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Letter from David A. Vogel, Continued

is no trend in these data ($F_{1,10} = 1.49$, $p > 0.25$), so they provide no evidence for a green sturgeon population decline in the Sacramento-San Joaquin Estuary." CDFG (2002)

CDFG specifically responded to the proposed sturgeon petition to list the species as threatened by stating that there are no data to indicate a decline in green sturgeon populations over the past 30 to 50 years (CDFG 2002). Moreover, CDFG believes green sturgeon populations are sufficiently abundant to allow angler harvest. The agency's regulations currently allow sport harvest permitting year-round take of one fish per day between 117 cm and 183 cm (3.8 feet to 6 feet long) total length and is not contemplating any changes in angling regulations at this time (CDFG 2002).

The DEIS/EIR incorrectly suggests that habitats for sturgeon upstream of RBDD are preferable to downstream habitats. In one instance, the DEIS/EIR implies that green sturgeon need colder and cleaner water upstream of RBDD[18] but fails to acknowledge that all the habitat attributes necessary for sturgeon spawning and rearing exist in abundant quantities downstream of RBDD. The reasoning is noticeably lacking.

The presence of green sturgeon at Red Bluff is apparently a relatively new phenomenon. For example, the USFWS reported:

> "*In recent years green sturgeon Acipenser medirostris adults have been observed below RBDD during electrofishing operations for adult salmon. Prior to this, the range of the green sturgeon had not been recorded farther upstream than the Delta.*" USFWS 1992

Although some green sturgeon are now known to migrate upstream of RBDD prior to dam gate closure in the spring (May 15), the available information indicates that the number of fish that do so is very small when compared to the total population in the Sacramento River. Nevertheless, the DEIS/EIR implies that there is some sort of biological requirement for sturgeon to do so (again, for reasons not articulated in the document) and that the entire green sturgeon population must attain access to the mainstem upstream of RBDD. The reality is that there is no empirical evidence to prove it is biologically necessary for the species to do so. Furthermore, it is evident that the DEIS/EIR's analysis of the various alternative effects on sturgeon is just a small portion of the population.[19]

457-6, cont'd

[18] "Green sturgeon are thought to require colder and cleaner water than do white sturgeon (Moyle et al., 1995)." DEIS/EIR Page B-14

[19] This major error and misleading analytical approach are exemplified by the following statement in the DEIS/EIR: "These tables provide the summary of the passage index scores (scaled to 100 as a maximum value). The index values represent the approximate portion of the species and lifestage that is unaffected by operations of the RBDD facilities for the entire calendar year. For example, an adult passage index of 89 means that approximately 89 percent of the entire annual population would pass RBDD and Lake Red Bluff without blockage, delay or some loss or injury." DEIS/EIR Page B-26

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The DEIS/EIR is actually assessing the effects of a percent of a percent of the sturgeon at RBDD (as similarly discussed re. spring-run chinook) which provides misleading results in the analyses. For example, assume the number of migrating green sturgeon reaching Red Bluff is small (e.g., one or two dozen) compared to the total population (hundreds to thousands). Of that small number, the majority reach and pass Red Bluff unimpeded prior to May 15 when the gates are lowered (e.g., two-thirds, using the estimates provided in the DEIS/EIR). Of the small proportion reaching Red Bluff after May 15 (a third of one or two dozen, or 4 or 8 fish), those fish can spawn and rear successfully downstream of RBDD. The spawning habitat available downstream of the dam is more than adequate for the small number of fish. The DEIS/EIR does not reconcile its misleading rationale. Furthermore, the DEIS/EIR used green sturgeon as a one of the primary fish species to focus on in the document[20] and, therefore, misleads uninformed reviewers of the document and artificially skews the analyses to invalid conclusions of project alternative effects on fish.

457-6, cont'd

Interestingly, the CDFG states that fish ladders can be designed to pass sturgeon because the north ladder on Bonneville Dam on the Columbia River passes sturgeon successfully (CDFG 2002). Although the numbers of sturgeon using that ladder are small (Steve Rainey, NMFS, personal communication) it warrants further examination in the DEIS/EIR.

Problems/Errors with the DEIS/EIR Assumptions on Downstream Fish Passage

Distortion of Juvenile Fish Mortality

Prior to 1987 when RBDD was operated with the gates in 12 months/year, CDFG and USFWS performed numerous research projects to ascertain potential problems associated with downstream migration of juvenile salmonids at the dam. Most of these experiments fell into the category of "mark/recapture" experiments. A known number of juvenile salmon were either tagged or marked and released at a variety of locations upstream of the dam (experimental groups of fish) and other groups of differently tagged or marked juvenile salmon were released at various locations downstream of the dam (control groups of fish). A small portion of each group of these tagged/marked fish was subsequently recaptured either as juveniles (during the same year of the experiments) or as adult fish several years after the experiments. The proportion of each group recaptured was then compared to the groups released upstream and downstream of the dam to ascertain potential proportional differences in recapture rate. If the recapture rate was less for the group released downstream of the dam as compared to the group released upstream of the dam, the difference was assumed to be attributable to all sources of fish mortality associated with dam passage (e.g., entrainment into the Tehama-Colusa and Corning Canals, physical injury, and predation in Lake Red Bluff or immediately

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[20] "The principal NAO fish species occurring at RBDD are green and white sturgeons and Pacific and river lampreys. Of these, the Fishtastic! analyses focused on the green sturgeon, because this species is known to congregate downstream of RBDD during periods when the dam gates are in place (K. Brown, pers. comm.)." DEIS/EIR Page B-28

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457-7 The commentor contends that estimated juvenile mortality in the *Fishtastic!* analysis using a factor of 55 percent mortality is not appropriate and distorts juvenile mortality. The effects of RBDD to downstream migrating juvenile fish, although primarily are assumed to be related to direct predation (mortality resulting from predators), it attempts to include additional considerations. The DEIS/EIR Appendix B, Attachment B1, explicitly states that the…"cost to migrating juveniles reflects both direct predation (i.e., actual predation of juveniles from the population), but also other factors are included in the estimation of effects, such as energy costs due to predator avoidance, altered feeding behavior, or delayed migration ultimately affecting the viability of the population" (page B1-20). In other words, the juvenile predatory effect value does not directly equate to a predation mortality estimate (such as 55 percent). A predatory effect value was selected to provide a surrogate passage efficiency value (e.g., 0.45) and was derived from predation mortality estimates from pertinent literature for juveniles passing RBDD. The predatory effect value (55 percent) used to derive the passage efficiency used in the impact assessment tool was chosen as a surrogate value to represent a predation mortality and passage effects estimate. As depicted in the commentor's Table 2, historical predation mortality estimates from studies conducted at RBDD ranged from 0 to 79 percent direct juvenile mortality. However, the predatory effect value applied in the *Fishtastic!* analysis tool was chosen to represent not only just direct predation mortality but also other "costs" of juvenile migration past RBDD, including expenditure of avoidance energy, altered behavior, or the "cost" of delayed migration. Then, to estimate downstream passage effects to juveniles, the predatory effect value was scaled against the potential presence of predators at RBDD as recently estimated by Tucker (1998), as cited in Appendix B, Attachment B1, to the DEIS/EIR. This juvenile passage effect was intended to represent a current estimate of predator conditions at RBDD, and was intended to be only an approximation given; no recent studies are appropriate. The approach does not attempt to distort effects of passage to juveniles and, furthermore, represents a maximum downstream passage effect value for juveniles passing RBDD. The downstream passage effect value was applied equally in the analysis of all alternatives. Finally, even when applying a very robust downstream juvenile passage efficiency estimator, the results of the analysis indicated that the alternatives would not measurably affect or improve passage for juvenile salmonids compared to the No Action Alternative.

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downstream of RBDD). After many experiments over many years, the primary source of mortality was principally attributed to predation by pikeminnow immediately downstream of the dam. The studies also found that large numbers (hundreds of thousands) of juvenile salmon were entrained into the two large irrigation canals annually.

Results of these studies are provided in Table 2.

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Table 2. Juvenile salmonid fish experiments associated with RBDD.

Researcher(s) Author(s)	Study Date	RBDD Gate Operations	Type of Experiment*	Estimated Fish Mortality Rate (%)
Hallock 1983	Early June 1975	In 12 months/year	Daytime, short-term mark/recapture, Lake Red Bluff	29
Hallock 1983	Early June 1975	In 12 months/year	Daytime, long-term mark/recapture, Lake Red Bluff	77
Hallock 1983	Late May 1976	In 12 months/year	Daytime, short-term mark/recapture, Gate 10	0
Hallock 1983	Late May 1976	In 12 months/year	Daytime, long-term mark/recapture, Gate 10	29
Hallock 1983	Early/Mid May 1977	In 12 months/year	Daytime, short-term mark/recapture, Lake Red Bluff	29
Hallock 1983	Early/Mid May 1977	In 12 months/year	Daytime, long-term mark/recapture, Lake Red Bluff	29
Hallock 1983	Early/Mid May 1977	In 12 months/year	Daytime, short-term mark/recapture, Gate 11	9
Hallock 1983	Early/Mid May 1977	In 12 months/year	Daytime, long-term mark/recapture, Gate 11	29
Hallock 1980	Late February 1973, 1974, 1975	In 12 months/year	Nighttime, long-term mark/recapture, Lake Red Bluff, steelhead	29
Hallock 1980	Late February 1973, 1974, 1975	In 12 months/year	Nighttime, long-term mark/recapture, Lake Red Bluff, steelhead**	26
Hallock and Fisher 1985	1973-1977 and 1979-1982	In 12 months/year	Various study purposes, composite analyses for fall-run chinook, late-fall run chinook, and steelhead**	35 salmon, 25 steelhead
Vogel et. al 1988	May 1984	In 12 months/year	Daytime, short-term mark/recapture	55
Vogel et al. 1988	April 1984	In 12 months/year	Nighttime, short-term mark/recapture	16
RBDD DEIS/EIR 2002	**No Study**	**In 4 months/year**	**None**	**55**

* CWT – Fish tagged with coded-wire tags for subsequent recapture during the adult life phase in the ocean sport and commercial fisheries and returns to the hatchery.
Mark/recapture – Fish marked with a distinctive, short-term mark to allow recognition when recaptured during the juvenile life phase.
** Comparisons between groups of fish released at Coleman Hatchery and groups of fish released downstream of RBDD; estimated mortality include the 40-mile reach between Coleman Hatchery and Lake Red Bluff

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In comparing these past research results at RBDD to that used in the DEIS/EIR, several noteworthy observations can be made. The document incorrectly or inappropriately:

1) Used results from only one of the many experiments performed at RBDD;
2) Used one of the highest juvenile salmon mortality estimates;
3) Used a daytime mortality estimate that does not reflect when most juvenile salmon migrate past the dam;
4) Used data collected when the RBDD gates were in year-round; and
5) Used fish mortality estimates developed prior to the period after extensive fish passage improvements at RBDD had been implemented.

