Appendix A-3

Comments regarding the DEIS for Pit 3, 4, & 5, Hydro Project

Craig Addley

May 2003

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Pit 3/4/5 FERC #233 May 2003

Ms. Kathy Turner, FERC Project Coordinator
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Re: Comments Regarding the Draft Environmental Impact Statement for Pit 3, 4, 5 Hydroelectric Project FERC No. 233-081 California

Dear Kathy,

The following are our comments on the Draft Environmental Impact Statement (DEIS) for the Pit 3, 4, 5 Hydroelectric Project. The DEIS is editorially well-written, concise, and easy to follow. This makes a discussion of both the DEIS and the key aquatic environmental issues associated the Pit Project easier to address.

General Comments

There are sections of the DEIS that address key aquatic environmental issues that are incomplete and in error because they were written without consideration of the results of **major** flow studies conducted by PG&E during the 2002 field season. These studies were conducted for the express purpose of providing information for the Pit 3, 4, 5 Hydroelectric Project licensing process. While we recognize the importance of maintaining reasonably aggressive timelines from the FERC licensing process, we view it as a fatal flaw to complete the DEIS (March 2003) and DEIS comment period (May 21, 2003) at the same time that field results from the 2002 field season (likely million dollars in studies) are being compiled in draft reports (May - July 2003), but not yet available to DEIS writers or agencies or individuals who would like to comment on the DEIS. It is acknowledged in the DEIS that these studies are being completed (e.g., pg 114), but the DEIS proceeds to utilize outdated and some cases errant data (e.g., PHABSIM study results, see discussion below) to analyze alternatives and, even more problematically, sets a comment deadline that precludes agencies and individuals from using these new data to address deficiencies in the DEIS. **In our opinion, the DEIS comment period should be extended for a**

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sufficient period of time to allow final results from the new studies to be included in agency and individual comments to the DEIS. This not only affects the USDA Forest Service (FS) directly, but potentially FS permittees.

In addition to the above statement, we also believe there are some errors in the DEIS that are a result of 1) misinterpretation of existing data and 2) misunderstanding the intent and purpose of the FS proposed flow regime. **Most importantly, it appears that the DEIS in general uses faulty biological reasoning to suggest that a higher and more natural flow regime in the Pit 3, 4, 5 bypass reaches (e.g., that proposed by the FS) is biologically damaging or biologically neutral. This simply is not true.** We recognize that 1) meaningful ecosystems can be, and are frequently, created downstream of significant water diversions that require less than natural flows and 2) that there is a necessity for FERC to balance ecological resource considerations and power production (e.g., cost/benefit). **This balancing, however, should not be done through questionable biological interpretations.**

Specific Comments

The following topics are addressed: 1) the pending study results that are not included in the DEIS for fish, amphibian, and eagle foraging habitat, and reanalysis of the old (1985) IFIM study, 2) the intent of the FS proposed flow regime, 3) fishery quality versus quantity, 4) water temperature effects on rainbow trout, 5) fluctuating flows, 6) ramping rates, and 7) misinterpretation of the Tennant Method.

1. Pending Study Results for Fish, Amphibian, and Eagle Foraging Habitat, and Reanalysis of the Old (1985) IFIM Study that are not included in the DEIS

The studies that were implemented by PG&E during the 2002 field season were developed by PG&E and participating stake holders to address, in a comprehensive way, flow versus aquatic habitat issues in the Pit 3, 4, 5 bypassed reaches over a range of flows from 150 to 1,800 cfs. These results are in draft form at the present time. A reasonable amount of time is not available between now and the May 21 comment deadline for PG&E to complete final reports and for us or the FS to obtain and assimilate these data. This is essential if prudent comments related to alternatives in the DEIS or the correctness of the DEIS alternatives analysis are to be made. **It is clear that the DEIS is missing these study results and would make substantially different conclusions regarding biological impacts of alternative flow regimes based on the inclusion of these results. While we (and the FS) can only provide incomplete comments to the DEIS because of lack of access to the study results,** we do provide comments based on the existing draft study results that show biological impact results contrary to the DEIS analysis.

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The draft results of the fish, amphibian, and eagle foraging habitat studies (empirical mapping and 2D modeling), reanalysis of the old (1985) IFIM studies, and validation of the temperature modeling clearly support ecologically a flow regime similar to the **intent** of the flow regime proposed by the FS (shaping of an annual 400 and 450 cfs in the Pit 3 and 4 bypassed reaches, respectively, from a minimum flow of 300 cfs up to1000 cfs based on results from the field studies, including the 2002 field studies). FERC appears to have misunderstood the FS proposed flow regime in part because the FS proposed flow regime is necessarily vague (i.e., future flow shaping) and can perhaps only be analyzed as a flat minimum 400 and 450 cfs due to its interim nature (400 and 450 cfs in Pit 3 and Pit 4 during the interim until a shaping pattern for the flow is developed and project facilities can be updated). The proposed flow regime will be discussed in a separate section below. Here, a few examples of the draft PG&E 2002 study results are presented in context of the **intent** of the proposed FS flow regime and deficiencies in the DEIS analysis of the flow regime both with respect to the interim flows (400 and 450 cfs) and the shaped flows.

Fish Habitat: The FS has previously objected to the use of the old (1985) IFIM study because of what appeared to be obvious problems with the modeling and the fact that the PHABSIM models (data decks) do not exist for review. The FS requested in their additional information requests (AIRs) that FERC require reanalysis of the data, but this was denied and FERC continued to use the suspect data. New modeling of the data by PG&E (draft results) shows clearly that the old IFIM analysis was flawed (likely hydraulics modeling or habitat weighting). It also shows that maximum habitat occurs at higher flows than the old IFIM indicated. Figure 1 and 2 show the old IFIM and reanalyzed IFIM data for adult rainbow trout. Dramatic changes in the magnitude of the weighted usable area and the shape of the habitat versus flow relationship occur. A local inflection (where habitat increases with increased flow become relatively minor) occurs at about 400 cfs for the Pit 3 reach and 450 cfs for the Pit 4 reach. These are the interim flows proposed by the FS based on field observations of the demonstration flows (and many other factors including past studies). Adult rainbow trout habitat would increase 33 and 65% in the Pit 3 and 4 reaches, respectively, under the FS proposed interim flow regime. **FERC should recognize this increase in habitat; however, we do not believe that FERC should use the draft IFIM reanalysis until the FS has had sufficient time to review the reanalysis and a final report available (we still have concerns regarding the hydraulic analysis and habitat suitability criteria).**

Due to the draft nature of the PG&E data and limited time, data from other species and life stages are not presented here, but similar large changes in the old IFIM and reanalyzed IFIM habitat relationships occur. **Clearly FERC should extend the DEIS comment period and**

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allow completion of PG&E's reanalysis of the old (1985) IFIM and review of these data by the FS. FERC has based its fish habitat analysis on faulty data.
In addition to the reanalysis of the old IFIM, fish habitat for various fish guilds was mapped during the demonstration flows (R2 Resource Consultants 2003, draft). These results are also shown in Figures 1 and 2 for the habitat guild that includes adult rainbow trout and adult Sacramento sucker (eagle forage species). These results extend over the range of flows from 150 to 1,800 cfs. The results support the shape of the reanalyzed IFIM results at low flows and show that at higher flows (beyond the range of the IFIM analysis) the amount of habitat continues to increase. Figure 2 shows habitat mapping results in Pit 4 with and without the Tunnel Adit site. Time is required to review the mapping results, but it appears that the sections of stream mapped at the Tunnel Adit site were fast water sections of river, and that, possibly there was not enough inclusion of pool and wide channel habitats. Other interpretations are also possible and require adequate time to review and interpret the results. Regardless, the results in part validate the reanalysis of the old IFIM and support the proposed FS flow regime. **Again the DEIS is missing both these data and the future extrapolation of the data to the entire Pit 3 and 4 reaches (e.g., extrapolate study site results to the entire reach based on habitat type percentages).**

