ATTACHMENT 1

U.S. FISH AND WILDLIFE SERVICE, CALIFORNIA DEPARTMENT OF FISH AND GAME, AND NATIONAL MARINE FISHERIES SERVICE'S COMMENTS ON THE DISTRICTS' DRAFT FISHERIES STUDY PLAN UNDER ARTICLE 58

The Agencies' specific comments on the Districts' Draft Fisheries Study Plan under Article 58 track the titles and order of the study plan elements specified by the Commission's December 2006 letter. In several instances we reference pertinent sections of our draft "Limiting Factors Analyses & Recommended Studies for Fall-run Chinook Salmon and Rainbow Trout in the Tuolumne River" (Agencies' Plan) which is attached to provide details and help clarify our views on the various study elements.

Instream Flow (Commission Letter, pp. 2-3)

> *There is a lack of evidence that either smolt survival or spawner escapement has increased in response to the increased flow requirements. The collection of additional data is needed to better define the flow to survival relationship; in particular, data points are needed for high flow years (i.e., greater than 4,000 cfs). Coded-wire-tag studies and improvements in screw trap methodology are needed to more accurately estimate smolt survival and production. The effects of releasing the spring pulse flows in a more natural pattern based on water year type, rather than releasing them at the same time every year, should be assessed.*

Instream Flow Issue #1

According to the draft Study Plan, the Districts believe the costs and risks associated with further coded-wire-tag (CWT) studies outweigh the benefits. *See* Draft Study Plan, p. 2. Instead they propose to test their hypotheses that high flows are associated with either reduced predator densities/predator effectiveness in particular habitats or reduced exposure time for juvenile and smolt outmigrants with an expanded analysis of existing CWT data at recovery locations. *See id.*

The Agencies agree with the Commission that additional smolt survival studies are needed to fill in the data gap where smolt survival versus flow empirical data are currently missing. We recommend the following:

(1) Smolt survival studies should be conducted by acoustically tagging naturally produced fish over a broad range of flows (*see* Agencies' Plan, Management Action # 1, p. 54);

(2) If hatchery fish are available, CWT studies should be conducted at high flows of at least 4,000 cfs (*see* Agencies' Plan, Management Action #5, p. 56).

Instream Flow Issue #2

The Districts do not propose to improve rotary screw trap (RST) calibration studies. *See* Draft Study Plan, p. 2.

The Agencies agree with the Commission that additional RST data are needed and the RST methods need improvement (*see* Agencies' Plan, Management Actions #2, pp. 53-55). We recommend the following:

(1) Paired RST studies should be expanded to cover most of the juvenile salmon migration period from January 1 to June 15;

(2) RST calibration studies should be conducted at 7 to 14 day intervals, with large groups of marked study fish (e.g., 500 fry - 2,000 smolts per test), a variety of fish sizes (fry to smolt-sized fish), and at all flow releases; and

(3) An RST operations protocol should be developed to increase daily and seasonal estimate accuracy and minimize confounding effects from marking and handling during RST calibration studies.

Instream Flow Issue #3

The Districts' proposal to study six experimental flow releases of 500 to 1,000 cfs for 3-5 days from late-January through March through 2011 is not responsive to the Commission's request to study spring releases that reflect a more natural pattern based on water year type and to evaluate high flows ($\geq$ 4,000 cfs). *See* Draft Study Plan, pp. 2-3.

The Agencies recommend implementing an experimental flow schedule designed to fully evaluate natural flow patterns (*see* Agencies' Plan, Experimental Flow Schedules

p. 70-75). Tests of the effects of instream flows must examine a wide range of flows from short duration, low magnitude flows to long duration, high magnitude flows. The Districts' experimental flow proposals are inadequate for the purposes of the study because the magnitudes are too low to inundate floodplain habitats and the duration is too short to substantially reduce predation or other stressors. Trend analyses using smolt production data measured with the Grayson RSTs from 1998 to 2006 suggest that flows must occur for an extended period (e.g., March through mid-June) and at high magnitudes ($\geq$ 2,000 cfs) to produce large numbers of smolt-sized fish. Furthermore, the Districts' assumption that fry dispersal increases juvenile survival and smolt production has not been demonstrated. If the Districts wish to test their assumption, it will be necessary to verify that fry and parr-sized fish that are flushed into the San Joaquin River and Delta survive at higher rates than those that remain in the Tuolumne River between La Grange Dam and Waterford (*see* Agencies' Plan, Management Question #5, p. 59).