The following describes how the DEIS/EIR analyzed project alternative effects on downstream migrating juvenile fish:

> "*Because there are not sufficient data to provide species-specific dietary preferences for predators, the passages efficiency values are not species-specific. The efficiency value selected by the user (see Figure 9) for each facility is calculated as the reciprocal of predator presence, where predator presence is determined empirically using predator study data (Vogel et al, 1988). Based on that data, the maximum predator effect is a 55 percent reduction in juvenile passage efficiency, corresponding to a downstream dam passage efficiency value of 0.45.*" DEIS/EIR Page B1-20

Translated, this means that the DEIS/EIR assumed that all juvenile fish species would suffer a 55% mortality rate when predators downstream of the dam were seasonally most abundant regardless of the ***actual number*** of predators and of all the major fish passage improvements. Vogel and Smith (1984) reported "spectacular feeding behavior of squawfish on juvenile salmon" following the May 14 daytime fish release that resulted in the 55% fish mortality rate used in the DEIS/EIR's analyses. This author recalls the episode of many thousands (est. >10,000) of pikeminnow actively feeding on the Coleman Hatchery test fish we released during the daytime, upstream of the dam.

The DEIS/EIR reports that there are no existing data on juvenile salmon mortality[21] (now that the RBDD gates are in only 4 months of the year, instead of 12 months) and, therefore, used the "highest mortality rate reported in the literature"[22,23]. The following hypothetical scenario illustrates an analogous approach to the DEIS/EIR's. In estimating

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[21] "The current extent of predation on juvenile salmonids passing RBDD is unknown." DEIS/EIR Page 3-15

[22] "The principal factors applied to assess potential predation at RBDD were based on a maximum literature value for predation for juvenile salmonids (Vogel et al., 1988) and the actual presence of predatory species at RBDD (Tucker, 1997). The estimated predation rate of 55 percent (Vogel et al., 1988) was weighted by predator presence as estimated by catch per unit effort (CPE) of Sacramento pikeminnow and striped bass at RBDD (Tucker, 1997)." DEIS/EIR page B1-7

[23] "To estimated monthly rates of predation, or a predation hazard index, the maximum predation rate (55 percent) estimated by Vogel et al. (1988) was scaled against the monthly weighted combined predator presence estimates." DEIS/EIR Page B1-9

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present-day automobile mortalities only data collected decades ago before installation of modern-day safety features were used (e.g., seat belts, air bags, road improvements and numerous other less-visible safety features). Since no data were collected since the safety improvements, using the DEIS/EIR rationale, there would have been no reductions in automobile mortalities. Assume also, of the data collected decades ago, the study showing the ***highest*** automotive mortality rate was used (i.e., worst-case scenario) to extrapolate to the modern day estimates. Using the DEIS/EIR's logic in this example, the assumption is that automobile mortalities have not changed and remain as severe as the worst-case study simply because modern-day "data are lacking". Therefore, automobile safety features have provided ***no benefit***. Obviously, this logic is invalid and it is also invalid for that assumed in the DEIS/EIR.

457-7, cont'd

Failure to Account for the Numerous RBDD Downstream Fish Passage Improvements

A major deficiency in the DEIR/EIR is the failure to account for the many RBDD improvements for downstream migrant fish. The DEIS/EIR is written and structured in a way that assumes no fish passage improvements have occurred at the dam. This erroneous circumstance is, in part, attributable to the DEIS/EIR using information on downstream migrant salmon mortality collected at RBDD ***prior to*** the numerous improvements being implemented. For the document to have any meaningful comparisons among project alternatives, data derived from RBDD prior to major measures that have significantly reduced fish mortality cannot be used. Table 3 provides a listing of many measures that have been implemented since the previously described fish studies were conducted.

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457-8 As acknowledged on page 2-2 of the DEIS/EIR, since the implementation of the Reasonable and Prudent and Conservation Measures from the 1993 BO for Winter-run Chinook Salmon, operation of RBDD have resulted in reductions in losses of fishery resources. On page 2-2 it is stated that effects of predation on juveniles was essentially eliminated with reduced gate operations as a result of the BO. The DEIS/EIS (page 2-6) also acknowledges the replacement of the old fish louvers with the installation of the rotary drum screens that now effectively exclude all salmon from the canal systems. Although not specifically described in the DEIS/EIR, all additional measures for improving downstream fish passage at RBDD (as shown in the commentor's Table 3) were implicitly included in the baseline affected environment as described in the DEIS/EIR. These improvements are all considered and included in the existing conditions at RBDD. The analysis of effects and benefits of each of the alternatives assumed that all of these improvements have greatly improved conditions for passing juvenile fish at RBDD. The improvement in passage conditions for juvenile anadromous salmonids (Appendix B Table B-8, page B-29 of the DEIS/EIR) is further acknowledged in the results of the analysis that indicate that none of the alternatives evaluated in the DEIS/EIR measurably improves passage conditions for juvenile anadromous salmonids (effects index values of 92 to 100 out of a possible of 100) over that of the existing conditions or the No Action Alternative. Although the measures implemented over the past 25 years have greatly improved juvenile salmonid passage conditions at RBDD, it is intuitive that removal of the RBDD gates for any additional period of time from the river beyond the existing operations at RBDD would further improve passage conditions for juvenile fish of all species. These improvements in passage conditions would benefit species, including green sturgeon, that are known to attempt to pass RBDD during the months the gates are currently in. This fact is demonstrated by the improvement in passage indices for those species under the 2-months Gates-in and Gates-out Alternatives as compared to the more restrictive Gates-in Alternatives, including No Action (Appendix B Table B-10, page B-31 of the DEIS/EIR).

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Table 3. Improvements for downstream fish passage at RBDD and percentage of results noted in the DEIS/EIR.

Fish Protection Measure	Effective Date	Actual Fish Passage Improvement	Portion of Benefits Described or Assumed in the RBDD DEIS/EIR
RBDD lights off at night	1983	Significant reduction in predation when RBDD gates in	0 %
Improved louver maintenance	mid 1980s	Major reduction of entrainment when RBDD gates in	0 %
Unclogging fish bypass pipe	1985	Major elimination of physical injury when RBDD gates in	0 %
Abandonment of salmon spawning channels	1987	Elimination of seasonal entrainment and significant reduction when RBDD gates in	0 %
TCC headworks deflector wall	late 1980s	Significant reduction in entrainment when RBDD gates in	0 %
Installation of new fish screens	1990	Elimination of entrainment when RBDD gates in	0 %
Installation of new fish bypass	1990	Major reduction of predation when RBDD gates in	0 %
RBDD gates out 6 months/year	1987	Major seasonal elimination of predation and significant reduction of predation when RBDD gates in	0 %
RBDD gates out 8 months/year	1993	Major seasonal elimination of entrainment and significant reduction of predation when RBDD gates in	0 %
Fixing leaks on the Dual-Purpose Canal fish screens	1985, 1986	Elimination of fish entrainment into the Tehama-Colusa irrigation canal	0%
Change in Acrolein treatment in the Dual-Purpose Canal	mid-1980s	Elimination or significant reduction in juvenile salmon mortality	0%
Elimination of flow-straightening vanes inside fish bypasses	1985	Elimination of physical injury and mortality of large numbers of juvenile fish	0%
Implementation of spring pulse flow	1985	Significant reduction in salmon mortality at RBDD	0%

Following are details of some, but not all, of the significant actions or features implemented that have improved downstream fish passage at RBDD. These measures are not listed in order of importance. ***None*** of these improvements are accounted for in the DEIS/EIR's analyses.

RBDD Lights Out

Upon the recommendation of this author and CDFG, the USBR began turning off the large sodium vapor lights on RBDD at night (Figure 11) as a measure of reducing nighttime predation of juvenile salmon (Vogel and Smith 1984). The USFWS considered the measure very successful in reducing juvenile fish mortality.

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Figure 11. Photographs of RBDD taken by the author with the large sodium vapor lights on top of the dam turned on and off.

Reduction in Fish Mortality in the Dual-Purpose Canal

During the course of fishery research projects in the Dual-Purpose Canal (DPC), located at the upper-most portion of the Tehama-Colusa Canal (TCC), it was discovered that the fish screens supposedly preventing fish entrainment into the Tehama-Colusa Irrigation Canal possessed leaks where young salmon could perish. Corrective action requiring SCUBA divers to plug the gaps in the screens was implemented (e.g., Vogel 1985e, 1986) eliminating the source of mortality.

Chemical Treatments in the Dual-Purpose Canal

The treatment of the Dual-Purpose Canal with an algaecide (acrolien) had occurred since 1976 and was known to kill large numbers of wild juvenile salmon (USFWS 1981). During the 1980s, the USFWS monitored the problems associated with the large fish kills in the DPC and worked with the USBR in altering the timing of acrolien application or, in some instances, elimination of the treatment which reduced fish mortalities.

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Installation of the New Fish Screens at the Tehama-Colusa Canal Headworks

The problems associated with the fish louver screens in the Tehama-Colusa Canal headworks at RBDD performing inefficiently and leaking wild fish into the canal system was recognized as early as 1972 (USFWS 1981) but not solved until the new, angled rotary drum screens were installed in 1990 (Figure 2). Installation of these screens prevented the well-documented annual entrainment of hundreds of thousands of juvenile salmon into the TCC (Vogel 1989b). The DEIS/EIR assumes this $15,000,000 fish screen resulted in no benefit to fish.

