay determine the circulation patterns in the Bay. Constituent input to the Bay, Bay circulation, and sediment characteristics determine water quality in the Bay. The bathymetry and structure of the Bay controls the extent of various habitat types within the Bay, but habitat is also influenced by sediment characteristics and water circulation. Basic sediment properties combined with constituent input, water circulation and habitat determine sediment quality in the Bay.

The model also recognizes that a number of parameters are important to aquatic biological communities that are not directly related to the physical and chemical processes. The levels of

noise, vibration, and human disturbance may affect biological communities in the Bay separately from water circulation and water chemistry influences.

1.3.2.3 Biological Drivers and Relationship to Biological Communities

Five types of physical and chemical conditions have been identified as "biological drivers" in the model, all are physical parameters or conditions that often are measured to indicate the condition of the Bay. These parameters include:

- Water quality - including both chemical composition and physical properties of Bay waters
- Water circulation - including currents and residence time of Bay waters
- Habitat - including the area or volume of several habitat types such as mudflats, marshes, and open water
- Sediment quality - including both the physical and chemical composition of sediments
- Other forms of disturbance - such as noise and human disturbance

These conditions play significant roles in the existence of biological communities in the Bay. Benthic biotic communities are largely controlled by sediment quality, water quality, water circulation, and habitat area, as well as by interaction with other biological communities. Water quality, water circulation, habitat volume, and various types of disturbance control pelagic communities, along with interaction with other biological communities. The avian and mammal communities are controlled by habitat area, various forms of disturbance, and by the availability of various food source communities (such as the benthic community) that are more directly controlled by physical parameters such as water and sediment quality.

1.3.2.4 Relationships Between Biological Communities

As indicated on Figure 1.3.2-1, complex biological relationships influence the individual biological communities concurrent with the influence of physical and chemical conditions. Figure 1.3.2-1 is not intended to indicate all of these relationships. To do so would make the model so complex that it would be reduced in value. Rather, the model is intended to illustrate general relationships of biological communities, such as the dependence of marine mammal populations on the availability of food sources represented by the benthic and pelagic communities. The discussion of key relationships between biological communities is presented in Section 6 of this report.

1.3.2.5 Operation of Project Impacts Within the Model

The model is based on the premise that a project such as the runway reconfiguration would modify the relationship of the underlying physical and chemical drivers with the biological drivers. The key areas of impact considered include:

- Changes in bathymetry due to fill placement (or structures) for runways, or dredging of access channel or borrow areas, would modify the interaction of bathymetry with hydraulic drivers, thus changing water circulation.

- New structures in the Bay would directly create new areas of one type of habitat (hard bottom) while displacing others (open water and soft bottom).
- Dredging operations would result in resuspension of bed sediments and associated contaminants, thus modifying the input of constituents to the water column and affecting water quality during the period of dredging operations.
- Sediment disturbance from dredging operation would modify the characteristics of surficial bed sediments, and may contribute to a changes in the area of some kinds of benthic or intertidal habitats.
- Modified stormwater runoff characteristics (in terms of volume, location, timing, and contaminant load) may change the constituent loading to the Bay, thus changing water quality and sediment quality.
- The additional human activity associated with construction and operation of the new runways would modify the existing levels of disturbance that affect some biological communities such as fish, birds, and mammals.

1.3.3 Application of the Model

The thought process behind the development of the model has guided the development of the methodologies used in the assessment described in the following chapters. The model has been used to identify key relationships between the controlling factors, physical and chemical conditions, and biological communities of concern. The model has been used to insure that the analyses performed provided a sound scientific basis for assessing the cumulative changes that would result from the runway reconfiguration alternatives.

1.3.3.1 Projection of Changes in Physical/Chemical Parameters

Changes associated with modified "inputs" to the Bay (i.e., platform footprint and dredging activities) may alter hydraulic, sediment, and water quality parameters. For instance, alteration of the platform footprint will change the hydrodynamics in and around the proposed platform. These changes include modified current speed and direction, namely increased current speed and altered current direction off the tips of the new runways. Conversely, currents in regions near the existing platform footprint may slow down behind the new runway sections creating more quiescent hydrodynamic conditions.

Changes to hydraulic parameters will most likely modify existing sediment parameters, including suspended sediment concentrations and depositional/erosional patterns. An increase in current speed increases the capacity for the water to suspend and transport sediments from the immediate vicinity, causing a subsequent increase in suspended sediment concentrations as well as increased erosion to those areas. Conversely, a decrease in current speed will lessen the capacity for the water to suspend and transport sediments, which will cause a decrease in erosion due to decreased shear stresses. Modification to existing current directions could alter suspended sediment distributions within the Bay and subsequent deposition/erosional patterns.

The hydrodynamic changes that lead to potential changes in sediment parameters may in turn lead to changes in water quality parameters. An increase in suspended sediment concentration due to increased current speed may lead to an increase or decrease in total contaminant concentration depending on relative contaminant concentration gradients. If relatively "dirty" sediment, or more contaminated sediment, is released into the water column, the likelihood of desorption of contaminants, or "sloughing" of the contaminants into the aqueous phase increases, increasing the dissolved contaminant concentration. Conversely, if relatively "clean" sediment, or less contaminated sediment, is released into the water column, the likelihood of adsorption of contaminants, or "scavenging" of contaminants from the aqueous phase in water column to the sediment particles in the water columns increases, resulting in a decreased dissolved contaminant concentration. The same potential effects apply to sediments released during dredging activities. Erosional and depositional pattern changes could also change water quality patterns. Changes to hydrodynamic parameters may lead to a chain effect on sediment and water quality parameters, which may lead to potential changes to biological communities with the Bay.

1.3.3.2 Projection of Changes to Biological Communities Resulting from Changes to Physical/Chemical Parameters

The use of the model to project the changes in biological communities that would result from changes in the physical and chemical environment is more subjective. These assessments have not been based on mathematical models, but reflect the professional conclusions of experts using their understanding of the life history requirements of the species involved and empirical evidence from previous observations and measurements of similar or functionally comparable physical changes.

A linkage table presented in Section 6 (Table 6.1-1) summarizes changes in biological communities that may result from both construction activities and operation of the reconfigured runways. The changes are discussed for the various linkages between biological drivers and food-web components. The linkages identified by letters and numbers on Figure 1.3.2-1 correspond to those identified in the linkage table. The purpose of the conceptual model and linkage table is to identify all of the relationships considered, and to illustrate for the lay reader the relationships of physical and chemical changes to changes in biological communities.