STATE OF CALIFORNIA
STATE WATER RESOURCES CONTROL BOARD

INFORMATIONAL PROCEEDING TO DEVELOP FLOW CRITERIA FOR THE DELTA ECOSYSTEM NECESSARY TO PROTECT PUBLIC TRUST RESOURCES

SUMMARY OF TESTIMONY
THE BAY INSTITUTE AND NATURAL RESOURCES DEFENSE COUNCIL

The Bay Institute (TBI) and the Natural Resources Defense Council (NRDC) submit this summary of the accompanying testimony submitted by TBI *et al*, which has been identified as TBI-1 through TBI-4. This summary answers the key Issues identified in the Dec. 15, 2009 Notice. This testimony will address each of the Panel Topics identified in the revised Notice dated Jan. 29, 2010.

KEY ISSUES

1. What key information, in particular scientific information or portions of scientific information, should the State Water Board rely upon when determining the volume, quantity, and timing of water needed for the Delta ecosystem pursuant to the board's public trust obligations? For large reports or documents, what pages or chapters should be considered? What does this scientific information indicate regarding the minimum and maximum volume, quality, and timing of flows needed under the existing physical conditions, various hydrologic conditions, and biological conditions? With respect to biological conditions, what does the scientific information indicate regarding appropriateness of flow to control non-native species? What is the level of scientific certainty regarding the foregoing information?

The Delta is one of the most intensively studied environments in the world. The testimony of TBI *et al* relies on this substantial body of scientific research in the Bay-Delta estuary to recommend flow volumes, timing, and other hydrological criteria necessary to protect public trust resources. Specific sources of scientific information are identified in the testimony, and the testimony incorporates additional analyses that were performed for this informational proceeding. The testimony relies on the best scientific information that is currently available, recognizing that the recommendations must be made without perfect information and understanding (*See* response to Issue #4).

In general, there is broad scientific consensus that the timing, duration, and magnitude of freshwater flows into and out of the Delta, as well as the hydrodynamic conditions within the Delta, substantially affect the abundance, productivity, diversity and spatial extent (and hence viability, *see* response to Issue #2) of public trust resources that live in, or migrate through, the Delta. Providing adequate flow conditions is directly related to restoring and maintaining the viability of these resources. Moreover, improved flow conditions address some so-called "other stressors" that adversely affect public trust resources; for instance, higher peak flow events in the

Delta can help control the spread of invasive species, and higher river inflows can reverse habitat loss and reduce predation by increasing the extent and duration of inundated floodplains.

The current Delta hydrograph (i.e., the timing, duration and magnitude of inflows, outflows and in-Delta circulation) has been dramatically altered over time by storage, diversions and exports. These alterations have had catastrophic effects on the health of Delta public trust resources and the estuarine environment that supports them, to such degree that a number of species that live in or migrate through the Delta, including delta smelt, longfin smelt, steelhead, and several runs of Chinook salmon, are on the brink of extinction, and many ecosystem functions are seriously impaired.

Many factors affect the health of public trust resources, but, after all is said and done, the relationship between flows and viability of public trust species is probably the strongest biological signal in the estuary. There is no compelling evidence that anything other than restoration of adequate flows can fuel restoration of public trust resources. Such flow restoration may not be sufficient in and of itself to fully protect public trust resources, because of the effect of other stressors, which must be mitigated; but without it, protection of public trust resources will not be possible.

Our flow recommendations consist of criteria for Delta outflow, Sacramento River inflow, San Joaquin River inflow, and Delta hydrodynamics, organized by season and water year type. They are explicitly designed to restore and/or maintain the viability of one or more public trust resources based on known causal, correlative and/or other relationships between flow and viability attributes (*see* the response to Issue #2).