Elimination of the Fish Louver Bypass System Mortality

During the mid-1980s, I found a major problem adversely impacting juvenile salmon at the old fish louver bypass system. Based on underwater observations of hydraulic characteristics of flow emanating from the fish bypass system, I became convinced that flow constriction was occurring in at least one of the five fish bypass pipes. I encouraged the USBR staff at RBDD to temporarily shut down the fish bypass system and I volunteered to crawl up into the 30-inch diameter pipes to inspect the system. I found a large amount of riverine debris crammed inside one of the fish bypass pipes. It turns out, after discussion with USBR personnel, that three steel vanes were added (welded) to the inside of each of the five fish bypass pipes shortly after dam construction to allow USBR engineers to improve accuracy of flow measurements though the pipes. However, after the flow measurements, all fifteen vanes were inadvertently left welded inside the pipes. After my discovery, the USBR used cutting torches to remove the vanes and ground the pipe surfaces smooth (Vogel 1991a). Downstream migrant juvenile salmon were highly concentrated in the flow through these pipes because each louver bay was approximately 500 cfs and the fish were concentrated down from this volume of water to only 30 cfs. This means that if the flow into the TCC headworks was 2,500 cfs, the fish in that volume of water were subsequently concentrated down to only 150 cfs (30 cfs per louver bypass) or a concentration factor of 16 fold. Large numbers were undoubtedly killed every year in those pipes since dam construction until the problem was corrected in the mid-1980s.

Relocation of the TCC Fish Screen Bypass Outfall

During the design phase for the new TCC fish screens at the RBDD headworks, the engineers for the project originally contemplated routing fish from the fish screen bypasses to the river at a location near the old fish louver bypass outfall structure. However, based on my underwater observations of major predation by pikeminnow on juvenile salmon entering the river at that location, I and the other fishery resource agencies insisted that the new bypass outfall be located further downstream away from the high concentrations of pikeminnow immediately downstream of the dam and in high velocity water away from eddies that may harbor predators. Ultimately, this latter option was chosen which added approximately $1 million to the new fish screen project. The biological rationale and benefits of this strategy are also recognized on the Columbia

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River.[24] Also, the design of the new bypass system ensured that air entrainment throughout the pipe would be eliminated to correct the previously discovered problem in the old fish louver bypass system. This was accomplished inside the bypass system at an intermediate structure where four fish screen bypass pipes converged into two larger-diameter pipes back to the river (Rainey 1990).

RBDD Gates Out Most of the Year

The DEIS/EIR admits that raising the RBDD gates for 8 months of the year has resulted in significant benefits:

> *"Operation of RBDD under the Reasonable and Prudent Alternatives specified in the Winter-run Chinook Salmon Biological Opinion (NMFS, 1993) which specified that the gates may not go in prior to May 15th,* ***have greatly reduced the impacts of predation on salmonids from pikeminnows.***" DEIS/EIR Page B-35 (emphasis added)

Inexplicably, the DEIS/EIR does not account for those benefits in the analysis section of the document. Instead, the DEIS/EIR chose to select the "highest level of predation reported in the literature for RBDD" (55%) to analyze the various gates-in alternatives. This is a direct contradiction in the document.

Failure to Account for Daytime versus Nighttime Fish Passage

Contrary to the assumptions presented in the DEIS/EIR, the majority of downstream migration of juvenile salmon occurs at night, not day (Vogel 1982a, Vogel et al. 1988, USFWS 1989).[25] The DEIS/EIR not only inappropriately used historical data developed prior to implementation of improvement measures discussed earlier, but also assumed that all juvenile fish pass the dam during the day, not night. This is an enormous error in the DEIS/EIR's model outputs. This error is further compounded for all runs of chinook salmon, steelhead, sturgeon, and other fish species listed in the DEIS/EIR because of the inappropriate use of the 55% mortality results for ***daytime*** tests on fall-run chinook juveniles as a surrogate for all other fish species.

The natural phenomenon of higher downstream migration of salmon occurring at night as compared to day is evident in rivers and streams elsewhere in the Central Valley. These results are consistent with more recent sampling by the USFWS at RBDD where the researchers found:

> *"Outmigrating salmon exhibited distinct diel patterns of abundance. Catches from traps indicated that during eight of twelve months, juvenile*

457-8, cont'd

[24] "Based on our results to date, we recommend that when siting new or modifying existing bypass facilities that the outfall be in an area of high water velocity and distant from eddies, submerged cover, and littorial areas in general." (Poe et al. 1993)

[25] Except during periods of high river flow and turbidity and during mass releases of fish from Coleman National Fish Hatchery.

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salmonid abundance was significantly (P<0.05) greater in nocturnal periods. Typically diurnal levels of abundance were lower than those observed during nocturnal sampling except during months of increased river flows." (Johnson and Martin 1997)

Furthermore, researchers established that the abundance of most larval non-salmonid fish species captured with the experimental pumps at RBDD was greater at night than during the day, a finding that was consistent with that of additional research by Bothwick et al. (1999) (Bortwick and Weber 2001). However, the DEIS/EIR implicitly assumed that all juvenile salmon and all other fish species emigration occurs during the day, not night.

The DEIS/EIR also assumed that a 55% mortality of all young fish species will occur when the fish migrate down through the ladders. A review by Marine (1992) of several comprehensive publications on fish ladder design and improvements revealed that there are no data or discussion available on the potential mortality associated with the downstream passage of juvenile salmon through fish ladders (Clay 1961 and Powers et al. 1985, as cited by Marine 1992). Civil works on the Columbia River dams designed to carry fish, such as the fish collection and turbine bypass systems, have been measured to cause on average approximately 2% mortality to fish passing through those facilities (Rieman et al. 1988, as cited by Marine 1992).

The same mistake of using inappropriate data was made in 1992 for "The Appraisal Study of Options for Improving Fish Passage at Red Bluff Diversion Dam". Specifically referencing that report, Vogel and Marine (1992) pointed out:

> "*Predation rates for downstream migrants rely heavily upon data developed by Vogel et al.* [1988] *which considered fall-run chinook salmon smolts and tagged fall-run and late-fall-run smolts released at Coleman National Fish Hatchery and below RBDD. The conditions reported by Vogel et al. (1988) were different from the present operating conditions. The gates at the RBDD are now raised during the non irrigating season and predaceous squawfish are allowed to migrate upstream thereby reducing predation of downstream migrant fall-run salmon. It is not appropriate to use these historical databases to analyze existing conditions.*"

It is not clear why the document chose the "highest" mortality value instead of a composite or range of values. The DEIS/EIR has artificially skewed the analyses to result in biased weighting against many of the alternatives presented. Therefore, this circumstance precludes the Fishtastic computer model from serving as a useful decision-making tool.[26]

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[26] "Although quantification of natural processes, particularly involving complex organisms, is at best, only an approximation based on many assumptions, Fishtastic! was designed to be a decision-making tool." DEIS/EIR Page B1-1

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Incorrect Data on Timing of Pikeminnow Migration at RBDD

The DEIS/EIR has apparently failed to use a more comprehensive database concerning pikeminnow migration in the fish ladders at RBDD. A later migration timing is assumed whereas the historical database on pikeminnow indicates an earlier seasonal timing through the RBDD fish ladders. Those data are shown in Figure 12.

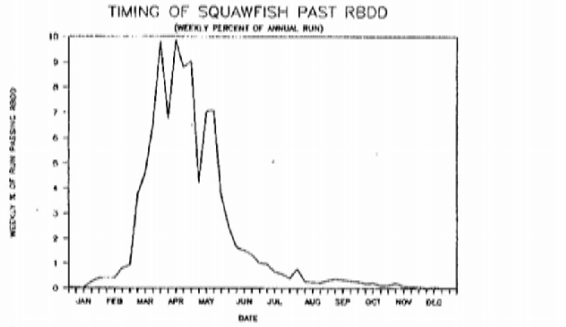

Figure 12. Timing of pikeminnow (squawfish) past RBDD – weekly percent of annual run based on counts in the RBDD fish ladders (from Vogel et al. 1988)

As evidenced in Figure 12, the vast majority of pikeminnow historically passed through the ladders prior to May 15. For the previously described reasons, a higher proportion would now be expected to pass Red Bluff prior to May 15 with the current mode of RBDD operations. This expected significant reduction in pikeminnow concentration downstream of RBDD was corroborated by Tucker et al. (1998).[27] However, the DEIS/EIR does not incorporate these significant findings into the document's analysis of alternative effects on fish.

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Incorrect Characterization of Lake Red Bluff Environment for Fish

Much of the DEIS/EIR's description of Lake Red Bluff suggests that it is a warm water environment full of ideal habitat for predatory fish species such as pikeminnow and striped bass[28]. The document and the scoping report are replete with statements that bird

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[27] "Comparing current data to those found in previous studies of Sacramento squawfish indicates that densities within the study area are much lower now than they were when the dam gates were left in year round." … "However, the overall trend has shown a definite reduction in Sacramento squawfish passage since the raising of the gates became a standard practice in 1986 (unpublished USFWS data, Red Bluff, California)." … "There is additional evidence that Sacramento squawfish densities behind RBDD have continued to decrease even after the policy of raising gates for extended periods was implemented." (Tucker et al. 1998)

[28] "…Lake Red Bluff, which is good habitat for predatory species like stripers." DEIS/EIR page B-39

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457-9 The commentor apparently failed to understand the method of analysis used to evaluate the effects of predatory pikeminnow on juvenile fish at RBDD. The DEIS/EIR recognizes that since the operation of RBDD in response to the 1993 BO for Winter-run Chinook Salmon changed to a 4-month gates-in operation, pikeminnow presence at RBDD has decreased when the gates are down (Tucker et al., 1998 as cited in DEIS/EIR Appendix B, page B-22). This reduction in pikeminnow congregation is a result of leaving the gates in the up position later in the year and, therefore, allowing pikeminnows a longer opportunity in the spring and early summer to pass upstream of RBDD on their annual migration. The DEIS/EIR recognizes the beneficial effect of the current gate operation as mandated by the BO (DEIS/EIR Appendix B, page B-22). However, the analysis to determine the current effects of predatory pikeminnows on juvenile fish at RBDD does not use the timing of migration of pikeminnows passing RBDD, it uses the temporal abundance of pikeminnows that remain at RBDD (as determined by Tucker et al., 1998) and is coupled with the passage efficiency value for juvenile fish (derivation as described in Response to Comment 457-7). In other words, the analysis of effects on juvenile passage did not rely on the number of predatory pikeminnow leaving the vicinity of RBDD and passing upstream through the fish ladders, it used an estimate of the temporal abundance of pikeminnows that remained congregated downstream of RBDD (the predators that did not pass RBDD).