The Districts also should concurrently test the Agencies' conceptual model that extended flood flows ameliorate a combination of stressors in the Tuolumne River that include increased food availability, access to high quality floodplain habitats, refuge from predators, reduced contamination, reduced disease, improved water temperature suitability, and early onset of smoltification when migratory conditions are good. The experimental flow schedule presented in the Agencies' Plan would provide the basis for testing both the Districts' and the Agencies' conceptual models as it would compare substantially different magnitudes, durations, and timing of flows that reflect natural water year type patterns (*see* Agencies' Plan, Experimental Flow Schedules, p. 69).

Instream Flow Issue #4

The Districts propose to conduct paired RST studies only through 2011. *See* Draft Study Plan, p.3.

The Agencies recommend that the paired RST studies be conducted until a sufficient number of replicates of juvenile survival and smolt production data have collected over the entire suite of experimental flows to produce statistically valid conclusions.

Habitat Restoration (Commission Letter, p. 3)

> *The remaining habitat restoration projects should be completed and the effectiveness of all projects should be assessed. A study to evaluate spawning habitat quality, using egg survival to emergence, gravel size and type, sedimentation, and flow penetration of spawning beds is needed. Additional efforts to increase spawning habitat utilization and to reduce redd superimposition by flow management, gravel restoration, and gravel addition in upstream areas is needed. The level of use of restored areas for spawning should be assessed.*

Habitat Restoration Issue #1

The Districts' Plan does not indicate a commitment to complete the remaining habitat restoration projects nor assess the effectiveness of all projects. *See* Draft Study Plan, p 4.

The Agencies want assurances that key restoration projects will be implemented and that appropriate studies will be conducted to determine the effectiveness of the projects within a reasonable amount of time.

Habitat Restoration Issue #2

The Districts' Plan will not assess all restoration sites. *See* Draft Study Plan, p. 4.

The Agencies recommend that all restoration project designs should be evaluated regardless of the implementing agency. There are many variations in the designs of

restored spawning and rearing habitats in the Tuolumne River and it is likely that some designs are much more effective than others. There is a need to evaluate all project designs in terms of egg survival to emergence, spawner use by both salmon and trout, and juvenile use. The comparisons should include a sample of each restoration design, unrestored control sites that provide usable habitat, and highly degraded sites in the reach between La Grange and Waterford. Predation and juvenile use should be evaluated throughout the river. The Agencies' recommended studies for habitat restoration are described in the Agencies Plan for Management Question #8, pp. 62-63.

Habitat Restoration Issue #3

The Districts propose to conduct one and possibly two years of intensive egg survival and spawner use studies at restoration sites if outside funding is provided. *See* Draft Study Plan, p. 6.

The Agencies recommend that the number of years required for these studies should be determined by the need to demonstrate a statistically significant response, which is affected by measurement accuracy, the statistical method used, stochastic fluctuations in flows and population abundance, and long-term changes in habitat quality, particularly at newly restored sites. It is likely that at least three years will be required for these studies and that a greater duration may be needed (see Agencies' Plan, Management Questions #7 and #8, pp. 61-63). In addition, egg survival studies should use newly fertilized eggs to fully evaluate spawning habitat effectiveness (*see* Agencies' Plan, Management Question #8, pp. 62-63).

Habitat Restoration Issue #4

The Districts have focused their restoration efforts on spawning habitat and captured mine pits.

The Agencies recommend that the Districts should restore a substantial amount of annually inundated and well vegetated floodplains that provide habitat for rearing juveniles and compare the effectiveness of these projects to the previous projects that focused on improving spawning habitat and restoring captured mine pits (see Agencies' Plan, Management Action #3, p. 63 and Management Question #9, pp. 63, 64). The strong correlations between flow, smolt production, and adult recruitment suggest that rearing habitat and floodplain inundation are key limiting factors. The Agencies believe that there are insufficient data at this time to focus restoration solely on the black bass populations in the captured mine pits when there are numerous potential benefits from inundating floodplain habitats (see Agencies' Plan, Chinook salmon model, pp. 38-41).

Habitat Restoration Issue #5

The Districts' Plan does not include new efforts to reduce redd superimposition by flow management.

The Agencies believe that there are insufficient data at this time to adequately utilize flow management or other management actions to reduce redd superimposition. The Agencies recognize that redd superimposition occurs and probably limits fry production. However, even after the 1997 floods degraded the spawning habitat in the Tuolumne River (Districts' 2005 Ten Year Summary Report), an estimated 7,297,177 juveniles passed the 7/11 rotary screw traps (RM 38.6) in spring 1999 and 3,481,884 juveniles passed the 7/11 traps in spring 2000. It is likely that these production levels were more than sufficient to saturate the rearing habitat with juvenile fish since only

0.4% and 1.4% of these fish survived to pass the Grayson traps (RM 5.2) at a smolt-size (≥ 70 mm FL) in 1999 and 2000, respectively. Therefore, it is unlikely that producing more fry will improve the production of smolt-sized fish or adults; whereas flow management would focus on improving rearing conditions and we believe the production of smolt-sized and adult fish.