<u>Delta Outflow:</u>

- *Winter/Spring Outflow*: Based on the strong and persistent outflow:abundance relationships known for numerous species, total outflows for the January through June period should range between 3.2MAF (in the driest 5% of years) to 20MAF (in the wettest 33% of years), along with outflow amounts for shorter periods during the season.
- *Fall Outflow*: Based on the need to reclaim core habitat for delta smelt and other species, increase fall outflow to ensure that X2 is positioned between 83 km (in the driest years) and 71 km (in the wettest years).

<u>Sacramento River Inflow:</u>

- *Winter/Spring Inflow:* Based on the well known benefits of floodplain productivity for a range of ecosystem values, provide Sacramento River inflows ranging from 27,5000 to 35,000 cfs every year or twice in every three years to create and maintain floodplain habitat in the Sutter and Yolo bypasses for 15 to 120 days between December and May.

<u>San Joaquin River Inflow:</u>

- *Spring Inflow*
    - *Duration*: In order to protect the diversity of salmonid populations, increase the duration of outmigration flows from 31 days in the driest years to 90 days in the wettest years.

- *Magnitude:* Based on the need to reverse the impact of the virtual flatlining of the San Joaquin River on salmonid abundance and productivity, provide spring migration flows that range from 5,000 cfs (in dry years) to flows in excess of 20,000 cfs for at least 2 weeks and average of at least 11,000 cfs for the migratory period (in 60% of years). In addition, provide sufficient flows to maintain a 65 degree average water temperature in the lower San Joaquin River in April and May of all years.

- *Year-Round Inflow:* In order to reestablish the connection between ocean and river habitat, ensure minimum flows of 2,000 cfs year round to prevent migratory barriers to salmonid migration created by low dissolved oxygen.

Delta Hydrodynamics:

- *Old & Middle River Reverse Flows*: In order to reduce the loss of millions of fish, eggs, and larvae of endangered fish species and other public trust resources and reclaim the southern Delta as habitat for public trust resources, ensure that reverse flows in Old and Middle River do not exceed -2,000 cfs in October and November, do not exceed -1,500 cfs in December through February and in June, and are greater than zero (i.e., positive) in March through May of most year types.

2. What methodology should the State Water Board use to develop flow criteria for the Delta? What does that methodology indicate the needed minimum and maximum volume, quality, and timing of flows are for different hydrologic conditions under the current physical conditions of the Delta?

TBI *et al* make four recommendations regarding the Board's method for determining minimum public trust flows in this proceeding: (1) the use of "umbrella" or keystone species; (2) use of viability characteristics identified by McElhany et al 2000 and Lindley et al. 2007; (3) consideration of four specific methods for determining flows that correspond to these species and viability criteria; and (4) using the most protective flow recommendation identified using this methodology in order to protect the broad range of public trust resources.

First, we recommend that the Board adopt, and this testimony is organized around, an analysis of the flow needs of particular umbrella species. While the flow criteria developed to protect these umbrella species are likely to benefit all or most other public trust resources, there may be specific flows related to the viability of some public trust resources that we have not considered and are not addressed by the flow criteria recommended in this testimony.

Second, this testimony bases flow criteria on four attributes of viability for umbrella species and broad ecosystem values. "Viability" is used here to mean maintaining appropriate levels of four characteristics that equate to the persistence of populations and estuarine ecosystems: (1) abundance; (2) distribution; (3) diversity; and (4) productivity.

Abundance:

- More abundant populations are less vulnerable to disturbances and risk of extinction.
- The relationship between abundance and flow is one of the strongest and most persistent relationships observed in the San Francisco estuary.

Distribution:

- More widely distributed populations are less vulnerable to catastrophic events and risk of extinction.
- Flows positively affect spatial distribution by facilitating the movement of organisms and by making suitable habitat available through floodplain inundation, salinity gradient, and other mechanisms.

Diversity:

- Species and populations that are both more genetically diverse, and more diverse in life history patterns, are more resilient to environmental change and less at risk of extinction.
- Maintaining the high variability in flows that characterize estuaries helps preserve the genetic and life history diversity of public trust resources.