457-10 In the DEIS/EIR, Lake Red Bluff was not characterized as a "typical reservoir" as stated by the commentor. However, there are attributes within areas of the lake that favor predatory species such as pikeminnows including shallower warmer water areas such as Sand Slough, as pointed out by the commentor. Furthermore, there were no statements or any implication that predatory fish species become: "instantaneously abundant and reproduce etc (?)" as stated by the commentor. As the commentor correctly points out, that is not biologically possible. What is possible, and even likely, is that, once the RBDD gates go in and Lake Red Bluff is formed, predatory fishes congregate in the lake from upstream and even pass through the fish ladders into Lake Red Bluff into areas that provide forage opportunities and favorable environmental conditions. Prior to 1993, some of these areas in Lake Red Bluff that contained shallow warmer habitats might also have been covered in abundant macrophyte plants. Since the gates-out 8-months/year operations went into

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and fish predators in Lake Red Bluff eat young salmonids.[29,30] The DEIS/EIR further implies that when the RBDD gates are lowered and Lake Red Bluff is formed, habitat is created where predator fish become instantaneously abundant and reproduce, etc. Biologically, this obviously cannot occur because of the very limited "ideal" predatory fish habitats present in Lake Red Bluff and the slow colonization that would naturally occur (explained below).

The DEIS/EIR's assumptions appear to be largely based on a juvenile salmonid radio-tagging study by Vogel et al. (1988) in Lake Red Bluff. The DEIS/EIR failed to recognize that researchers believed the predation on radio-tagged juvenile steelhead was likely a function of the highly visible, shiny radio transmitters attached to the backs of the test fish. For example, Vogel et al. (1990) reported:

> *"In addition, some predation of juvenile test fish by piscivorous birds was noted, but may have been attributable to the presence of the externally attached radio transmitters causing the fish to be more visible to the birds and/or less able to avoid capture."*

After noting the problem, we subsequently camouflaged the transmitters to make them less visible (Vogel 1991a). Recently, in some of my juvenile salmon migration research in the Sacramento-San Joaquin Delta, I have employed surgical implantation procedures to further reduce the potential problems of predation of radio-tagged juvenile salmon.

In 1989, the USFWS reported "*juvenile salmon showed little difference in migration rates with the gates in or out of the water*" (Vogel 1989), an extremely relevant fact not reported in the DEIS/EIR. Furthermore, Vogel et al. (1990) stated:

> *"The release and subsequent detailed monitoring of 192 radio-tagged juvenile steelhead trout and chinook salmon showed that delay of downstream migrants in the reservoir above the dam was minimal. This was further substantiated by hourly sampling of downstream migrant hatchery chinook immediately following their release from a location 30 miles (48 km) upstream; the fish moved through the reservoir in a matter of only a few hours."*

457-10, cont'd

[29] An additional effect of the existing operations of RBDD on juvenile salmonids, especially on steelhead smolts, includes predation by avian species while passing through Lake Red Bluff and downstream of the dam (Vogel et al., 1988; USFWS/USBR, 1998)." (DEIS/EIR Page B-7)

[30] "Juvenile salmonids passing downstream of RBDD are also susceptible to disorientation and predation when they arrive downstream of the dam, resulting in a decrease in their survival rates. Both Sacramento pike minnows (formerly known as Sacramento squawfish) and striped bass are known to prey heavily on juvenile salmonids both within Lake Red Bluff and downstream of RBDD."..."Lake Red Bluff provides a habitat that enhances predation on juvenile salmonids and reduces their survival rates. In addition to losses of juvenile salmonids to predatory fish, predation by fish-eating birds is known to occur in Lake Red Bluff. Reduction in the period of time that Lake Red Bluff is in existence likely has reduced the losses of emmigrating (sic) juvenile salmonids from both avian species and predatory fish." (CH2MHILL 2000)

Letter from David A. Vogel, Continued

457-10, cont'd

effect in 1993, it is likely that these dense layers of macrophytes no longer exist. The former areas containing dense layers of macrophytes that once might have provided cover for native fish, including salmonids and other species, from predators no longer exist, thus creating better foraging conditions for predatory fish such as pikeminnows. Regarding the avian predation of juvenile fish in Lake Red Bluff, the commentor states that the DEIS/EIR relied on his research of predation in Lake Red Bluff (Vogel et al., 1988) but failed to recognize his latter observations (Vogel et al., 1990) that: "…some predation of juvenile test fish by piscivorous birds was noted, but may have been attributable to the presence of the externally attached radio transmitters causing the fish to be more visible to the birds…" The commentor further states that later research was conducted with "camouflaged" transmitters. However, the commentor does not share any additional data or evidence of the benefits of camouflaged transmitters in reducing predation in investigations of bird predation in Lake Red Bluff. Regardless, USFWS and Reclamation (1998) in their Supplemental Fish and Wildlife CAR of the RBDD and TC Canal stated that a conclusion of the Vogel et al. (1988) report was that predation of yearling steelhead by cormorants in Lake Red Bluff "…could be a substantial cause of mortality." The CAR goes on to state: "…predation in both Lake Red Bluff and the RBDD tailrace was suggested as the primary cause of mortality of migrating salmon." Finally, NMFS's proposed recovery plan for winter-run Chinook salmon (1997) states: "…passage through Lake Red Bluff can delay downstream migrants and increase the opportunities for predation by birds and predatory fish (Vogel and Smith, 1986)."

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Because the small reservoir upstream of RBDD is relatively shallow and the water residence time is short, Lake Red Bluff could be more appropriately treated as a short-term, elevated riverine environment instead of the more lacustrine (lake-like) environment described in the DEIS/EIR. For example, Lake Red Bluff is estimated to be approximately 3,000 acre-feet in volume. With a summertime Sacramento River flow of 10,000 cfs, the exchange rate (or residence time) of the volume of water in Lake Red Bluff would change 6.6 times every 24 hours or replenish itself every 3.6 hours. This value is uncharacteristically very high for a typical reservoir and is why the summertime water temperature in the lake is very cold (with the exception of Sand Slough).

Historically, Lake Red Bluff was known to provide an extensive nursery area for salmon fry when the dam gates were in year-round. In the fall of 1969, 301,643 winter run fry were captured, in the fall of 1970, 109,100 were captured, and in the fall of 1971, 309,266 winter-run fry were captured. The fact that approximately 720,000 juvenile winter-run chinook salmon were sampled in Lake Red Bluff during September and October during this period, in addition to sampling in 1973 [Hallock and Reisenbichler (1980), Hallock and Fisher (1985)], indicate that this area was historically a large nursery for winter-run chinook fry. My recollection of the location is at the lower end of Lake Red Bluff in the left-side channel over relatively shallow, sand and gravel substrate near large amounts of aquatic macrophytes. Unlike the further-upstream Sand Slough, this part of Lake Red Bluff possessed flow-through current and was cold, similar to the main river channel. The aquatic macrophytes became established because of the relatively stable year-round river elevation but have since disappeared because of the current mode of dam gate operations.

Using the rationale articulated in the DEIS/EIR, if the 4-month formation of Lake Red Bluff is considered ideal habitat for predatory species, then the naturally abundant, year-round river oxbows present downstream of RBDD must be considered phenomenal habitats for predators. Therefore, the "ecological costs" associated with the numerous, naturally occurring oxbows downstream of Red Bluff would be very high. The DEIS/EIR does not reconcile its inconsistent logic on this topic.

457-10, cont'd

IMPACTS FROM THE PROPOSED LARGE-SCALE PUMPING PLANT AT THE MILL SITE

One of the alternatives proposed in the DEIS/EIR is construction of a very large-scale pumping plant at the Mill Site (Alternative 3). To justify this alternative, the DEIS/EIR suggests that a large pumping plant could be constructed and operated with no adverse affects on fish. Most surprising is the lack of information and detail in the DEIS/EIR as compared to other alternatives described in the document. In fact, the DEIS/EIR states:

> "*However, because only preliminary site investigations have been completed at the Mill Site, site constraints and development requirements are not fully known.*" DEIS/EIR Page A-42

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Letter from David A. Vogel, Continued

457-11 See Response to Comment 311-41. Regarding the commentor's statement of undisclosed impacts of unimpeded access of striped bass past the dam during months under the Gates-out Alternative, the following discussion is provided. Currently the gates–in operations during the mid-May through mid-September period act to attract post-spawning striped bass that congregate near RBDD to forage on juvenile salmonids (Tucker et al., 1998). It is believed that these striped bass "key in" on salmon juveniles coming from under the gates during the gate's in period (Tucker et al., 1998). In their investigation, Tucker et al. (1998) found that 98 percent of all striped bass captured in the five sampling locations near RBDD in 1994 through 1996 were captured at RBDD. Because of the disorientation and possible injury to juvenile salmonids passing under the gates a "feeding station" is created for striped bass when the gates are in. If the gates were removed during the striped bass post-spawning period of late spring and early summer, juveniles salmonids being transported/migrating through RBDD would no longer be swept under the gates and become vulnerable to striped bass predation. In that case, a feeding station downstream of RBDD would no longer exist, and striped bass would no longer congregate and ambush juvenile salmonids as they pass under the gates. It might be true that the striped bass have unimpeded access to rivers reaches upstream of RBDD, but in the case described above, they would also have a decreased opportunity to congregate and ambush disoriented prey. Furthermore, the colder Sacramento River water in reaches upstream of RBDD would likely further discourage striped bass from penetrating farther upstream. If the feeding station were to be removed by the removal of the RBDD gates, any striped bass would likely return to the warmer portions of the lower Sacramento River and Delta as they presently do. Therefore, it is unlikely there would be any incremental increase of impacts to juvenile salmonids from striped bass predation should the gates-out operation occur.