Habitat Restoration Issue #6

The Districts propose to evaluate the effectiveness of restoration projects with several metrics: redd distribution, egg survival, indices of spawning habitat (e.g., substrate permeability), fry emergence rates, and unspecified geomorphic and biological site-specific metrics.

The Agencies recommend that restoration projects be evaluated with both site specific metrics and population metrics. There are three population metrics that should be included:

1. Juvenile production: number of juveniles that pass rotary screw traps near Waterford relative to the number of adult spawners;

2. Smolt production: number of smolt-sized fish that pass rotary screw traps near Grayson; and

3. Adult recruitment: the number of adults in the escapement and ocean harvest (See Agencies' Plan, Management Questions #1 and #2, pp. 52-57).

Fry Survival (Commission Letter, p. 3)

> *A statistically valid estimate of fry production per female spawner and of fry distribution is needed, and should include site-specific fry emergence, fry distribution over time, and fry transport relative to flow.*

Fry Survival Issue #1

The Districts continue to rely on seine data to generate estimates of fry abundance.

The Agencies recommend that paired RST data be used to estimate fry production and fry transport (*see* Agencies' Plan, Management Action #2, p. 52 and Management Action #2, p. 53). Seining studies cannot provide useful information regarding fish distribution or abundance relative to habitat restoration and flow management unless they are calibrated with releases of marked fish. Furthermore, they cannot be effectively used in complex sites such as vegetated floodplain habitats or in complex riverbeds, such as the restored Bobcat Flat site.

Fry Survival Issue #2

The Districts present an hypothesis that high winter flows cause movement of rearing fry out of the gravel-bedded reaches and through areas of higher predator density at times when predator efficiency is lower due to low temperatures and increased turbidity, thereby increasing river-wide fry and smolt production and subsequent escapement.

As previously discussed under the Instream Flow issues, the Agencies believe that causing fry to migrate in a downstream direction does not lead to increased juvenile survival and adult production. Therefore, it is important to monitor fry movement, survival, and health:

1. monitor fry movement in both time (season) and space (longitudinal and lateral habitat use as a function of flow related channel characteristics);
2. fry survival as the percentage of fish that successfully migrate between the upper and lower rotary screw traps (see Agencies' Plan, Management Question #3, pp.s 57-58); and
3. fry health as a function of energy reserves, disease, smoltification timing, and toxic insult to the liver and kidneys (see Agencies' Plan, Management Question #4, p. 59).
4. The contribution of fry rearing in the Delta versus those that rear in the Tuolumne River toward adult recruitment should also be tested (see Agencies' Plan, Management Question #5, p. 60).

Steelhead Presence/Protection (Commission Letter, p. 3)

> *The size and habitat needs of the Oncorhynchus mykiss population in the Tuolumne River, and the presence of anadromous members (steelhead trout) of this population should be determined. The use of steelhead trout data from nearby rivers should be employed for comparative purposes. Additional studies on the flow and habitat needs of steelhead trout will be needed if they are present in the Tuolumne River population of Oncorhynchus mykiss; these additional study elements should be described in the study plan.*

Steelhead Presence/Protection Issue #1

The Districts would survey *O. mykiss* abundance only during the summer, not during the winter and spring when steelhead adults and smolts would be present.

The Agencies recommend studies to determine the abundance of resident and anadromous adult and juvenile *O. mykiss* at specific intervals throughout the year to determine temporal abundance and distribution (see Agencies' Plan, Management Questions #1 and 2, pp. 64-66).

Steelhead Presence/Protection Issue #2

The Districts' draft study plan does not include assessment of the habitat needs of *O. mykiss* in the Tuolumne River.

The Agencies recommend extensive studies of adult and juvenile habitat use at both unrestored and restored sites (see Agencies' Plan, Management Questions #5 and #6, pp. 68-69).

Steelhead Presence/Protection Issue #3

The Districts did not propose to use steelhead trout data from nearby rivers.

The Agencies agree with the Commission that it is important to use the data from nearby rivers due to the lack of information on the Tuolumne River.

Steelhead Presence/Protection Issue #4

No future studies were described that would evaluate the flow and habitat needs of steelhead adults and smolts.

The Agencies recommend instream flow studies under Management Question #7 on p. 69 and a Limiting Factor Analysis under Management Question #8, pp. 69-70 in our Plan.

