or understate the actual hydrological conditions in the estuary because precipitation patterns in the two river basins are not identical. Further, one of the reasons EPA chose the three locations for compliance (all at or downstream of the confluence of the Sacramento and San Joaquin Rivers) was to give the State Board maximum flexibility in determining the source of flows to meet the Estuarine Habitat criteria. To reflect the importance of the San Joaquin River basin, the final criteria have been revised to measure unimpaired flow by reference to both the Sacramento River basin (Sacramento, Feather, Yuba, and American rivers) and the San Joaquin River basin (Stanislaus, Tuolumne, Merced, and San Joaquin rivers). EPA believes that the Sacramento/San Joaquin Unimpaired Flow Index described by CUWA is the best statement of how this unimpaired flow should be computed, and will generally refer to this index as the "8-River Index."<sup>17</sup>

(III) "Parts per thousand" versus "electroconductivity". The Proposed Rule stated the criteria as a requirement for 2 ppt salinity at the three compliance stations for varying numbers of days. In order to state the requirement more precisely, the final rule language will define the criteria in terms of millimhos per centimeter electroconductivity or "mmhos/cm EC" instead of parts per thousand salinity. This change is being made to conform the final rule to the more traditional methodology for measuring fresh water salinity. Accordingly, the final rule will state the criteria value as "2.640 mmhos/cm EC," which is equivalent to 2 ppt salinity.

Although EPA is restating the actual rule language in the more precise electroconductivity language, it will

1. Sacramento River at Band Bridge, near Red Bluff

2. Feather River, total inflow to Oroville Reservoir

3. Yuba River at Smartville

4. American River, total inflow to Folsom Reservoir

- 5. Stanislaus River, total inflow to New Melones Reservoir
- 6. Tuolumne River, total inflow to Don Pedro Reservoir
- 7. Merced River, total inflow to Exchequer Reservoir

8. San Joaquin River, total inflow to Millerton Lake."

continue to refer to this criteria value as 2 ppt in this discussion of the final rule. To do otherwise would unnecessarily confuse the interested scientific and policy community, which for a number of years has been using the 2 ppt language in its discussion of estuarine habitat criteria.

These revisions to the underlying computational methodology apply to the Estuarine Habitat at all three monitoring sites (the Confluence, Chipps, and Roe Islands). The remaining revisions to the final criteria pertain primarily to the methodology used in defining the number of days of compliance to be met at Chipps and Roe Islands.

(ii) Using a Sliding Scale.

In the final Estuarine Habitat criteria, EPA is restating the number of days that the 2 ppt salinity value must be met as a sliding scale correlating the number of days of compliance with unimpaired flow. The sliding scale approach has also been called the "continuous function" or "smooth function' approach. This approach replaces the Proposed Rule's statement of the criteria as a single fixed number of days of compliance for each of the five water year categories. The previous approach did not account for the substantial differences in hydrological conditions within water year types. For example, an "above normal" water year type could range from a wet "above normal" year to a dry "above normal" year. Given the extreme variation of hydrological conditions in the Bay/Delta, these variations within each of the five standard water years types are substantial, and should be factored into the calculation of the number of days of compliance with the 2 ppt salinity criteria.

The sliding scale approach addresses this problem by transforming the average salinity values for the five discrete water year categories into a more precise equation (graphically, a single line or curve) correlating the number of days of compliance with the specific observed hydrological conditions. This sliding scale approach would result in the same average number of days of compliance for each year type, and therefore represents the same level of protection for the Estuarine Habitat use as the Proposed Rule. The new approach, however, more accurately reflects differences within water year categories, thereby allowing a more accurate reflection of the natural hydrological cycles representative of the reference period necessary for protection of the use.

In addition, while the sliding scale approach equally represents the

conditions under which the estuary attains its designated uses, the sliding scale results in lower water costs and, for operational reasons, may actually enhance protection of the uses. Testimony at recent State Board hearings criticized the use of water year type categories. Because water year types can change as the year progresses, criteria based on the historical mean for each water year type can cause major changes in project operations and habitat conditions if a given year shifts from one water year type to another over the course of the winter months. For example, a later season storm could cause the water year type to be reclassified from the below normal category to the above normal category. This shift would increase the number of days the criteria must be met at one of the monitoring sites. Such large and sudden changes are inefficient for water resource management and may harm aquatic resources by dewatering or washing away newly spawned eggs. Incorporating a sliding scale definition of the criteria would likely ease the actual operational procedures necessary to meet the criteria and would avoid the relatively sudden, large scale changes in operations that might come from a sudden shift in the determination of year type as spring progresses. The comments EPA received on the

The comments EPA received on the Proposed Rule were generally supportive of this change in approach (CUWA 1994a, California DWR 1994, NHI 1994, and Kimmerer 1994a). Both written comments and the discussions at the CUWA scientific workshops offered several suggestions as to how the sliding scale function should be formulated.

There are two major components to the sliding scale approach. First, the shape of the scale must be determined. Second, the actual scaled values must be determined.

(I) *Defining the sliding scale.* There are a number of possible mathematical definitions of a sliding scale, including (a) a straight line, (b) a quadratic equation, or (c) a logistic equation.<sup>18</sup>

In the Proposed Rule, EPA suggested that a quadratic equation could be used to define the sliding scale. After reviewing the public comments, EPA has concluded that the Estuarine Habitat criteria should be stated as a logistic equation defining the sliding scale. Dr. Wim Kimmerer, in his comments on the Proposed Rule (Kimmerer 1994a), noted that the logistic model is "appropriate

<sup>&</sup>lt;sup>17</sup> As stated on page 3 of Appendix 1 to the California Urban Water Agencies

<sup>&</sup>quot;Recommendations to the State Water Resources Control Board for a Coordinated Estuarine Protection Program for the San Francisco Bay-Sacramento and San Joaquin River Delta Estuary" dated August 25, 1994, the Sacramento/San Joaquin Unimpaired Flow Index "shall be computed as the sum of flows at the following stations:

<sup>&</sup>lt;sup>18</sup> The standard forms of these types of equations are (a) a straight line  $(y=a+b^*x)$ , (b) a quadratic equation  $(y=a+b^*x+c^*x2)$  or (c) a logistic equation  $(y=1/(1+e^{3(a+b^*x)})$ .