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Letter from David A. Vogel, Continued

Due to these missing elements, the final document must provide more substantive information for evaluation among the potential project alternatives in order to meet its goal.[31]

I noted that the DEIS/EIR provided a table showing the average depths at different sites contemplated for the proposed pumping station (DEIS/EIR Table A-3, Page A-11), but did not show similar data for the Mill Site. I performed a reconnaissance-level survey to determine the site's bathymetry when the RBDD gates were out. Those results are shown in Figure 13.

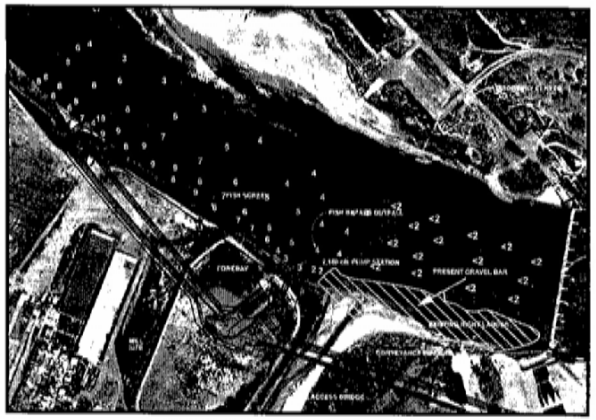

Figure 13. Bathymetry map of water depths (feet) in the vicinity of the proposed large fish screen at the Mill Site when the RBDD gates are out (modified graphic from the DEIS/EIR).

The most striking result from this survey showed that the shallow water at this site will make it highly problematic to place a large-scale fish screen on the river. This circumstance is, in part, attributable to severe aggradation of the mainstem riverbed just downstream of the Mill Site in recent years. Figures 14 – 16 show the large gravel bar

[31] "NEPA is a procedural law requiring agencies to evaluate a range of reasonable alternatives, disclose potential impacts, and identify feasible mitigation. Reasonable alternatives must be rigorously and objectively evaluated under NEPA (as compared to CEQA's requirement that they be discussed in 'meaningful detail')." DEIS/EIR Page 1-3

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Letter from David A. Vogel, Continued

extending out from the Red Bank Creek confluence into the main river channel that did not exist 25 years ago and resulted in the course change of the Sacramento River.

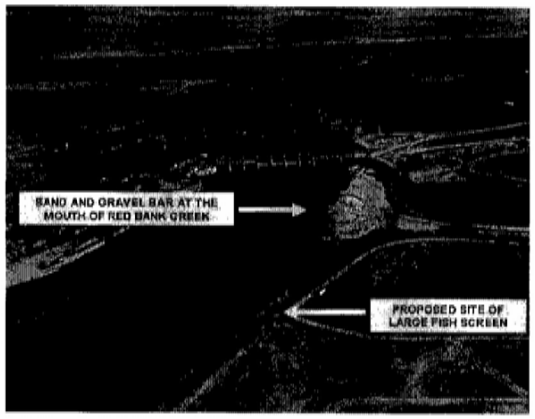

Figure 14. Aerial photograph taken by Marshall Pike on September 20, 2002.

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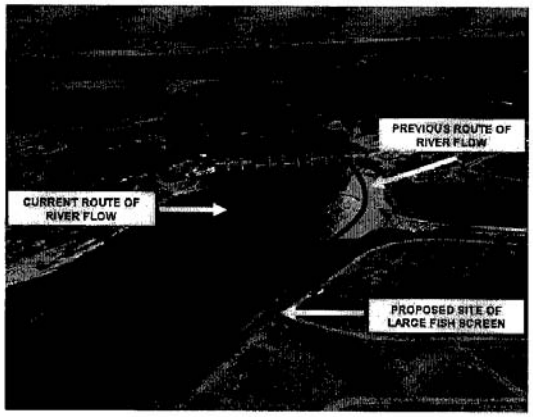

Figure 15. Aerial photograph taken by Marshall Pike on September 20, 2002.

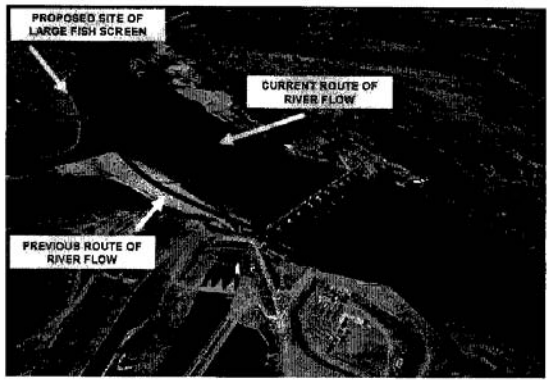

Figure 16. Aerial photograph taken by Marshall Pike on September 20, 2002.

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I examined some of my prior USFWS research reports and found that I had taken bathymetry profiles in this area during the mid-1980s in preparation for specialized field sampling efforts with fish trawling equipment (Figure 17 - 18).

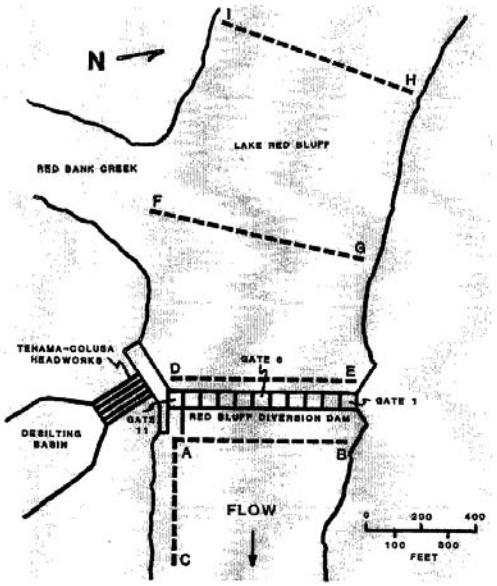

Figure 17. Location of depth profiles (transects) measured near RBDD by the USFWS in 1984 (from Vogel and Smith 1984).

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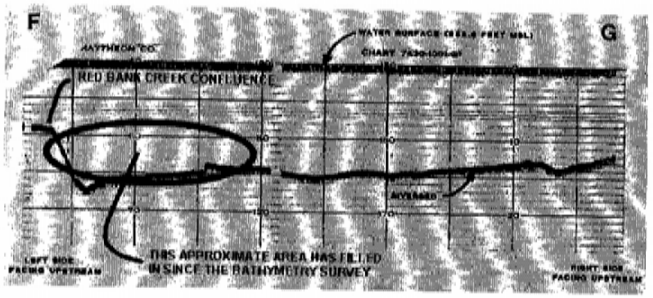

Figure 18. Cross-sectional depth profile measured in Lake Red Bluff upstream of RBDD at the confluence with Red Bank Creek in 1984; refer to Figure for location of transect F-G (from Vogel and Smith 1984).

Installation of a new large pumping plant and fish screen on the bank of the Sacramento River, while concurrently ensuring a reliable water supply and meeting fish protection criteria, will not be an easy proposition as suggested in the DEIS/EIR. In fact, it may be impossible to construct without a massive, permanent reconfiguration of the channel geometry and hydraulics in combination with a regular (seasonal) in-river dredging program. Initial, large-scale dredging in the river will be necessary to make the channel deeper to accommodate the required depth and surface area on the screens to meet the required maximum approach velocity of 0.33 feet/second and provide the necessary sweeping flows past the screens. The enormous area of sediment at the mouth of Red Bank Creek will have to be removed for the fish screens to function properly (Figure 14). These dredged sumps would be deeper than the surrounding riverbed and create predatory fish habitat impacting juvenile fish encountering the screens.

To meet the fish protection measures at the pumping plant mentioned above, a regular river channel maintenance (dredging) program will have to occur to ensure adequate depth and keep the area from re-aggrading. These measures at the downstream end of the proposed screens will probably create ideal habitat for predatory fish that will easily prey on large numbers of juvenile fish concentrated down to a lesser amount of flow at the end of the screens. Because of "competing" hydraulic conditions in the river and to the pumping station, some sort of a permanent training wall in the main river channel opposite the fish screens will probably be required to concentrate the flow against the fish screens. Positioning the necessary fish bypass outfall structure will also be very difficult because of the relatively recent changes in the river's route (Figures 15 – 16). If the bypass is located in an area subject to significant change, the fish could ultimately be routed into undesirable predator holding habitat.

It can fully be expected that this new, yet-to-be-designed large fish screen on the river will be much more problematic for fish protection than the existing screens at the TCC

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headworks where physical and hydraulic conditions have been proven to meet fish screening criteria. A major advantage to the existing TCC screens is the controlled hydraulics that can never change. Conversely, on-river fish screens have greater opportunity to go out of variance of accepted criteria for fish protection. Routine maintenance of a large-scale pumping plant may jeopardize not only fish beyond the normal 4-month period when the RBDD gates are traditionally in, but also the reliability of the water supply for the TCC, eliminating the two primary objectives of the proposed project. However, a smaller-sized facility positioned at the upstream-most end of the Mill Site may be less problematic but will still require extensive and careful analysis for the previously described reasons.

The DEIS/EIR does not describe the environmental impacts that will occur by allowing unimpeded access of striped bass past the dam during the summer months under the gates-out alternative. Unlike the pikeminnow[32], this predator is not native to the Sacramento River and do not pass through fish ladders. Also, pikeminnow have naturally co-existed with salmon for thousands of years[33], whereas striped bass have not. There are many knowledgeable scientists that attribute declines in some Central Valley salmon runs to striped bass (voluminous testimony available through the archives of State Water Resources Control Board Hearings). Raising the RBDD gates year-round will allow striped bass to enter all the prime summer salmon nursery areas for fry and juvenile salmon upstream of Red Bluff. Because of RBDD operations, the striped bass upstream migration has been blocked from those salmon nursery areas for nearly 40 years.