Predator Control (Commission Letter, p. 3)

> *The reduction of predation on juvenile salmon by other species will improve smolt survival. An identification and implementation of measures to this end, and the monitoring of the effectiveness of these measures are needed.*

Predator Control Issue #1

The Districts acknowledge that flow affects predation rates but restrict tests to 300-500 cfs (possibly up to 1,500 cfs).

The Agencies recommend multi-phased smolt survival and predation studies to be conducted over a wide range of flows described for Management Question #2 on pp. 53-57 and Management Question #4, pp. 58-60 in our Plan. There are no plans to restore the majority of the predator habitat in the Tuolumne River and so flow recommendations should not be based on the channel configurations of the two predator isolation sites (SRP 9 and 10).

Predator Control Issue #2

The Districts focus on predation by black bass and ignore other predators such as Sacramento pikeminnow and striped bass.

Black bass, Sacramento pikeminnow, and striped bass utilize different habitats in the Tuolumne River and they prey on juvenile salmon during different times of the year. The Agencies are concerned that measures to reduce predation by black bass would not

reduce predation by these other species and therefore would not substantially improve smolt survival. Before implementing new measures to reduce predation, the Agencies recommend that broad predation studies should be conducted that would investigate all potential predator species and their habitats throughout the winter and spring rearing and outmigration periods (*see* Agencies' Plan, Management Questions #2 and #4, pp. 53-60). Due to the broad nature of the studies, the Agencies recommend implementing these studies in a phased approach to keep costs at a reasonable level.

Predator Control Issue #3

The Districts propose to survey predators only during the spring.

Sacramento pikeminnow feed extensively on fry during winter, whereas black bass typically begin feeding in late April when smolts are migrating. The Agencies recommend that predation studies be conducted throughout the winter and spring rearing and outmigration periods (*see* Agencies' Plan, Management Questions #2 and #4, pp. 53-60).

Predator Control Issue #4

The Districts propose to evaluate predation by tagging juvenile salmon with either radio or acoustic tags.

The Agencies recommend surgically implanted acoustic tags because they have no external antennae that would attract predators or affect the escape behavior of the juvenile salmon (*see* Agencies' Plan, Management Action #1, p. 54). Radio tags either have external antennae or, if equipped with an internal antenna, would be too large to implant in normal sized, naturally produced smolts.

Predator Control Issue #5

The Districts propose to monitor predation at restoration sites only if outside funding is provided.

The Agencies want assurances that studies will be conducted to determine the effectiveness of the predator isolation projects.

Predator Control Issue #6

Paired RST monitoring will be used to evaluate juvenile movement in response to flows and turbidity.

As discussed above, paired RST studies cannot provide evidence that juvenile movement from the river will result in increased adult recruitment. Instead the Agencies recommend that juvenile survival estimates based on paired RST studies and juvenile tagging studies should be used to evaluate the importance of predation and the effectiveness of predator control measures (*see* Agencies' Plan, Management Action #2, p. 53, and Management Actions #1 and #2, pp. 54-55).

River Temperature (Commission Letter, pp. 3-4)

> *The effect of project operations on river temperatures and the resulting effect on the fisheries resources should be assessed. The development of a thermal model for the Tuolumne River would allow the flow-temperature relationship to be better understood. The study should include an analysis of how conditions in the Delta might affect the success of any measures taken to improve thermal conditions in the Tuolumne River.*

River Temperature Issue #1

The Districts propose that they will synthesize the results of existing and ongoing studies to compare fish distribution and condition in relation to river flows and instream temperatures. However, they do not specify how they will collect information on the fish

distribution and condition relative to flow and temperatures. The Districts have attempted this method in the past and it has not been successful (Districts' 2005 Ten Year Summary Report).

The Agencies recommend the following five studies to assess the effects of water temperature:

1. paired rotary screw trap studies to determine how flow and temperature affect the survival and production of smolts (see Agencies' Plan; Management Questions #1 and #2, pp. 52-55);

2. escapement and age analyses to determine how flow and temperature affect adult recruitment (*see* Agencies' Plan; Management Question #1, pp. 52-54);

3. acoustic tag studies to determine how flow and temperature affect smolt survival (*see* Agencies' Plan, management Question #2, pp. 54-55).

4. bioassay studies to determine how fish condition, in terms of energy reserves (lipid content of muscle tissues), disease, smoltification timing, and contamination (toxic insult of kidney and liver tissue), is affected by flow and water temperature (*see* Agencies' Plan; Management Questions #1 through #4, pp. 52-60); and

5. Predation studies should include the effects of water temperature and flow (*see* Agencies' Plan; Management Question #2, pp. 54-57).