Amphibian Habitat: Amphibian habitat, particularly foothill yellow-legged frog breeding habitat, was mapped during the 2002 demonstration flows (Spring Rivers Ecological Sciences 2003, draft). The results are discussed elsewhere by the FS, but we briefly present the summary results. Figure 3 shows the amount of breeding habitat measured versus flow. Breeding habitat for the two canopy types that represent existing suitable vegetation and vegetation that would be destroyed under sustained higher sustained baseflows (i.e., when inundated) is included. Maximum habitat occurs at approximately 600 cfs. This flow also provides some substantial buffering of frog eggs and new tadpoles from natural and induced spill events in the project reaches (particularly compared to the 150 cfs baseflows that frogs must breed in under current conditions) (see discussion in the fluctuating flow section below). These results support the FS interim flow regime and also support the concept of shaping of the 450 cfs flow in the Pit 4 bypassed reach. That is, providing higher spring flows (greater than 450 cfs) to benefit frog breeding, possibly other amphibians, and possibly spawning fishes and early YOY fishes, and then reducing flows during other time periods when the flow is biologically less important. **The DEIS incorrectly states the FS proposed flows "do not benefit foothill yellow-legged frog" breeding habitat. The DEIS does not recognize the potential ecological benefits of using the 2002 field studies to shape a flow regime that benefits multiple species during different seasons as outlined in the proposal to shape the flows.**

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Eagle Foraging Habitat: Eagle foraging habitat was mapped during the 2002 demonstration flows (R2 Resource Consultants, Inc. 2003, draft). The results are discussed elsewhere by the FS, but we briefly present the summary results. Figure 4 shows the amount of mapped eagle foraging habitat (slow shallow habitat). Eagle foraging habitat increases with flow up to approximately 1,200 cfs (or stays relatively constant if one dominant habitat unit is ignored). This supports the FS proposed increased flow regime. **The DEIS incorrectly suggests that the proposed FS flows would reduce eagle foraging habitat.**

The DEIS also incorrectly utilizes PG&E's 1985 BEFS results. The BEFS contains two categories of shallow habitat: shallow non-turbulent habitat and flooded sedge (Carex sp.). During the study, the mapping of flow releases higher than the minimum flow at the time showed inundated low lying shallow areas colonized by Carex. Carex colonized these areas due to a long period (many years) of dewatering of the river that had occurred prior to the studies. If these areas were continuously inundated by higher baseflows the Carex would (and will) die out and become eagle foraging habitat. The shallow habitat (< 2 ft) containing inundated Carex, however, was not considered non-turbulent shallow eagle foraging habitat, when much of it should have been. **The DEIS needs to utilize the new mapping data (2002 field season) for the eagle foraging and, if the 1985 BEFS data are used, shallow inundated Carex habitat must be included in the analysis of eagle foraging habitat.**

Fishability, DEIS Pages 123-125: During the 2002 demonstration flows fishability data were collected (Whittaker and Shelby 2003). The results of these data are that fishability, based on the wading-based fly angling approach currently popular in the Pit 3, 4, and 5 reaches, would be substantially altered if flows were higher than about 250 cfs in the Pit 3 and Pit 5 bypassed reaches, or about 350 cfs in Pit 4, bypassed reach. This supports the FS proposal that flows should be shaped during different seasons to adjust flows for biological and potentially, user based interests, but may also suggest that the FS proposed minimum flow of 300 cfs (from shaping) should be reduced if wade fly fishing is an important activity to be accommodated in the Pit 3 reach. We suggest the minimum flow should be reduced to 250 cfs. Temperature considerations in the Pit 3 reach (see discussion of temperature below) would allow this without compromising ecological goals. The FERC analysis correctly states that wading would become more difficult with the higher FS flows, but does not identify that this pertains primarily to the interim minimum flows (400 and 450 cfs). **The DEIS incorrectly states that the FS proposed flow regime (flow shaping with a 300 cfs seasonal minimum flow) would not accommodate wade fishing in the Pit 4 reach (DEIS Page 124), but correctly suggests that wade fishing would be affected in the Pit 3 reach (DEIS Page 123). It should also be noted, however, that in the Pit 3 reach flows were still in the acceptable range up to 300 cfs (Whittaker and Shelby 2003, Figure 27).**

The FERC DEIS puts an inordinate amount of weight on wadeability. Wadeability or the ability to cross a river or wade fish should only be one factor in determining an appropriate instream flow. The National Forest portions of the Pit 3 and 4 reaches are within Northwest Forest Plan "Riparian Reserve" designation where returning the ecosystem to a more natural condition takes precedence over recreational factors. In addition, while wading in the river is a preferable way to catch fish at current flows, there is much anecdotal evidence to suggest the Pit River was a very successful angling river at unimpaired flows of 2,000 cfs and above. The Whittaker and Shelby report additionally discussed that some new areas would probably open up (for angling) while areas currently fished at lower flows may not be as fishable. The report states "Most agreed that new fishing "hot spots" would emerge in response to new flows, but that these might evolve over time". Our observations during the demonstration flows are that this is true. Obviously a successful catch rate is not dependent on the current existing flow regime, and changes in angling methods (e.g. angling from the bank or in shallower water, from a fishing raft, or even installation of foot bridges to allow crossing of the river) can allow the anglers to adjust to new flows. The most important factor is that improved fish habitat will benefit both fish and ultimately the angler (not just one method of angling). **The FERC DEIS should explicitly state the factors that are being used to determine an appropriate or inappropriate flow regime and show explicitly how much weight is being given to each factor (e.g., how important is wadeability compared to other factors).**

Temperature: The water temperature validation modeling during the 2002 demonstration flows in general supported the previous temperature modeling. We address temperature in a separate section.

2D Modeling: 2D flow and habitat modeling is in the process of being completed for a few short reaches of river. These results are not generally available. Preliminary results for one site, Delucci, where there is overlap between the old IFIM cross-sections and 2D modeling, clearly supports the fact that the new reanalysis of the IFIM data is accurate, while the old IFIM analysis is incorrect. The DEIS should extend the comment time period to allow inclusion of these results.

Summary: The FS proposed flow regime (shaping 400 and 450 cfs, Pit 3 and 4, respectively, with minimum flows of 300 cfs and maximum flows of 1000 cfs) provides the opportunity to substantially benefit aquatic resources in the Pit 3 and 4 reaches by seasonally optimizing the biological benefits of a relatively modest flow of about 13-15 % of mean annual flow. This optimization of biological benefits would be based directly on the results of the substantial habitat and flow studies conducted by PG&E. The FERC proposed alternative in the DEIS,

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however, essentially leaves the flows in the bypassed reaches at approximately their current levels based on what appears to be faulty biologic reasoning and **incorrectly identifies, in many instances, the FS proposed flow regime as being biologically damaging or neutral. This stance is unsupportable based on substantial data and should be rectified.**

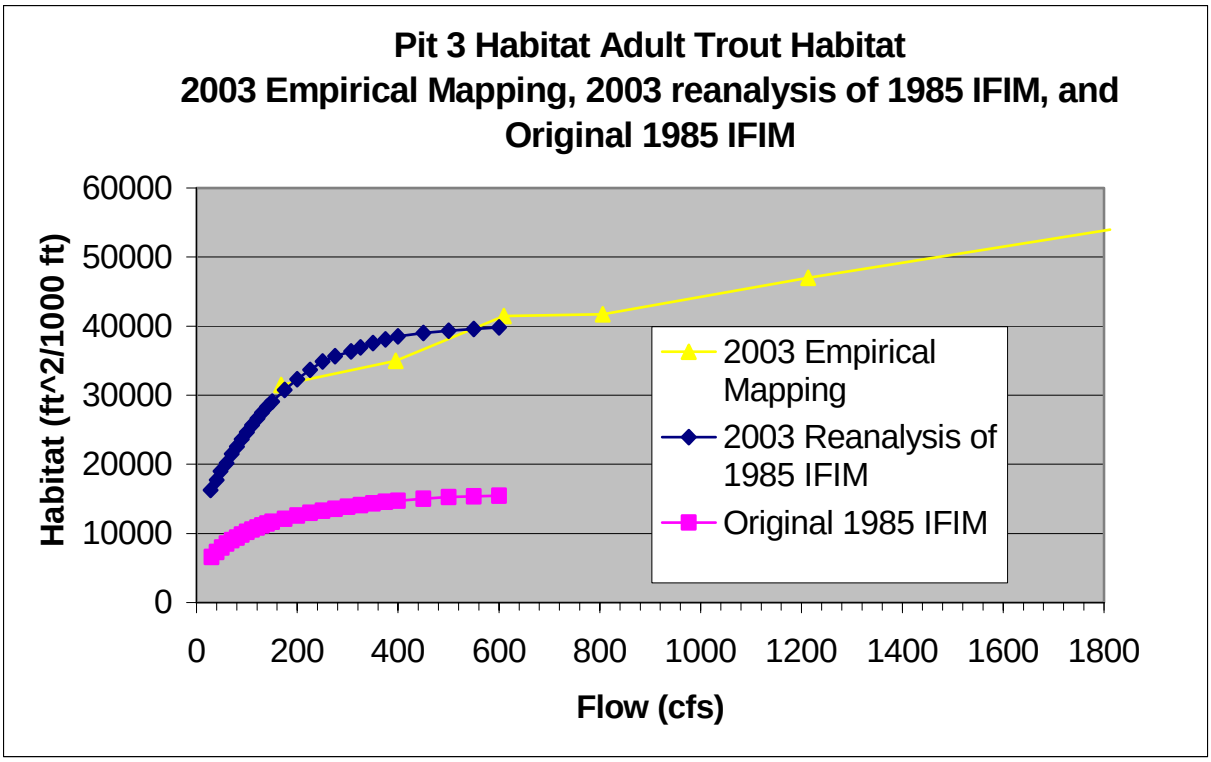

Figure 1. Adult rainbow trout habitat versus flow for the Pit 3 reach including the 2003 empirical mapping (during 2002 demonstration flows), 2003 reanalysis of old (1985) IFIM results, and original 1985 IFIM results.