The biological consequences on the salmon runs could be severe because of the extreme predatory nature of striped bass compared to all other native or non-native fish species present in the Sacramento River. For example, nation-wide notoriety occurred at Lake Davis where a non-native predator, northern pike, was introduced and unsuccessfully eradicated in an attempt to avoid adverse impacts on Central Valley salmon. Allowing striped bass unrestricted access to areas upstream of Red Bluff would be not unlike artificially stocking large numbers of adult northern pike in the upper river. Details on this potential disaster were severely lacking as noted by its reference only twice in the entire voluminous document.[34,35]This circumstance must be considered as an adverse impact to any rearing Sacramento River salmonids upstream of RBDD during the summer months (e.g., endangered winter-run chinook fry and threatened steelhead trout fry). A worst-case scenario is that this consequence could affect the species' survival. A

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[32] "This species can and does readily pass through the existing fish ladders at RBDD."DEIS/EIR Page B-35

[33] "The Sacramento squawfish *Ptychocheilus grandis* is a native piscivorous species that co-evolved in the system with salmon and steelhead. In a natural free flowing river setting the predator-prey relationship between Sacramento squawfish and salmon is balanced and has no significant long term affect on salmonid populations." [Brown and Moyle (1981), as cited by Tucker et al. (1998)]

[34] This may result in undesirable increases in predation by striped bass on juvenile salmonids upstream of RBDD." DEIS/EIR Page B-39

[35] "The alternative would allow adult stripers to migrate unimpeded as far as Redding, and by doing so, may result in undesirable increases in predation of rearing anadromous salmonids in the Sacramento River upstream of RBDD." DEIS/EIR Page B-44

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lesser, but still important consequence, is that the recovery of the species may be affected.

Another undisclosed fact in the DEIS/EIR is that the pumping plant will likely have some effects on downstream migrating fish not just only during the May 15 to September 15 period, but earlier and later in the season (Figure 19). Those effects will be both operationally- and structurally-facilitated. This circumstance will encompass a greater range of the downstream migration period for the threatened and endangered fish species of concern (i.e., winter-run chinook, spring-run chinook, and steelhead).

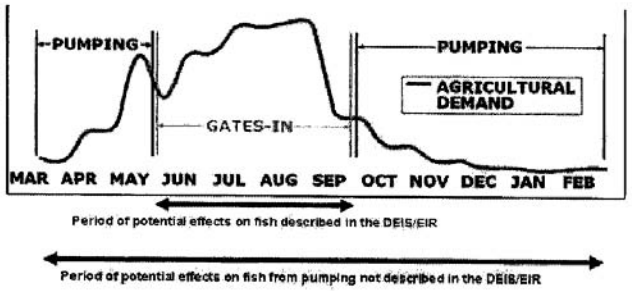

Figure 19. Period of potential impacts on fish resulting from year-round pumping (adapted from DEIS/EIR graphic)

Astonishingly, the DEIS/EIR states that no effects on fish will result from operations of the proposed large-scale pumping plant on the river at the Mill Site.[36]

Recent lessons learned from new fish screens constructed elsewhere on the Sacramento River must be heeded. For example, the M&T/Lano Seco Fish Screen Facility, located on the Sacramento River 50 river miles downstream of RBDD (Figure 12), was constructed in 1997 at a cost of $4.7 million. The full capacity of the diversion is only 150 cfs (CALFED 2002a).

> *"Since then, river dynamics have created substantial sediment depositions and the pumping plant intake is now in an eddy behind the gravel bar at the mouth of Big Chico Creek and in danger of being severed from the Sacramento River during seasonally increased river flows. Intake screens are no longer providing sufficient sweeping flows critical to fish screen operation and fish survival."* (CALFED 2002a)

[36] "Gates-out Alternative: Operations. No significant adverse impact to fishery resources would occur with operations of this alternative. Therefore, no mitigation is required." DEIS/EIR Page B-43

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"... the intake screens are no longer providing sufficient sweeping flows consistent with National Marine Fisheries Service and CDFG fish screen criteria due to the deposition of sediment. Eddy currents are also unable to maintain a clean screen as originally designed. As a result of these changes, anadromous fish including spring-, fall-, late fall-, and winter-run chinook salmon and steelhead trout in the Sacramento River and Big Chico Creek have the potential to be adversely impacted by non-functioning fish screens." (CALFED 2002a).

A short-term partial solution was proposed to CALFED in order to alleviate the immediate problems at this water intake. This approach recommended excavation of up to 100,000 cubic yards of sand and gravel from within the active river channel. In addition, the preparation of a "Feasibility Report" was proposed to: 1) gather existing data, 2) research existing conditions in the river, 3) understand fluvial geomorphology, 4) monitor the gravel bar, 5) gather data from surveyors, hydrologists, and geo-technical engineers, and 6) prepare a river model to assist in determining an appropriate long-term solution (CALFED 2002a). An expected outcome of this proposed project was to *"provide a valuable opportunity to advance the science and practice of river restoration and management that can be applied to future fish screen projects on the Sacramento River."* (CALFED 2002a)

This $1,816,500 proposed project was rejected for funding and considered a "directed action" for potential future funding consideration. The CALFED Proposal Selection Panel recommended a re-write so that the actions *"not be solely focused on protecting the existing facility, but should consider alternative means of meeting the water needs of beneficiaries of the present facility, including modifications to the existing facility to accommodate river meander and sediment deposition."* (CALFED 2002b) This proposal has been subsequently resubmitted to CALFED for funding consideration.

457-11, cont'd

COMMENTS ON THE USE OF THE RBDD DEIS/EIR'S FISHTASTIC MODEL

The DEIS/EIR describes a simple computer spreadsheet model (called "Fishtastic") used to analyze the various fish passage alternative effects on fish. The Fishtastic model is largely based on speculation.[37,38] There are numerous major errors in the model's assumptions that render the DEIR/EIS fish passage analyses and results meaningless. In every instance, the assumed impacts to fish and fish passage are greatly overstated and based on a disproportionate manner for each alternative. Although the DEIS/EIR provides a few caveats stating that the model outputs are mostly biologically meaningless, it nevertheless used those outputs to describe presumed specific cause and

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[37] E.g.: "The efficiency values assigned to the "future" facilities (e.g., "new" ladders) were estimated based on perceptions of their relative efficiency as compared to the existing facilities' efficiencies." DEIS/EIR Page B1-2

[38] Therefore, the assumed adult passage delay from other dam facilities (e.g., new ladders or a bypass channel), were extrapolated and were subjective." DEIS/EIR Page B1-3

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457-12 See Thematic Response No. 1. The adequacy of the fish passage analysis methods is questioned by the commentor. The commentor states that the analysis is based on "speculation," and the results are "meaningless," "greatly overstating" impacts. In addition, the commentor states the analysis is based on a "disproportionate manner" (?), and the "model" was not "technically sound." As stated in the introduction of the *Fishtastic!* Approach, Assumptions, and Methodology Appendix B (Attachment B1) to the DEIS/EIR, this analysis used a tool and is not a "model." The tool (*Fishtastic!*) was developed and was applied to distinguish differences between project alternatives and not to predict actual changes in numbers of individuals or populations of fish, and as such was not intended to be a "spawner-recruit model." By the nature of the many variables and the issues at RBDD, this tool was developed by continuous input and professional consensus of members of the Project TAG. The TAG membership was made up of technical representatives with backgrounds in fisheries biology and engineering from the resources agencies and the DEIS/EIR consultant. In many instances, no data were available to draw from, and guidance to direct the analysis and accomplish the goal of distinguishing differences between alternatives was through consensus and application of best professional judgment using the TAG members' experience with fishery investigations and issues at RBDD. This process was hardly "meaningless" and certainly not "technically unsound." An extensive number of TAG meetings over a period of several years resulted in constant dialog and re-evaluation and tuning of the assumptions, variables, data used in, and the results of the passage analysis. The commentor states the "model" possesses an inconsistent and nonobjective approach between alternatives, resulting in a fatally flawed approach, and invalidates its usefulness. The commentor states that when assessing the effect of any "gates-in" alternatives, the ecological costs for juvenile fish screened out of the existing TC Canal are increased because they are "affected by the facilities," and the same was not true for fish exposed to the proposed Mill Site fish screen. That comment is inaccurate. As stated on page B1-7 of Appendix B (Attachment B1) to the DEIS/EIR, "It was assumed that any alternative would include juvenile fish protection facilities in accordance to existing NMFS and CDFG criteria, and therefore, there would be no difference in juvenile passage efficiencies related to these facilities." Furthermore,

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effect biological relationships on fish and show presumed biological benefits of one alternative over other alternatives. [39] The method is not technically sound.

Inappropriate and Invalid Model Parameter

The DEIS/EIR attempts to create a new paradigm on how an upstream and downstream fish passage project should be evaluated:

> *"The ultimate output of the adult module in Fishtastic! is neither actual numbers of fish passing the dam, nor percentages of the overall population passing the dam, but instead a relative index score (from 0 to 100). At each step in the adult module, an ecological "cost" or consequence of passage to that species is calculated. Although this concept is relative and somewhat abstract, it is necessary to avoid inappropriate assumptions or conclusions regarding species survivorship or injury and consequent changes in populations. Therefore, the passage index represents a relative score in terms of a composite of possible costs, such as reduced energy for egg development, swimming stamina, reduced survivorship, recovery from injury, etc. Thus, it is important for the user to understand that Fishtastic! is merely a tool for evaluating the relative effects of RBDD facilities management, rather than an absolute cost, in numbers (mortalities), to a given population."* DEIS/EIR Page B1-11

Despite the convoluted logic and ambiguity with these statements, the DEIS/EIR proceeded to use the model outputs to derive conclusionary statements on so-called quantifiable fish passage benefits in order to compare the project alternatives.

The model possesses an inconsistent and non-objective application between DEIS/EIR alternatives that results in a fatally flawed approach and invalidates its usefulness. For example, when assessing the affects of any gates-in alternative, it reduces the "fish passage index" and increases the "ecological cost" for juvenile fish screened out of the existing TCC canal (due to the new angled rotary drum screens) because the fish are "affected" by the facilities. Conversely, the model fails to reduce the fish passage index for juvenile fish exposed to the proposed facilities at the Mill Site. The TCC screens have eliminated entrainment and impingement and possess a state-of-the-art fish bypass system that routes juvenile fish pasy the dam to a location downstream of predator fish concentration. This existing feature has also been demonstrated to not injure fish nor increase the vulnerability of juvenile salmon to predators from potential stress (Vogel and Marine 1997).