Productivity:

- The potential of a particular species to respond with positive population growth to changing conditions in a dynamic estuary is key to maintaining its viability.
- Large-scale flow impairment can cause chronic negative population growth.

For each viability characteristic, flow recommendations are provided to meet specific objectives relating to that characteristic (e.g., increased population growth, abundance at levels specified in an ESA recovery plan).

Third, this testimony utilizes a hierarchy of four methods for determining minimum public trust flows: (a) Mechanistic; (b) statistically significant correlations between flows and viability criteria; (c) historic flow conditions that correspond to periods when public trust resources were more productive and abundant; and (d) unimpaired flow conditions. This testimony is largely based on the first two methods. However all four methods constitute important and scientifically sound evidence for purposes of developing public trust flow criteria, and should not be dismissed on the grounds that they are less or not applicable because of changing environmental conditions in a dynamic and highly stressed estuary. Similarly, to assume that flows are unimportant because their functionality has not been definitively determined is unacceptable from both a scientific and a public trust protection basis.

Fourth, where flow recommendations overlap (e.g., for different species or different viability criteria), the most protective flow is recommended, because it should address the other public trust flow needs.

3. When determining Delta outflows necessary to protect public trust resources, how important is the source of those flows? How should the State Water Board address this issue when developing Delta outflow criteria?

Inflows are an essential ingredient for maintaining viability characteristics of public trust resources in the Delta, and therefore developing inflow criteria is part of the Board's statutory responsibility in this proceeding. These inflows literally create the habitat in the Delta that public trust species use for spawning and rearing and the migratory cues and drivers that anadromous species use to travel between ocean, riverine, and headwaters habitats. The relative contribution of the inflows that cumulatively (along with water diversions and exports) produce Delta hydrodynamic conditions and outflows has enormous consequences for the habitats (e.g.,

floodplains, turbidity, flow velocity and direction, habitat volume) available to species in the Delta, as well as ensuring that the connection between the estuary and upstream habitats is maintained. In addition to developing inflow criteria, we recommend that the Board include the principle that responsibility for meeting Delta flow criteria should be proportionately shared among source streams and watersheds, subject to the ecological conditions and disturbances particular to each source stream and watershed and other considerations.

4. How should the State Water Board address scientific uncertainty when developing the Delta outflow criteria? Specifically, what kind of adaptive management, monitoring, and special studies programs should the State Water Board consider as part of the Delta outflow criteria, if any?

The State Board's recommended public trust flows should be based on the best available science, consistent with its statutory obligations. There is substantial scientific evidence that supports improving flow conditions in the Delta to protect public trust resources. Although perfect knowledge is unattainable and scientific uncertainty will persist, as recognized in the *Mono Lake* decision, the public trust allows for reconsideration of water rights and in-stream flow recommendations at any time to consider new scientific information. More specifically, any flow recommendations that result from this proceeding would have to undergo subsequent review and analysis, including public hearing and comment, before being utilized in a water rights proceeding that implements the recommendation.

The absolute prerequisite for addressing uncertainty and constructing an adaptive management program is the identification of clear and measurable goals and objectives for public trust resources, beneficial uses, etc., which then guide the development, selection, implementation and performance assessment of flow measures and other water quality protections. The specific monitoring, research, performance assessment and decision-making components of an active adaptive management regime should be established in subsequent proceedings.

5. What can the State Water Board reasonably be expected to accomplish with respect to flow criteria within the nine months following enactment of SB 1? What issues should the State Water Board focus on in order to develop meaningful criteria during this short period of time?

The Board has more than enough information, and will undoubtedly receive even more in the submissions for this proceeding, to be able to reasonably determine flow criteria for Delta outflows, inflows, and in-Delta hydrodynamics within the Legislatively-mandated timeframe. The Board should ensure that its findings in this proceeding include flow criteria that are relevant not only to existing conditions, but which also address issues raised by several ongoing processes, particularly the Bay Delta Conservation Plan, the Delta Stewardship Council's Delta Plan, and future water quality and water rights proceedings of the Board itself.