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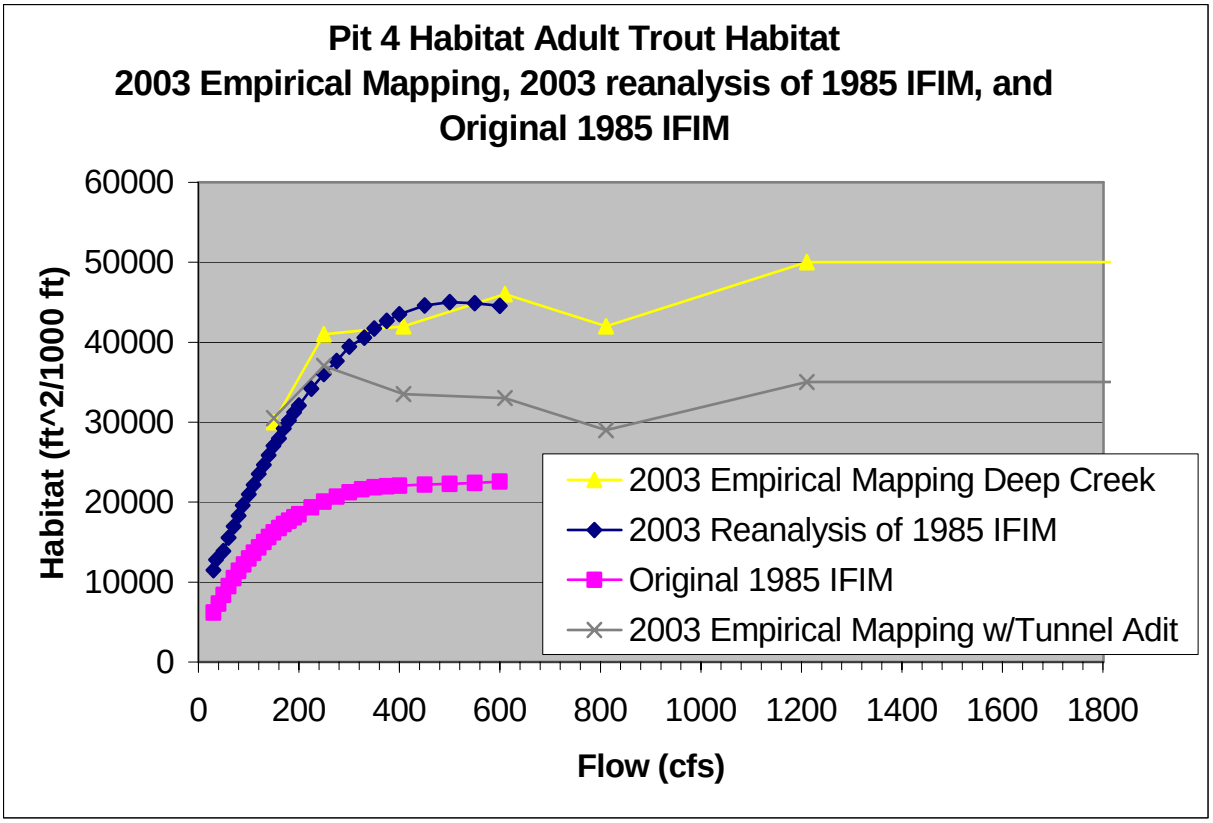

Figure 2. Adult rainbow trout habitat versus flow for the Pit 4 reach including the 2003 empirical mapping (during 2002 demonstration flows), 2003 reanalysis of old (1985) IFIM results, and original 1985 IFIM results.

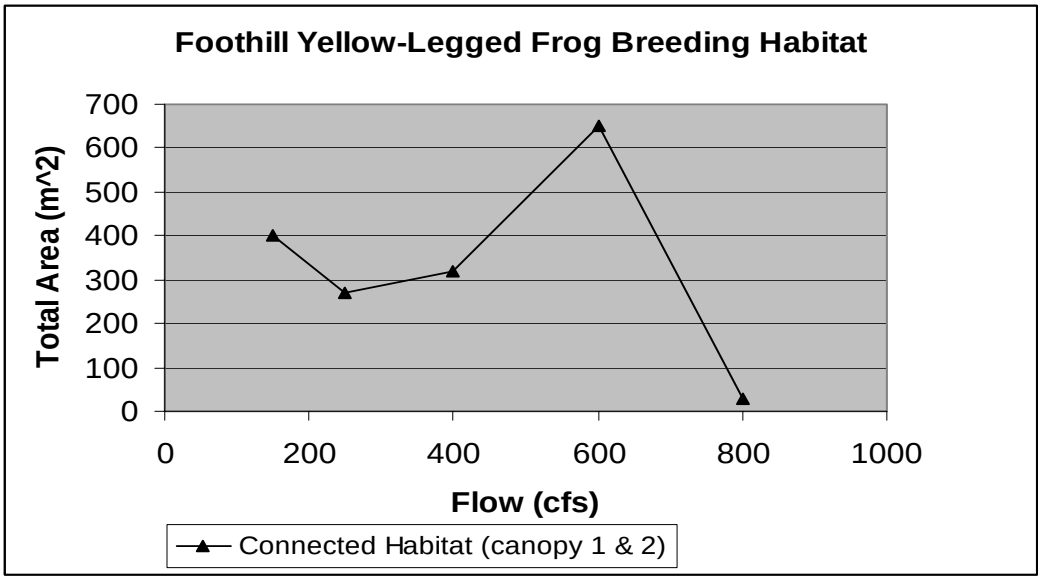

Figure 3. Foothill yellow-legged frog breeding habitat versus flow.

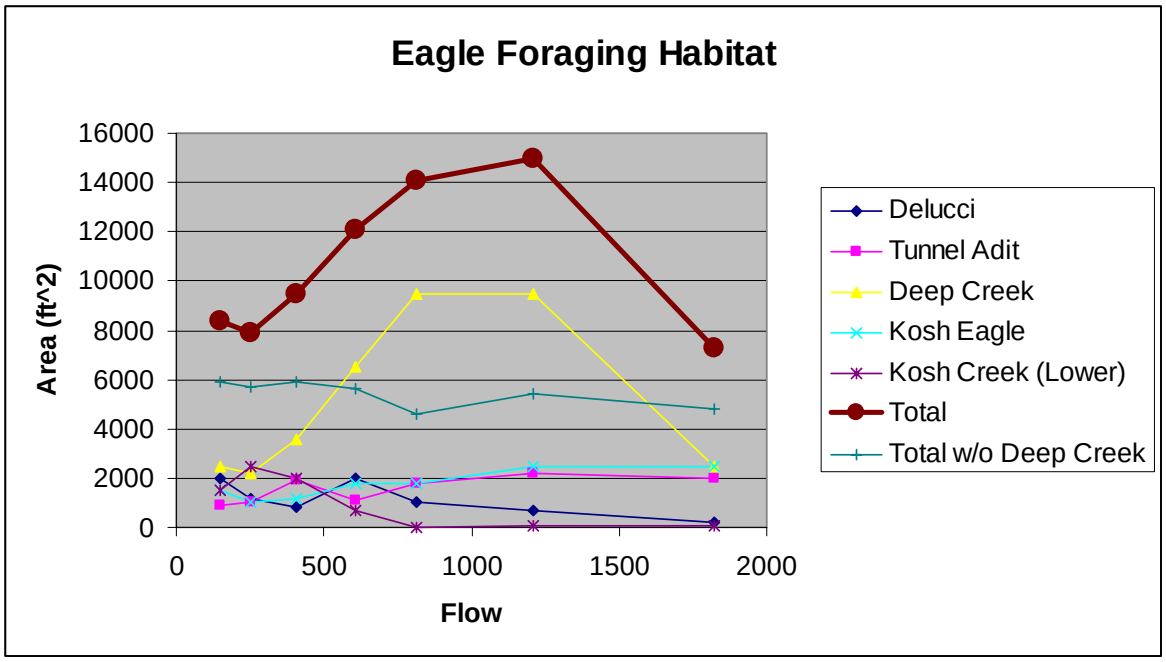

Figure 4. Eagle foraging habitat versus flow.