[39] "The following describes the development of a tool ***for quantifying fish passage*** under a variety of dam facility management scenarios (Project Alternatives), ***and to describe the results and repercussions*** of this analysis. The analytical tool is called Fishtastic!, and was developed specifically to gain a better understanding of fish passage at the Red Bluff Diversion Dam (RBDD) in Red Bluff, California." [emphasis added] DEIS/EIR Page B1-1

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Appendix B states: "The principal mechanisms of impact to downstream migrating juveniles fish was therefore assumed to be from predation related to RBDD facilities." Therefore, the tool does not calculate an ecological cost of the effects of the fish screens, neither the existing rotary drum screens at the TC Canal headworks nor any new proposed screens (e.g., at the Mill Site pump station). As stated in the assumptions in Appendix B, what the juvenile module of the *Fishtastic!* tool tracks is the effects of passage efficiency, primarily related to predation of juveniles as they pass RBDD facilities. The tool does not "choose to ignore the protection given by the existing fish screens at the TCC canal and assumes no impact will occur from a new facility." The commentor states that the analysis ignores the significant reductions in the abundance of predatory pikeminnows at RBDD since the implementation of the 1993 BO and reduced gate-in operations. That comment is inaccurate; the analysis did not ignore the reduction in the abundance of pikeminnows. However, it used monthly combined striped bass and pikeminnow temporal presence distributions at RBDD as estimated by Tucker (1998) (as cited in Appendix B, Attachment B1, to the DEIS/EIR). Despite the robust reduction in the number of predators at RBDD that has been documented and acknowledged in the DEIS/EIR, predators continue to seasonally congregate downstream of RBDD when the gates are in, especially striped bass, which do not use the fish ladders. The juvenile passage effect estimator was intended to capture and represent the continuing predator presence effects and current conditions at RBDD. As previously noted, for the majority of species for which the juvenile lifestages are not passing RBDD when these predators are congregated below RBDD, the differences in the juvenile passage indices between project alternatives are negligible. This reflects low abundances (= lack of congregation) of predatory species when juveniles of those species migrate past RBDD. The commentor states that the DEIS/EIR has created a "new analytical paradigm" inconsistent with scientific and recent fish passage projects elsewhere. In response to that comment, it was necessary to develop a project-specific tool to evaluate and distinguish proposed alternatives for this project. The analysis methodology was developed to distinguish differences between alternatives, and its approaches, assumptions, and results are not analogous to hypotheses testing experimental designs used in scientific research. The unique

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The DEIS/EIR has chosen to ignore all of these facts and assumes that juvenile fish are impacted as though the new fish protective facilities were never constructed.[40] Incredibly, the DEIS/EIR proceeds with its "analysis" by stating that zero impacts on fish will occur from a new facility that has been far from adequately described.[41]

Distortion By Use of Proportion, Not Abundance

Unfortunately, the Fishtastic model juvenile fish component is driven by the 55% mortality value (assumed pikeminnow predation at RBDD) previously discussed. Although the DEIS/EIR makes the statement, "*This is an indication that the densities of these predators are now much lower since the RBDD gates are in only from mid-May through mid-September.*" (DEIS/EIR Page 3-15), the document and model completely ignore the biological significance in the analysis.[42] For example, when I performed my USFWS research at RBDD in the early 1980s, and derived the daytime estimate of 55% juvenile salmon mortality, the abundance of pikeminnow downstream of the dam in May was estimated at more than 10,000 fish. This was consistent with a prior estimate by CDFG in May and June 1977 when the dam gates were always closed [Hall (1977), as cited by Tucker et al. (1998)]. It is now a known fact that the pikeminnow abundance in May has diminished by probably an order of magnitude as compared to the dam gates in year-round.

Unequal Application of the Model between Project Alternatives

The DEIS/EIR makes the statement:

> "*For analysis purposes, it was assumed that there would be no impacts or benefits to juvenile life stages from the ladder and/or bypass elements of the alternatives.*" DEIS/EIR Page B-25

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[40] "In the juvenile analysis module of Fishtastic!, provisions for spatially distributing downstream migrating juvenile fish present at RBDD were built into the tool. The parsing of juveniles could be assigned to each of the RBDD's facilities at other locations around RBDD depending upon the proportion of river flow at each location. However, after much discussion with the Fish Technical Advisory Team, it was decided that differential predation rates based on the location of juveniles within the river or at various RBDD facilities was not feasible. Therefore, in Fishtastic!, juveniles were subjected to the predation assessment ("*E. A. Gobbler*" sub-routine) without regard to any flow-based spatial juvenile distributions. The principal factors applied to assess potential predation at RBDD were based on a maximum literature value for predation for juvenile salmonids (Vogel et al., 1988) and the actual presence of predatory species at RBDD (Tucker, 1997). The estimated predation rate of 55 percent (Vogel et. Al, 1988) was weighted by predator presence as estimated by catch per unit effort (CPE) of Sacramento pikeminnow and striped bass at RBDD (Tucker, 1997)." DEIS/EIR Page B1-7

[41] "Gates-out Alternative: …this alternative would result in passage indices of 100 (on a scale of 100)." DEIS/EIR Page 43

[42] This occurs because the computer model erroneously uses seasonal proportional presence at RBDD, not estimated numbers of predators or . In doing so, the model has not compensated for the known reduction in predator concentrations.

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457-12, cont'd characteristics of the passage problems, existing facilities, life-history dynamics, and fish species assemblages affected by RBDD made it necessary to developed a methodology to distinguish effects and benefits of the project alternatives. The commentor states that there is no factual basis for using a 3-day delay downstream of RBDD as a lower incipient threshold for presumed "severe" adverse impacts to adult salmon. Although the DEIS/EIR refers to the delays to adult salmon as ecological (passage) costs due to delay, it does not refer to these costs as severe. The ecological cost of passage only would become severe with extended passage delays in that the ecological costs are proportional to the length of the delay. The TAG determined that a 3-day delay would be appropriate as a threshold before any negative effects (cost of passage) were assigned in the analyses. There is, in fact, a basis for this 3-day passage-delay threshold. In the evaluation of the fishery benefits of the proposed improved fish passage facilities at RBDD conducted by USFWS's Northern Central Valley Fishery Resources Office, a predictive relationship was developed between salmon blockage at RBDD and time of delay (USFWS, 1991). This evaluation determined that blockage of upstream adult salmon migrants would be eliminated or minimized when delay was less than or equal to 1.9 days (approximately 2 days). Therefore, the use of a 3-day delay in passage before adverse effects to adult salmon occurs from passage delay as used in the DEIS/EIR adult passage analysis is reasonably consistent, if not slightly less stringent, than that developed by USFWS in their analysis.

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In actuality, the DEIS/EIR artificially inflates implied mortality (reducing the index) for fish passing through the ladders and bypasses by erroneously assuming a maximum 55% mortality whereas zero mortality for fish is assumed using a new fish screen bypass system.

Distortion By Unrealistic Biological Assumptions

The computer model assumes "instantaneous" maximum mortality for juvenile fish passing RBDD immediately following May 15 when the RBDD gates are placed back in the river. It also assumes maximum delay up to 21 days for adult salmon approaching RBDD in early September immediately prior to dam gate removal on September 15. Neither of these circumstances can be true.

Overstatement of Predation

The DEIS/EIR states: "Tucker et al., (1998) determined that during summer months (gates-in operations), approximately 66 percent (by weight) of the stomach contents of Sacramento pikeminnows consisted of juvenile salmonids." What the DEIS/EIR failed to report is that Tucker et al. (1998) found that of the pikeminnow stomachs sampled ***only 24%*** obtained food items.

Dissimilarity with Other Fish Passage Projects

The DEIS/EIR has created a new analytical paradigm inconsistent with scientific principles and recent fish passage projects elsewhere. The DEIS/EIR's use of this approach was apparently not applied to another recent Sacramento River mainstem fish passage improvement project at Lake Redding and the Anderson Cottonwood Irrigation District diversion dam where new, improved fish ladders were installed (CALFED 1997). Numerous examples throughout California, the Pacific Northwest, and elsewhere exist where this approach has not been employed. This inconsistent logic is not reconciled in the DEIS/EIR.

Unrealistic Standards

The DEIS/EIR suggests a juvenile fish passage standard at RBDD that is impossible to achieve. Using the standard applied in the DEIS/EIR, there can never be a suitable or satisfactory fish passage facility at the dam. However, the DEIS/EIR does not apply this standard equally between project alternatives. The document assumes that there is an "ecological cost" associated with juvenile fish passage at the recent TCC screens, but then conversely assumes that there is no "ecological cost" associated with the un-described fish screens at the Mill Site.

The DEIS/EIR Fishtastic model arbitrarily suggests that greater than 3 days delay downstream of RBDD should be the lower incipient threshold for presumed severe adverse impacts to adult salmon. No factual basis for this value is provided in the document. The effect of delay in salmon passage is further assumed in the DEIS/EIR to

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have a linear relationship after a three-day period. The irony of this assumption is the very large increase in the fall run salmon populations (numerically the largest salmon run most affected by the existing gate operations) passing RBDD in recent years. In fact, the DEIS/EIR cites 1997 as the highest run of salmon passing RBDD in the last 30 years[43]. Obviously, the current mode of operation has not adversely impacted the fall run salmon populations, yet the DEIS/EIR remains silent on this and many other relevant facts.

Speculation and Subjectivity

In performing this technical review of the DEIS/EIR, I contemplated executing my own "model runs" of the Fishtastic computer spreadsheet model. Having read the model's documentation and adjusted the parameters, I concluded that such an exercise is worthless because the parameters driving the model are so subjective, the outputs are of no value.

A computer model is only as good as the assumptions and data entered into the model. Here, the DEIS/EIR model is clearly deficient. According to the document, no matter what design features are incorporated into new fish ladder(s) and/or fish bypass, it will always be substandard. The Fishtastic computer model allows any individual to derive any conclusions they desire (Figure 20). The final EIS/EIR must use a different approach to overcome this deficiency.