2. Intent of the FS Proposed Flow Regime

It is clear that the intent of the FS proposed flow regime is not explicitly clear and not completely understood in the DEIS. Our belief is that the intent of the FS was to reserve an interim block of water, approximately 400 cfs in the Pit 3 bypassed reach and 450 cfs in the Pit 4 bypassed reach, to later (based on PG&E study results) be shaped seasonally to create an ecological based flow regime. The shaping would occur at some future date when the 2002 field data were available and when the facilities were modified to release variable flows (e.g., Pit 3). The FS intent is generally to shape the flows similar to the example discussed in the October 9, 2002 Preliminary 4(e) Terms and Conditions Document (PTCD), but with input from all the studies and other agencies.

The proposed FS preliminary 4(e) flow regime, however, is not completely defined and leaves little option, but for FERC to analyze it as the fixed 400 and 450 cfs interim minimum flow. Also, because the proposed FS flow does not specify the amount (or block) of water to be shaped, it is not clear if FERC has viewed the proposed flow as such.

DEIS Page 81, Table 22 states that the FS recommended flow regime would require 125,607 acre-feet annually in the Pit 3 bypassed reach and 197,072 acre-feet annually in the Pit 4 bypassed reach (note: as a separate issue, it appears FERC neglected to include the existing 150 cfs minimum flows into the baseline when making these calculations). This amounts to an additional 173 cfs and 272 cfs annually in the Pit 3 and 4 bypass reaches, respectively, when water from natural spills is accounted for. This is generally the additional amount of water we believe the FS intended to provide in the shaped flow regime. We recommend, after calculating the amount of water ourselves, that the FS add something similar to the following in its preliminary 4(e) condition to explicitly clarify FS intent:

> The average annual amount of water used for shaping will not exceed the equivalent amount of water required to provide a flat line 400 cfs minimum flow in the Pit 3 bypass reach and a flatline 450 cfs minimum flow in the Pit 4 bypass reach. For illustration purposes, using the 1975-1999 period of record the amount of additional non-spill water required to meet the 400 cfs minimum flow in the Pit 3 bypass reach (above that needed to maintain the previous 150 cfs minimum flow baseline) is approximately 130,000 acre-feet. The amount of additional non-spill water required to meet the 450 cfs minimum flow in the Pit 4 bypass reach (above that needed to maintain the previous 150 cfs minimum flow baseline) is approximately 200,000 acre-feet.

We believe the amount of water outlined above (an additional 130,000 and 200,000 acre-feet on average annually in Pit 3 and 4, respectively) will provide the FS with an adequate quantity to shape an ecologically based flow regime as they have proposed.

It should also be restated (noted above) that it appears that FERC did not use what we believe is the correct baseline for evaluating the cost of the FS flows. The project with the existing 150 cfs minimum flows in the Pit 3 and 4 reaches should be the baseline. This is the baseline that has provided the existing conditions that are being environmentally analyzed. Table 22 in the DEIS should either identify an amount of additional water required to meet the no action alternative of about 19 cfs annually (Pit 3 and 4), or subtract approximately 19 cfs from the quantity of water required by the other proposals. This discrepancy with the baseline occurs because minimum flows changed in the reaches during the 1970-present time period that is used in the analysis (we use both a 1970-1999 and 1975-1999 time period). For example, there was not a minimum flow requirement in the Pit 3 reach until 1987 and the minimum flow in the Pit 4 reach has increased to 150 cfs.

In addition to clarifying the amount of water to be set aside for shaping, if FERC is to analyze the FS proposed shaped flow regime, the FS must provide an example shaped interim flow regime. This provides a flow regime to be analyzed even if the PG&E facilities are not capable of delivering the flow regime immediately and even if the flow regime is slightly altered later due to a more refined shaping process. We suggest the following interim shaped flow regime in Table 1 be provided to FERC that is consistent with FS intent (also see Figure 7 in a later section):

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Table 1. Example shaped flow regime for 3 representative water years.

Example shaped minimum flows consistent with the FS shaped flow proposal for three example water years. Note the FS shaped flow proposal creates a different shape depending on water inflow to the project each year and should not be viewed as a fixed flow by water year type. The flows represented here should be viewed as representative water year examples. Flows are rounded to the nearest 10 cfs.

½ Month	Pit 3 Bypass Reach			Pit 4 Bypass Reach		
	Dry (1977)	Normal (1980)	Wet (1983)	Dry (1977)	Normal (1980)	Wet (1983)
Oct 1-15	360	320	390	360	350	410
Oct 16-31	380	320	400	380	350	420
Nov 1-15	380	380	420	380	390	430
Nov 16-30	390	390	440	390	390	460
Dec 1-15	400	400	460	400	400	490
Dec 16-31	400	360	510	400	410	550
Jan 1-15	400	430	620	400	440	660
Jan 16-31	400	1000	570	410	1000	610
Feb 1-15	400	720	800	400	750	870
Feb 16-28	410	650	970	420	670	1000
Mar 1-15	430	1000	1000	440	1000	1000
Mar 16-31	420	820	1000	420	870	1000
Apr 1-15	400	700	1000	400	730	1000
Apr 16-30	360	560	1000	470	580	1000
May1-15	350	560	850	350	590	920
May 16-31	350	530	970	360	590	1000
Jun1-15	360	550	790	370	560	860
Jun 16-30	330	460	650	360	570	700
Jul1-15	320	350	510	350	470	520
Jul 16-31	320	320	460	350	410	470
Aug1-15	310	320	420	350	350	440
Aug 16-31	310	310	410	350	350	430
Sep1-15	320	310	410	350	350	440
Sep 16-30	320	320	420	350	350	440

* flows were derived by taking 16.5% of the previous ½ month inflow and setting a minimum of 300 cfs in the Pit 3 bypass reach and 350 cfs in the Pit 4 bypass reach and using a maximum of 1000 cfs. This is the approach the FS outlined in the PTCD document. It uses approximately 130,000 acre-feet (Pit 3) and 200,000 acre-feet of additional water on an average annual basis (actually less, depending on how it is calculated). The amount of flow used is much less than 16.5% of the mean annual flow because the minimum flow only fills in the “hollows” during the spill season.

The flow regime in Table 1 was set using a minimum flow of 300 and 350 cfs in the Pit 3 and Pit 4 bypassed reaches, respectively. Based on a consideration of wading issues in conjunction with other resource issues, particularly water temperature issues in Pit 4, the final shaped flows in the FS proposed minimum flow regime (e.g., Table 1) could conceivably under the FS proposed flow regime be set lower (250 and 300 cfs in Pit 3 and 4, respectively) during various times of the year to help facilitate wade fishing (i.e., the FS preliminary 4(e) condition specifies shaping could go as low as 250 and 300 cfs).

It is clear in the DEIS that FERC did not explicitly recognize that the FS flows were to be shaped based on the results of existing and recently completed (2002 field season) flow studies. FERC frequently interprets the flow regime as being biologically damaging or biologically neutral. This is completely incorrect if the flow regime is designed (shaped) specifically to enhance the biology of the Pit system (i.e., based on the results of the Pit River new and existing studies). **The FS should clarify the proposed flow regime to provide a more accurate biological and economic analysis. FERC should use the flow values in Table 1 to analyze the FS shaped flow regime and recognize the flow regime is to be shaped to benefit the ecology of the Pit 3 and Pit 4 bypass reaches.**

3. Trout Fishery Quality Versus Quantity

DEIS Page 94-98 presents data regarding the quality of the Pit 3, 4, 5 fishery. This quality is used to justify the existing flow regime and subsequently minimize the effects of the FS proposed flow regime. Ironically, the FERC DEIS (Page 123) uses California Department of Fish and Game (CDFG) quality goals to argue against increased flows when CDFG has proposed a significant increase in flow in Pit 3, 4, 5. FERC does not clearly articulate the difference between quality and quantity. The quality of the fishery is largely a function of the remoteness of the site and relatively low use at the present. The Pit 3, 4, 5 reach consists of 22.5 miles of river. PG&E fishing effort surveys indicate that during peak use (weekends and holidays) less than 30 parties per day currently use the reach. The same surveys indicate a steady decline in fishing quality in Pit 3 as use of the reach increases (CDFG data do not show this decline). While quality is important, quantity is equally important, especially in the future as use of the reach increases. By way of analogy, a very small piece of quality steak is not nearly as satisfying of a meal as an entire steak. Clearly the quantity of the fish habitat and fishery is important. **The FERC analysis should be based both on the quantity and quality of fish habitat.** The quality of the fishery will remain constant in Pit 3 and will increase in Pit 4 (better temperatures) with the proposed FS flow regime, but quantity (amount of habitat and total number of fish) will increase in both reaches.

In addition, if there are cost/benefit issues (cost of increasing habitat versus relative gain) related to increasing flows, these should be articulated by FERC in the DEIS. Our sense is that the DEIS is using the biological (environmental effects) analysis to make cost/benefit evaluations, but not articulating the basis of these evaluations.

4. Water Temperature Effects on Aquatic Species

DEIS Page 123 for Pit 3, 124 for Pit 4, and 125 for Pit 5:

On these referenced Pages, FERC concludes that keeping flows at 150 cfs in Pit 3 reach, increasing to 200 cfs in the Pit 4 reach, and to 250 cfs in the Pit 5 reach would be consistent with PG&E's resource goals as defined on Page 110. Aside from the obvious problem with using PG&E's resource goals as a basis for decision making on FS lands, the text from page 119 to 125 continuously, and erroneously uses water temperature as a basis for recommending low flows in the Pit 3, 4, 5 bypassed reaches. The FS has addressed elsewhere temperature issues related to aquatic mollusks. Here we discuss temperature issues related to fish species.

On Page 123 of the DEIS FERC states: "These higher release flows [in the Pit 3 reach] may, however, cause water temperatures to become less favorable for trout and for the nugget pebblesnail (an FS ROD SM species) and the scalloped juga (an FS Sensitive Species), which prefer coldwater temperatures." On Page 124 FERC states: "However, the availability of habitat suitable for coldwater molluscs could be reduced due to higher minimum flows overwhelming the localized cooling effects of spring inflows. If localized spring-fed pockets of cooler water are washed out, it would limit the availability of coldwater refugia that could be important for trout rearing during the summer." There is similar wording on Page 125 for the Pit 5 reach. This interpretations by FERC that FS proposed higher flows may be less favorable, or will inundate and overwhelm the spring flows, is counter to PG&E's temperature data, which are partially displayed in Figures 9-11 (Pages 120-122) of the FERC DEIS, and are described on Page 119.

We agree with FERC's understanding of PG&E's temperature data in the first paragraph on Page 119 as stated here:

- "…increasing minimum flow releases would tend to increase summer water temperatures in the Pit 3 reach and increase the uniformity of temperature conditions throughout the length of the Pit 4 and 5 bypassed reaches."
- "Average summer water temperatures in the Pit 4 and 5 reaches would generally be reduced…",

We note from PG&E's data, that the above referenced "increase in Pit 3 water temperatures" is only approximately 1/2º C during the worst case warm/dry meteorological scenario and less than this in cooler/wetter meteorological conditions. Other PG&E data (PG&E Application Volume 8

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of 9, Appendix B, Page B10-5) show that the average water temperatures in the Pit 3 reach during July in a warm/dry (worst case) scenario range from 15.9-16.6º C. Even if the reach experiences a 1/2º C increase during a warm/dry July, water temperature will still be on the low end of the preferred temperature for rainbow trout of 15-18 ºC (Moyle 2002) and well below the 19-20 ºC parameter narrative statement in the State Basin Water Quality Plan. This temperature change can be viewed as beneficial or neutral for trout, but cannot correctly be viewed as a "less favorable" condition for trout. The reality is that slightly increasing temperatures in the Pit 3 reach would increase growth of trout during early summer and early fall when temperatures are "too cold" for optimum growth and keep trout at optimum temperatures for growth during the summer.

We interpret FERC's reference to "increased uniformity" as meaning a reduction in the discontinuity (or segmentation) of temperature along the length of the Pit 3, 4, and 5 reaches (i.e., no rapid increases or decreases in temperature along the longitudinal profile of these reaches). This is much closer to the temperature regime that existed in these reaches in the unimpaired state (DEIS Figure 11) and cannot possibly be construed as a detrimental condition for species native to these reaches. We also view "increased uniformity" occurring due to the fact that increased flows would flatten (reduce the range of) the approximately 3º C diel temperature fluctuation as a result of the thermal buffering affect of increased flows (greater thermal mass). (See FS temperature sensors data Appendix D-3 from the Pit 4 reach and DEIS Figure 10). In the Pit 4 and 5 reaches where July and August average high temperatures are already approaching the 19-20º C Basin Plan narrative water parameter, the **maximum** daily temperatures (considering the approximately 3º C diel fluctuation) already exceed this 19-20º C Basin Plan parameter on a frequent basis (Appendix D-3). The reduction in this diel fluctuation at higher instream flows would result in reduced maximum temperatures bringing the range more closely in line with Basin Plan values (and unimpaired conditions) for the referenced coldwater species, which is therefore a benefit to these species.

Besides the benefits of reduced diel fluctuation in the Pit 4 and 5 reaches, there would also be reduction in the average water temperatures in these two reaches, as stated by FERC above. Our interpretation of PG&E's data shows this water temperature reduction to be approximately 1º C during summer months. While not an overwhelmingly large reduction in temperature, since these reaches currently approach (using averaged temperature, or frequently exceed given maximum temperatures) the State Basin Plan narrative parameters, even a 1º C reduction in water temperatures moves the system in the correct direction for the referenced coldwater species and unimpaired conditions.

Given these temperature discussions and data analysis, we do not understand FERC's statement above concerning higher flows "…overwhelming the localized cooling effects of tributary inflows". It does not appear that the very moderate changes in water temperature of + 1/2º C to -1º C are overwhelming, and in fact the water temperature would move in a beneficial direction.

In summary, our interpretation of PG&E's water temperature data is that the proposed FS increased instream flows are beneficial to coldwater aquatic species in the Pit 3, 4 and 5 reaches. While the benefits afforded by a 1º C decrease in water temperature in warm/dry years in the Pit 4 and 5 reaches along with a drop in the diel fluctuation daily maximum temperatures may alone not be justification for implementing higher instream flows, these changes in the aquatic temperature regime provide a clear benefit, and not a detriment, to all referenced aquatic species in the Pit 3, 4 and 5 reaches. **FERC should rewrite the portions of the DEIS that suggest detrimental consequences of the temperature regime resulting from increased flows and state the obvious benefits of such an action.**

Page 124:
FERC quotes PG&E material and states that " temperature of outflows from the Pit 3 powerhouse would probably increase if the minimum flow release were increased to levels greater than approximately **250 cfs**, which would deplete the pool of cool water in the deeper part of Lake Britton". This statement "deplete the pool of cool water" is erroneous or at a minimum misleading. Under the July dry/warm scenario a release of **1,600 cfs** provides temperatures in the Pit 3 reach of between 17.8 and 18.1 ºC (DEIS Figure 9). This is the hottest month and a flow release 6 times greater than the 250 cfs quoted above and temperatures are still within the 15-18 ºC preferred temperature range of trout. A flow release of 400 cfs creates a temperature regime of 15.8-16.7 ºC, which during the hottest month and warmest climatic conditions is exactly in the preferred temperature range of trout. Figure 11 shows the unimpaired (without Lake Britton) temperature during a normal water year in Pit 3. Unimpaired temperature is 17.4 – 17.8 ºC, again, exactly in the range of preferred temperatures for trout. Water temperature in the Pit 3 reach historically (unimpaired conditions without Lake Britton) were optimum for trout due to the 400 cfs inflow of 16 ºC ground water from Hat Creek and 170 cfs inflow of 10 ºC groundwater from Burney Creek (and other cool water inflows) mixed with Pit River water (see DEIS Figure 11 for unimpaired flows). Optimum trout temperature in the Pit 3 reach is not dependent on a "pool of cool water" from Lake Britton, it is the natural state of this river system. In fact, current temperatures in the Pit 3 reach under the existing 150 cfs flow regime are on the cool side for optimum trout growth during the late spring/early summer and fall if food is abundant in the system. **FERC should remove the misleading language in the DEIS regarding temperature (initiated by PG&E report text) in the Pit 3 reach under an**

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increased flow regime and simply state that temperatures will remain in the preferred range for trout.