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[43] The annual fall chinook escapement upstream of RBDD has ranged from over 205,000 (1997) to less than 30,000 (1977) ***with an increasing trend in escapement over that period*** (Figure B-2). DEIS/EIR Page B-3. (emphasis added)

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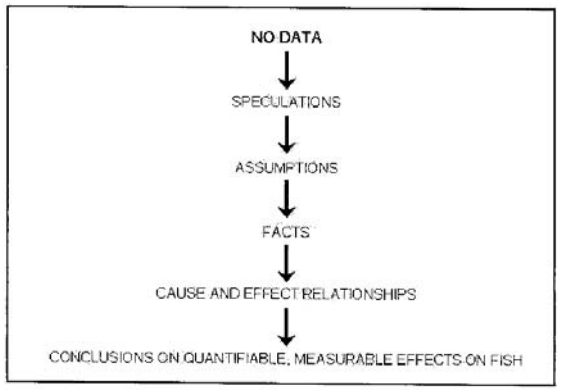

Figure 20. The DEIS/EIR's process to develop conclusions concerning the proposed project alternatives' effects on fish at RBDD.

OPPORTUNITIES FOR IMPROVED FISH PASSAGE

There is every reason to believe, based on the abundance of available information, that upstream and downstream fish passage can be dramatically improved with new, large fish ladder(s) (and/or a bypass). Extensive historical data collected at RBDD and elsewhere clearly demonstrates that upstream fish passage is largely affected by river flow, flow through the fish ladders, and physical configuration of the ladder entrances. Because river flow is seasonally low during the current gates-in period, there is ample opportunity to build new large fish ladder(s) with modern-day physical configurations resulting in minimal or no fish delay or blockage. Unlike other dams where available flow through fish ladders and their auxiliary diffusers (for fish attraction) may be extremely limited during summer-time low-flow periods (e.g., bypassing hydroelectric turbines or reducing limited irrigation water supplies), this practical restriction does not exist at RBDD. Additionally, the northeast side of RBDD is largely undeveloped, federal land, that would allow construction of appropriately-sized fish passage facilities and consequently allow more flow for fish passage. The improved facilities will undoubtedly disperse the concentration of the indigenous pikeminnow that can prey on salmon behind the RBDD gates. Also, more flow through fishways translates into less flow through (under) the

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457-13 The commentor states that it was his belief that upstream and downstream fish passage can be dramatically improved with new large fish ladders and or a bypass. However, this belief is speculative and unproven at RBDD, and likely is not true for sturgeon. Larger ladders and/or a bypass were considered in the fish passage benefit analysis of alternatives considered and summarized in Appendix A to the DEIS/EIR. The fish passage benefits analyses considered information including technical reports by Reclamation's Technical Service Center and CH2M HILL's prescoping report, and used recommendations from those technical evaluations to develop the larger ladder and bypass components for the DEIS/EIR. Detailed field investigations conducted by Reclamation Technical Service Center were used as a basis of specific designs examined in the fish passage benefits evaluation (DEIS/EIR Appendix A). The results of those evaluations were that new fish ladders' AWS were nearly tripled in size as a measure to attract fish into the improved new ladders. Furthermore, the new ladders were redesigned to include improved "Ice-Harbor" weirs, a improved ladder weir design, and ladder-entrance bay improvements, all widely accepted technologies for fish passage improvement. In spite of these major improvements for the new fish ladders, it was uncertain if a major problem of fish passage at RBDD, namely delay due to gates-in operation, would be sufficiently reduced to significantly improve passage of salmonids through newly designed ladders. Additionally, none of these ladder improvements have been proven to improve passage for adult sturgeon, a species of concern identified and addressed in the DEIS/EIR. In the evaluation of the benefits to fish passage (Appendix A), the Bypass Alternative resulted in numerous liabilities being identified, including land use conflicts, public safety, and incompatibility of simultaneous public use and fish passage. Despite the experimental nature and uncertainty in fish passage efficiency, the Bypass Alternative was carried forward into the DEIS/EIR. However, the result of the fish passage analysis conducted in the DEIS/EIR indicated that because of the uncertainties of this experimental bypass facility to improve fish passage delay at RBDD, it was likely that the bypass would be inferior to reduced gates-in operations and would likely perform similar to an improved fish ladder. Therefore, the performance parameters used for the evaluation of the benefits to passage in the *Fishtastic!* tool for the bypass facility were those of an improved fish ladder.

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dam gates further reducing potential predation down to ultimate limited levels. These measures will serve multiple beneficial purposes to greatly improve anadromous fish passage.

New, larger-scale fish ladder(s) will, with certainty, greatly improve fish passage not only for salmon, but also for pikeminnow. This will greatly diminish the concentration of pikeminnow downstream of the dam and reduce juvenile salmon predation mortality in the area. The DEIS/EIR falsely assumes there would be no measurable improvement to pikeminnow passage with new fish ladder(s).[44] The lack of supporting scientific justification was surprising[45] due to the fact the best available information indicates otherwise.

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RECOMMENDATIONS

This critique has proven that the DEIS/EIR is clearly flawed and must be re-written. The draft document falls far short of achieving its intended purpose. The critically important assumptions and analytical approach used to compare project alternative effects on fish must be re-addressed. The numerous speculative statements and conclusions that only increase ambiguity and uncertainty should be deleted. Large amounts of highly relevant data and information were not used in formulating the document; that must be corrected to provide a meaningful final EIS/EIR. The profound influence that errors have placed on the analysis and conclusions must also be corrected. The document should be re-structured to allow a fair and balanced analysis and discussion of viable project alternatives. The document must provide clear scientific objectivity that will go far towards reaching its intended goals.

It is highly recommended that formation of a group of outside experts without a vested interest in the outcome be brought into the process to ensure a scientifically balanced and objective assessment of potential alternatives. Individuals with broader expertise in fish passage investigations and structural facilities should be included in developing the final EIS/EIR. For example, experts with experience on the large fish passage facilities in the Columbia River basin (U.S. Army Corps of Engineers[46] or U.S. Bureau of Reclamation)

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[44] Under the 4-month Improved Ladder Alternative there may be additional passage opportunity provided for adult pikeminnow through the new fish ladders proposed for the left and right banks. However, the incremental increase in ladder passage provided to pikeminnows by the new ladders ***is likely to be small and not measurable.*** DEIS/EIR Page B-35 (emphasis added)

[45] "It was assumed that ladder designs were not sufficiently important in estimating juvenile fish downstream passage efficiency. The assumption was that predation was the single most important factor contributing to reduced passage efficiency at RBDD. It was assumed that any alternative would include juvenile fish protection facilities in accordance to existing NMFS and California Department of Fish and Game (CDFG) criteria, and therefore, there would be no difference in juvenile passage efficiencies related to these facilities. Thus, it was assumed that ladder design (and pump station/fish screen designs) would have no calculable effect on juvenile passage efficiency and calculation of their indices. The principal mechanism of impact to downstream migrating juvenile fish was therefore assumed to be from predation related to RBDD facilities." DEIS/EIR Page B1-7

[46] "In general, the adult passage facilities constructed by the Corps proved to be effective in design and operation. Steve Pettit, a fish passage specialist for the Idaho Department of Fish and Game, praised the ladders in 1990, noting that 'the Corps knows how to build them well.' This view remains widely held

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457-14 The following is in response to the comment that the critique provided proves that the DEIS/EIR is flawed and must be re-written. The commentor has not proven anything specific, but has provided an alternative point of view and his professional judgment of the analysis of fish passage conducted for the project alternatives. This commentor's dissenting judgment differs from professional judgments of the results of the analysis and professional judgments provided by the project TAG, which included numerous engineering and fishery professionals familiar with the conditions and the fish passage problem at RBDD. The commentor's recommendation that calls for additional field data collection before a solution to fish passage problems at RBDD would continue the status quo and delay and jeopardize recovery efforts for several species listed under the state and federal governments. For the purposes of meeting the needs of NEPA/CEQA to distinguish alternatives for improving fish passage at RBDD, it is not essential that additional data be collected or an additional panel of outside experts be convened.

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could provide a wealth of highly valuable information for a future fish passage program at RBDD. To a large degree, because of the importance of this project, it may be warranted to acquire additional field data relevant to the current mode of gate operations during the May 15 to September 15 period to correct the obvious deficiencies in the DEIS/EIR.

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among fisheries scientists familiar with adult fish passage problems caused by dams." Mighetto and Ebel (1994)

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No. 457

Letter from David A. Vogel, Continued

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Letter from David A. Vogel, Continued

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Vogel, D.A. and K.R. Marine. 1992. An assessment of the Appraisal Study of Options for Improving Fish Passage at Red Bluff Diversion Dam. August 1992.

No. 458

Letter from Wilkie Talbert, Dated May 22, 2002

458-1 Thank you for your comment. Electric power generation was not considered for the RBDD Fish Passage EIS/EIR.

Proposal

Red Bluff Municipal Power

Author- Wilkie Talbert
5/22/02

Submitted to
Susan Price, City Manager
Charles Hayden, Director of Development

No. 458

Letter from Wilkie Talbert, Continued

Proposal
Red Bluff Municipal Power

This is a proposal to establish a Red Bluff Municipal Power Authority. The advantages of having Municipal power were well demonstrated during the utility power havoc the first half of last year. The beneficial characteristics were well documented for Los Angeles, Sacramento, and Redding and can be examined for suitable application to Red Bluff in other discussions. This Proposal discusses how to generate the power.

A unique and fortuitous situation has developed which could be of substantial advantage to Red Bluff:

!. Red Bluff is located on the Sacramento River with the flow principally controlled by releases from Shasta Dam which maintains a continuous and regular flow pattern. The flow has some variation but during the summer months is relatively constant and the power potential is augmented by the additional head due to Lake Red Bluff.

2. The Diversion Dam exists. The normal flow pattern with Lake Red Bluff can be used with advantage to channel and control flow through a set of water turbines and provide mounting and support for the turbines, generators and cabling for year around operation. Electrical power generation during the summer when the demand is highest would be increased by the head from Lake Red Bluff.

Additionally, some turbines could be arranged to drive water pumps directly rather than generators when the lake was out.

3. A unique water turbine has been recently developed and patented by Alexander Gorlov, Professor Emeritus at Northeastern University, specifically for low head water flows with velocities typical for rivers and ocean channels. The American Society of Mechanical Engineers awarded Dr. Gorlov the Edison Patent Award for 2001.

An outstanding property of the Gorlov Helical Turbine is that it's power generation varies as the cube of the water velocity. Hence, surveys of the actual water velocities at locations for the turbines are very important in order to maximize the power generation.

A second noteworthy property of the turbines is that their efficiency is 35% over a large range of water velocities. Propeller driven water turbines have efficiencies of 20% at best so that a given site can be used