DEIS Page 126 states that "the current diversity of thermal environment created by spring and tributary inputs…is important for supporting the existing diverse assemblage of non-game species of fish". We agree completely that the cool water spring and tributary inflows to the Pit River reaches are critical for maintaining the native aquatic assemblage by maintaining the summer temperatures below approximately 19 ºC. We view the myriad of ground water and tributary inflows as an essential component of the Pit River ecosystem that along with whole-river cooling also provides thermal diversity. We do not view artificially creating whole channel temperature discontinuities (segmented temperatures) due to severe dewatering of the channel as a beneficial kind of thermal diversity, however, as is implied in the DEIS text. Further segmenting a river by whole channel thermal discontinuities that is already segmented by many dams can in no way be viewed as beneficial to the movement and dispersal of aquatic populations. In the Virgin River (Utah), thermally segmenting (different sections of warm and cold water inflows) of an otherwise free running stretch of river is likely one of the main causes of the recent rapid decline (almost extirpation) of the woundfin minnow population (Pers. Obser.).

5. Fluctuating Flows

FERC in the DEIS ignores the detrimental effects of the increase variability of flows in the reach due to low base flows. The ratio between high peak flows and base flows has been repeatedly shown to have a strong influence on aquatic biota. Flow fluctuations in the Pit River under existing conditions are more than an **order of magnitude** greater than they would be under natural conditions. This occurs due to the limited influence the project has on natural peak flow events and the greatly reduced base flow in the bypass reaches. Where naturally flows ranged from 20,000+ to 2,000 cfs (one order of magnitude) they now range from 17,000+ to 150 cfs (two orders of magnitude). Due to low base flows, even operational flow releases resulting from turbine shutdowns, etc., that release natural base flows (e.g., 1,500 – 3,000 cfs) into the bypass reaches, become large flood events to biota confined in the 150 cfs minimum flow channel. The coefficient of variability (CV) of mean annual flow in the Pit River bypassed reaches has increased from 24% to 74% as a result of the low baseflows and high peak flows. The CV is the ratio of the standard deviation of mean annual flow to the mean annual flow and is a measure of annual flow variability. Streams with a higher CV have more variable flows from year to year. Figures 5 and 6 show the USGS gage data in the Pit 4 bypass reach. Notice that the scale is logarithmic and that the flow variability is very large.

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The FS provided extensive discussion and literature citations in their October 9, 2002 Preliminary 4(e) Terms and Conditions Document (PTCD) regarding the effects of high flow events in combination with the current low base flows (please see the High Flow section of this document). The FS proposed flow regime (flow shaping and interim flows) reduces the flow fluctuation in the Pit bypass reaches half of an order of magnitude and reduces the CV significantly. These changes are expected to benefit recruitment of fishes, benthic invertebrates, and amphibians (see citations in PTCD). Figure 7shows an example of the reduction in variability that the FS proposed shaped flow regime provides (also see Table 1) for the Pit 4 bypass reach (results are similar for the Pit 4 bypassed reach). The proposed FS flow regime would decrease the flow variability by about a ½ order of magnitude and the existing flow spikes that occur in the system would be buffered in magnitude and duration to provide a more natural ecologically based flow regime. This flow regime would have a natural timing, shape and duration of high flow events that Pit River native species are adapted to exploit based on their evolved life history strategies. The FS proposed flow regime cannot be viewed as biologically damaging or neutral as it is presented in the DEIS.

A site specific, illustrative Pit River example of damaging effects of reduced baseflows superimposed by natural (in this example not natural) higher flow events occurred during the spring of 2002 with foothill yellow-legged frogs. In April, frogs laid egg masses within the 150 cfs minimum flow channel at the tailout of a pool and along the margins of the channel near Deep Creek. FYL frogs lay egg masses in sites very insensitive to flow fluctuations (see citations in PTCD). As a result of both an emergency spill (PG&E) and biological study flow releases of approximately 1,200 cfs, nearly the entire year class of frogs was lost due to scour of egg masses. Some egg masses were salvaged by moving them to a protected tributary stream, otherwise most of the known egg masses would have been lost. The 1,200 cfs flows were relatively small (20% less than the unimpaired driest year base flows) and not an uncommon event during years when natural spill events occur (or in this case a study or emergency spill occurred). But the flows were very damaging because of the low base flow. Essentially an order of magnitude flow increase occurred (150 to 1,200+ cfs). Had the frogs laid egg masses in a base flow of 600+ cfs the majority of the egg masses would have survived (Sarah Kupferburg, Pers. Comm.). Given a higher baseflow, 600 cfs, it would have taken a flow of roughly 6,000 cfs to produce an equivalent order of magnitude spill event (i.e., compared to the 150 to 1,200 cfs event).

In every river system we are aware of, where minimum flows have been increased or operational fluctuation of flows (e.g., hydropeaking) have been curtailed, such that the range of flow fluctuation is reduced, there have been dramatic increases in fish and benthic invertebrate productivity (see citations and examples in PTCD). **The FERC DEIS should recognize the**

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extremely large flow variability that currently occurs in the Pit bypass reaches due to severely reduced base flows and recognize the biological benefits of reducing the magnitude of the flow fluctuations through increased minimum flows.

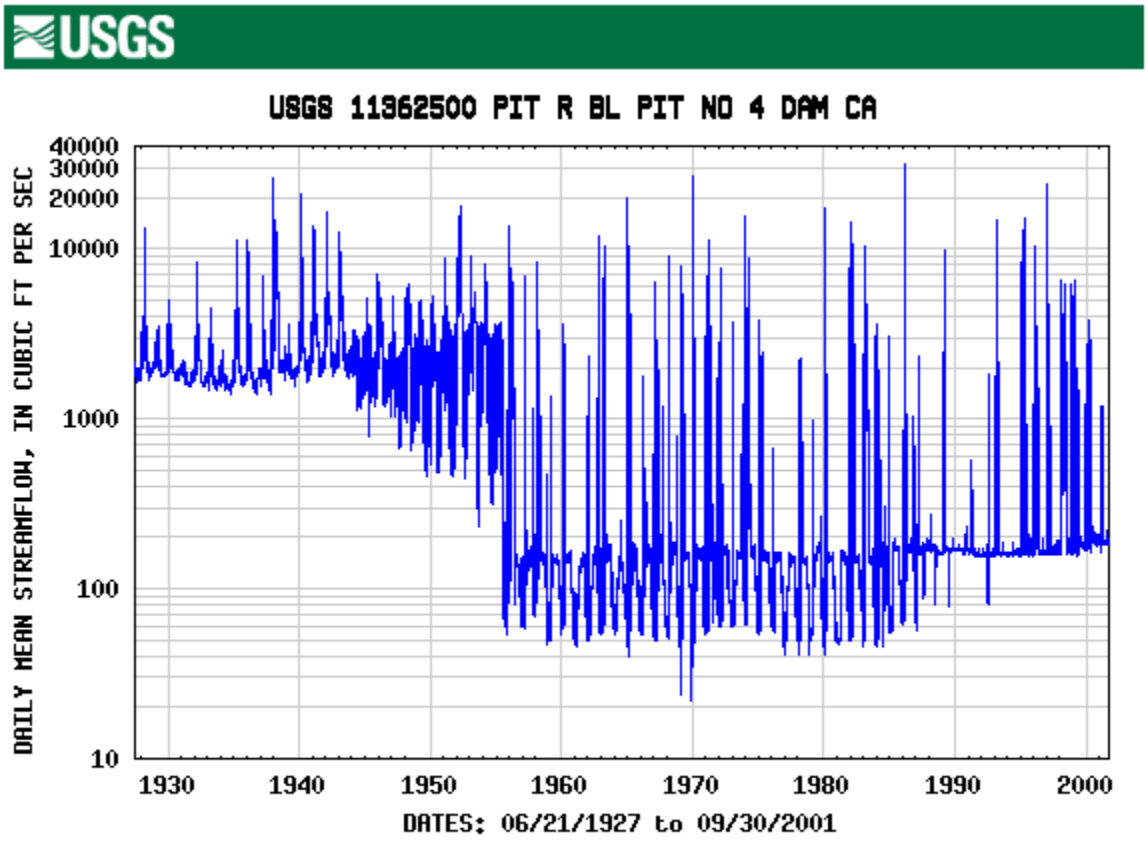

Figure 5. Flows in the Pit 4 bypassed reach from 1930 to 2000. Not the range of flows in the 1930's prior to the project and the one to two order of magnitude increase in flow fluctuation as a result of the Pit Project.

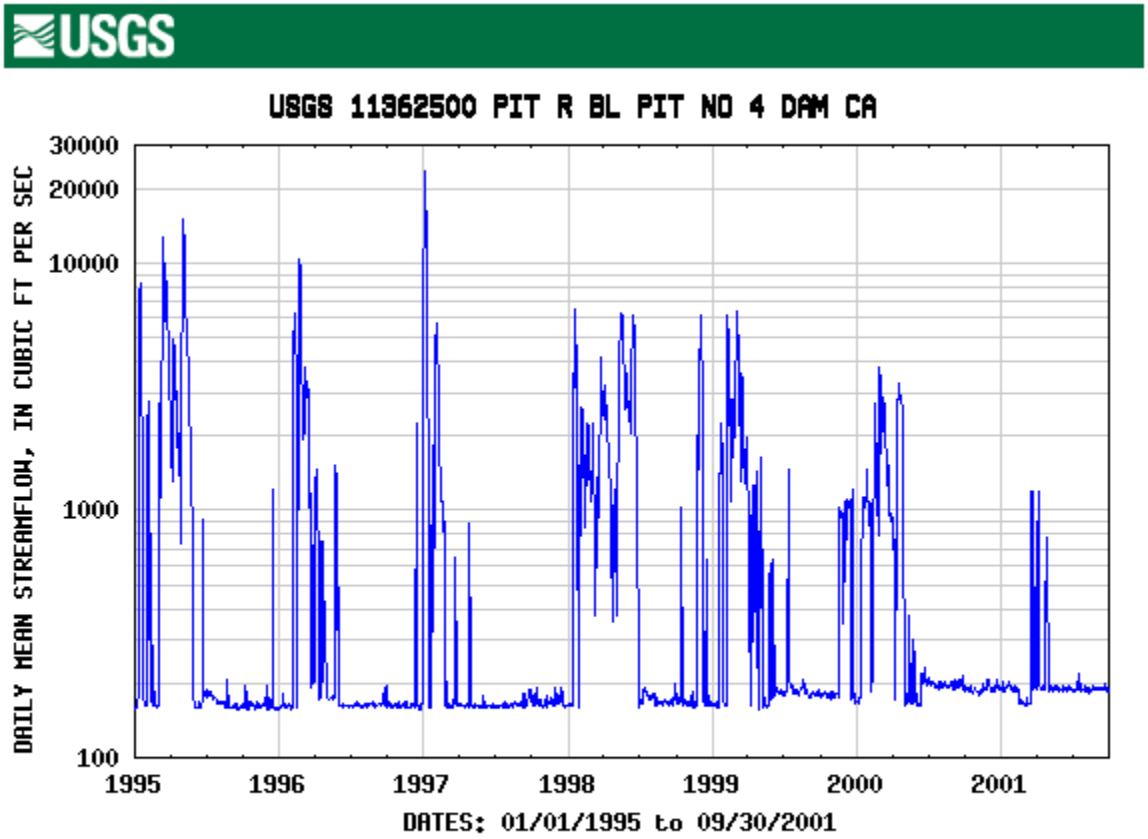

Figure 6. A close up view of the current flow fluctuations in Pit 4 bypassed reach. Notice the frequency and magnitude and short duration of these events.

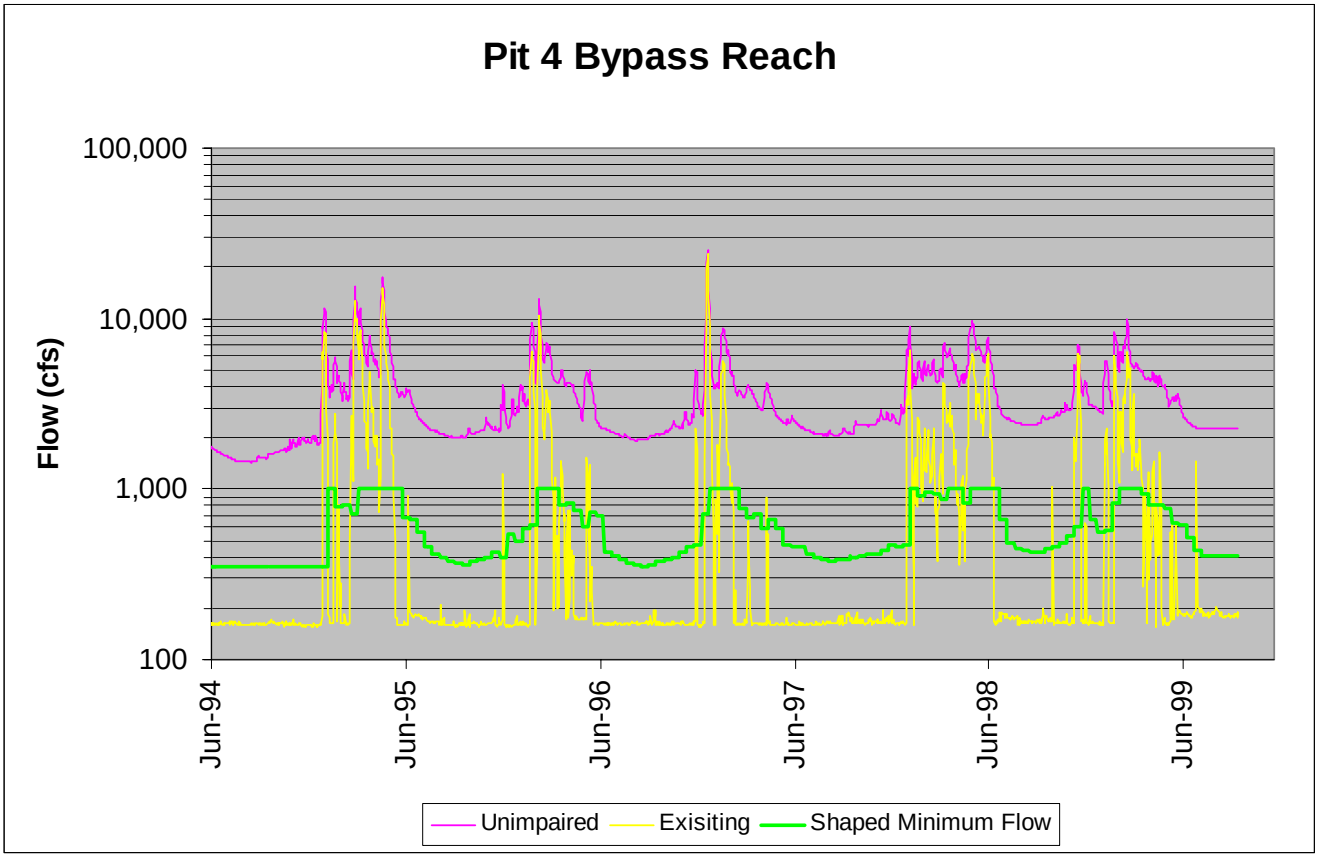

Figure 7. An example of unimpaired flows in the Pit 4 bypass reach (magenta), existing flows (yellow) and the FS proposed shaped minimum flows (green). The actual flow under the FS proposed minimum flow would be the maximum of the green and yellow lines. Notice that the proposed FS flow regime would decrease the flow variability by about a ½ order of magnitude and that the existing flow spikes would be buffered in magnitude and duration to provide a more natural ecologically based flow regime (i.e., a natural timing, shape and duration of high flow events that Pit River native species are adapted to exploit based on their evolved life history strategies).

6. Ramping Rates

DEIS Page 129. Based on a review of the proposed FS down ramping rates during natural high flow spill events we recommend that the FS provide a simple down ramping rate to be used by PG&E to attenuate spills in addition to the option provided of letting the spills attenuate naturally

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by holding the reservoir and power intake levels constant. This should be based on a review of the slope of flow attenuation of natural events and possibly the operational capabilities of PG&E. The down ramping rate should be composed of both a reasonable hourly rate (e.g., 0.2 feet per hour) and a daily rate (e.g., 400 cfs per day) that provides a semi-natural flow attenuation (for spills below 4,000 cfs).

The FERC analysis of the FS down ramping rates only looked at fish stranding issues (DEIS Page 129-130). The FS down ramping criteria are not aimed so much at stranding and trapping of fish from short term spill events as providing a more natural descending limb of longer duration spill hydrographs, particularly in the spring, to provide increased inundation of riparian vegetation and longer duration events to facilitate natural biological processes (e.g., spawning). We believe that in reality the FS shaped minimum flow hydrograph in conjunction with the ramping rate criteria (for flows 4,000 cfs down) deals with the biological process issues the FS is concerned with. The ramping rate criteria should not be viewed in isolation.

Likely the FS ramping rate criteria should be more specifically tied to the spring declining hydrographs and other criteria (e.g., faster down ramping criteria) should be provided for short duration spills at other times of the year

It should be noted that the stranding issue that FERC analyzed with PG&E study data is a short duration spill event and stranding/trapping associated with short-term events when organisms have not had time to invade newly inundated habitats. This is an entirely separate issue than trapping and stranding after long duration spring spill events when organisms have had time to invade “floodplain areas” and begin spawning etc. and then are rapidly dewatered.

7. Misinterpretation of the Tenant Method

DEIS Page 114 – Tennant Method (Tennant 1976): FERC restates PG&Es assertions that the Tennant Method was developed only from a limited number of rivers with “different hydrology and channel type” than the Pit River and that Tennant’s “10 percent of mean annual flow from April to September (i.e., Tennant’s severe degradation category) would be expected to have few, if any, self-sustaining rainbow trout populations.” FERC accordingly states that the “Tennant Method has limited value for establishing minimum flows in the Pit River.”

We believe the value the “Tennant Method” lends to the establishment of instream flows in the Pit River is **perspective.** The method evolved from “17 years (of work) on hundreds of streams” in “21 different states” (Tennant 1976). Since publication of the Tennant Method many hundreds of site-specific studies (e.g., Hatfield and Bruce 2000; see others in Instream Flow Council 2002) have supported the general channel/flow relationships embodied in the Tennant

Method. The method rates habitat degradation based on the functions that the natural channel and flow regime provide. The method is a relative ranking of function. A careful reading of the conclusions related to 10% of mean annual flow in Tennant (1976) and a elementary knowledge of the Pit River will convince any objective person that the degraded conditions (relative to natural flows) discussed in Tennant (1976) apply directly to the Pit River and that the DEIS statements above are incorrect.

The following statement comes directly from Tennant (1976; pg. 9). It comes from the section of the original document that discusses various river functions when flows are reduced to 10% or less of mean annual flow. We have added comments (*in parentheses*) to the original text to illustrate its applicability to the Pit River:

> Ten percent of the average flow: This is a minimum instantaneous flow recommended to sustain short-term survival habitat for most aquatic life forms (*this was a relative statement by Tennant regarding the amount of habitat needed to maintain a rivers' natural biotic assemblage and abundance, not a statement that no fish would persist at this flow-see remainder of his discussion*). Channel widths, depths, and velocities will all be significantly reduced and the aquatic habitat degraded (*this is true in the Pit River*). The stream substrate or wetted perimeter will be about half exposed, except in wide, shallow riffle or shoal areas where exposure could be higher (*this is true in the Pit River, except vegetation encroachment has covered many of the main channel substrates*). Side channels will be severely or totally dewatered (*this is true in the Pit River*). Gravel bars will be substantially dewatered (*this is true in the Pit River, except little gravel exists in the system*), and islands will usually no longer function as wildlife nesting, denning, nursery, and refuge habitat (*possibly true in some sections of the Pit River, but not generally applicable, in some areas islands may have been created*). Stream bank cover for fish and fur animal denning habitat will be severely diminished (*not applicable in the Pit River because many years of dewatering have allowed early seral stage vegetation encroachment*). Many wetted areas will be so shallow they no longer will serve as cover, and fish will be crowded into the deepest pools (*true in the Pit River in the sense that fish are confined to the narrow incised thalweg that creates boulder runs and in pools, little separation of shallow fry, juvenile, and amphibian habitat from adult fish habitat exits*). Riparian vegetation may suffer from lack of water (*true for main channel margin vegetation regeneration in the Pit River, not true for encroaching vegetation*). Large fish will have difficulty migrating upstream over riffle areas (*not generally applicable to the Pit River*). Water temperature often becomes a limiting factor, especially in the lower reaches of streams in July and August (*true in the Pit River*). Invertebrate life will be severely reduced (*not true in the existing wetted channel of the Pit River, but likely true*

when the extent of the main channel dewatering is considered). Fishing will often be very good in the deeper pools and runs since fish will be concentrated (*true in the Pit River, but not applicable due to the long history of dewatering. There is no concentration of fish from the larger channel to the low flow channel, because only the lower flow exists now*). Many fishermen prefer this level of flow (*true in the Pit River*). However, fish may be vulnerable to over harvest (*true in the Pit River, except that the remoteness and difficult conditions mitigate this to some extent, but see PG&E declining catch rate statistics for the Pit 3 reach*). Floating is difficult even in canoe or rubber raft (*true in the Pit River*). Natural beauty and stream esthetics are badly degraded (*would be true in the Pit River except years of dewatering have resulted in vegetation encroachment that has mitigated the dewatering esthetics problem*).

Clearly the Tennant Method has general applicability to the Pit River. Thankfully due to the narrow incised thalweg and large substrates that exists in the Pit River 3 and 4 reaches the degraded conditions are not as bad as would be expected in a more typical channel. Nevertheless, the fact that the Pit 3, 4, 5 bypassed reaches currently have minimum flows that are approximately 5% of mean annual flow and that hundreds of instream flow studies have shown that this level of flow creates severely degraded conditions (relative to typical natural flows) lends perspective to the current Pit River situation.

The incorrect perception (misinformation) of the Tennant Method in paragraph 1, page 114 should be removed. FERC should acknowledge the perspective that the Tennant Method provides and simply state that the more detailed studies conducted in 2002 and reanalysis of previous studies (e.g., 1985 IFIM) allows a more detailed analysis of Pit River instream flows than can be accomplished with the more general Tennant Method.

The Instream Flow Council's recently published book, Instream Flows for Riverine Resource Stewardship (Instream Flow Council, 2002) reviews the appropriateness of several instream flow analysis techniques including the Tennant method. They note on page 235 "The Tennant method was developed based on extensive field observations of 12 habitat and use parameters and measurements of hydraulic conditions at numerous locations across the United States. Data were collected from eastern, western and midwestern streams. Although often regarded as a method suitable only for the western United States, the method was developed using data from a much wider geographic area and range of stream types in the United States". They also note on page 237 that "Because of it robustness, this method is a reasonable starting point for quantifying instream flow needs to which refinements can be made if needed."

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DEIS Page 111:
FERC states that one of the four bases for the FS instream flow 4(e) condition was use of the Tennant method. While FERC did appropriately attribute that basis to the FS, it was not heavily relied on during development of the preliminary instream flow conditions as might be implied by it's listing as the first of four "approaches". In addition to the three other factors mentioned by FERC (i.e. flow observations, magnitude of annual variation, water temperature study data) the Forest Service relied significantly on a review of PG&E's project record, including IFIM data collected during the last license (although it was known to have significant flaws, as discussed in this report). Use of the Tennant method was limited to providing overall perspective to the general magnitude of flows presently occurring in the Pit River and proposed flows (i.e., a check against the instream flows developed with the other information stated above).

Conclusions

We believe that there are some serious flaws in both the DEIS process (time lines) and aquatic environmental impacts analysis that should be remedied. The DEIS comment period should be extended 3-5 months to allow inclusion of new study results in a manner that allows review of the study results by the FS and others.

The FS proposed shaped minimum flows cannot be accurately construed to be either biologically damaging or neutral for aquatic species and riparian communities. The proposed flows are specifically designed to enhance the biology and ecology of the Pit River bypass reaches. The DEIS should recognize these benefits.

We commend the DEIS writers in general for providing a concise and well organized document that facilitates review of the important issues related to the Pit 3, 4, 5 hydroelectric licensing process.

Respectfully,

R. Craig Addley
Thomas B. Hardy