Land Protection Partners

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To: State Water Resources Control Board

From: Travis Longcore and Catherine Rich

Date: May 11, 2009

Re: Samuel Sweet Comments on Alternative Flow Regime for Middle Piru Creek

This memorandum addresses issues raised by Dr. Samuel Sweet in his review of our proposal for an alternative flow regime for middle Piru Creek. Dr. Sweet found fault with our interpretation and conclusions, and criticized a number of substantive assertions. We do not address all of Dr. Sweet's comments here, but rather concentrate on a subset where there are material disagreements that are relevant to the decision before the State Water Resources Control Board. Some of the issues raised by Dr. Sweet are dealt with in a separate response to the U.S. Fish and Wildlife Service (FWS) on this matter (attached). William Haas, who co-authored our proposal, may follow up on other issues directly relevant to his extensive experience with arroyo toads and other California riparian species after his spring field season is complete.

We appreciate Dr. Sweet's fieldwork in this system and his expertise with southern California natural history. Our fundamental underlying disagreement concerns the reasoning supporting the maintenance of minimum summer flows in Piru Creek to guarantee persistence of populations of a host of native species including the arroyo toad (*Bufo californicus*), red-legged frog (*Rana aurora*), rainbow trout (*Oncorhynchus mykiss*), as well as occurring bird species (e.g., least Bell's vireo, *Vireo bellii pusillus*) and species that may establish resident populations in the future (e.g., southwestern willow flycatcher, *Empidonax traillii extimus*).

Our goal was to provide a multi-species approach to habitat management that fosters native species persistence and which is in keeping with the FWS cornerstone management tool, habitat conservation planning. Such an approach necessarily involves compromises between the needs of multiple species to achieve long-term biological and regulatory goals. Rather than privileging one species over another, we sought to outline a beneficial multi-species management scenario that can be applied to the Piru Creek system.

The environmental review for the proposal to emulate "natural" flows in middle Piru Creek unequivocally states, and we do not disagree, that the project would have an adverse impact on native rainbow trout. Habitat modeling for *O. mykiss* maps the middle portion of Piru Creek as low potential habitat based on the temperature and flow regime described by a regression containing rainfall and catchment area (Boughton & Goslin 2006). Yet native rainbow trout are

found in this reach and applicable environmental laws dictate that impacts to them should be disclosed and mitigated. Our purpose was to provide a flow regime that accommodates both the native fish and listed amphibians within an adaptive management framework.

Winter Releases Benefit Arroyo Toad

One of the first steps in adaptive resource management is to share information about the system to be managed and then to develop an idea about the way the system works — a model of some sort. It is evident that we have a disagreement with Dr. Sweet about the model of the system. In short, Dr. Sweet presents various comments that suggest that summer flows are the primary factor degrading arroyo toad habitat in middle Piru Creek and that winter releases from Pyramid Dam are of lesser importance (especially compared with locally derived runoff from tributaries below Pyramid Dam). Dr. Sweet forcefully states that the scouring flows that benefit middle Piru Creek derive from local drainages into the creek. He writes,

> the greatest source of scouring flow (and sediment) in middle Piru Creek is not runoff from above Pyramid Lake, but instead from the several steep drainages between Frenchman's Flat and Ruby Canyon, in Piru Gorge. Canyons including Fish Creek and Turtle Creek drain the SE extension of the Alamo uplift; together with Agua Blanca Creek these drainages receive orographically-enhanced rainfall in major storms. This arrives as rain and runs off very quickly. By contrast, the Piru drainage above Pyramid Lake lies too far inland to benefit from orographic effects, and much precipitation falls as snow. The difference yields markedly different flood peak profiles.

He furthermore states that summer water is the problem for arroyo toads. He places great weight on release of water from Pyramid Dam in the summer as a factor that adversely impacts arroyo toads and other amphibians, and apparently sees little benefit in releasing water during the winter. This view appears to be at odds with the project proponents, who repeatedly include winter scouring flows as a benefit of the project.

Dr. Sweet's model of scouring flows being predominantly locally derived is not supported in the Environmental Assessment (EA) for the project, which associated additional winter releases from Pyramid Lake with increased erosion, sediment movement, and scouring along middle Piru Creek:

> The licensees' proposed operating regime would result in higher flows during storm events that would increase erosion and sediment movement and scouring along the project reach (EA, p. 53).
>
> Proposed changes in the project operation regime to closely mimic the inflow to Lake Pyramid, as operationally feasible, would result in higher peak flows, a larger floodplain, and greater geomorphic changes within the project reach during storm and flood events smaller than the 50-year event (EA, p. 54).
>
> The operating regime specified in article 52 has resulted in well-developed riparian vegetation and marsh along the project reach because of the presence of year- round flow and the decrease in scouring flooding events (EA, p. 55).

> Instituting a more natural flow regime in the project reach would create a more variable flow regime whereby there would be an increase in the frequency and magnitude of high flow events in the project reach, which would increase scouring and aid in sediment transport (EA, p. 55).
>
> In addition, more frequent flood events would benefit arroyo toads by increasing fluvial geomorphic processes such as providing the scouring needed to reduce riparian and emergent vegetation, increasing stream terraces and sandbars, and redistributing sediments (EA, p. 58).
>
> The No-action Alternative would: … (3) limit the scouring and erosion along the project reach (EA, p. 66–67).

We have not conducted any independent modeling to evaluate the geomorphic work in middle Piru Creek that is contributed by local tributaries compared with releases from the upper watershed. We note, however, that the analysis of the proposed project is based on an assumption that release of winter storms under the new "natural" regime will indeed increase scouring and reworking of sediments in middle Piru Creek in such a manner as to reduce riparian and marsh vegetation and to provide suitable habitat for arroyo toads and other native species. It is not clear whether or not Dr. Sweet disagrees with this assumption, but his comments downplay the benefits of additional winter releases in providing a stream morphology that can productively accommodate greater flows (see Sandburg 2006). If Dr. Sweet disagrees with the benefits of releasing winter flows from Pyramid Lake, it is not clear why he would support the winter release portion of the project. On this point it appears that Dr. Sweet's views conflict with the EA for the project, which lays out a series of benefits of the winter releases.

Alternative Flow Proposal Allows Summer Drying

Dr. Sweet does not seem to take into account that the floor we propose for summer flows is 40% lower than the 25 cfs that had been released from 1992 until the interim operating regime was established in 2005. Apparently arroyo toads were able to survive in middle Piru Creek from the construction of Pyramid Dam through 1992 with approximately 10 cfs baseflow from the dam in the summer (and with a series of other undesirable hydrologic events such as summer water deliveries and radial gate testing). It is premature to claim that our floor of summer flows at 15 cfs through August, combined with guaranteed scouring winter flows, would cause the channel entrenchment and build up of riparian vegetation in current arroyo toad habitat that Dr. Sweet claims. Our plan would also allow for the possibility that releases from Pyramid Lake would decline to zero during dry years, but our plan limits the period during which this might happen to the middle of September on to the first winter rains. Our proposal therefore does include late season drying that project proponents appear to believe will dramatically reduce impacts from exotic bullfrogs; it simply limits that drying period until after the end of the breeding season for red-legged frog and shortens the period of stress on the native rainbow trout due to low flows. We have doubts, however, about whether such drying will limit the distribution of adult bullfrogs within the project reach in a way that will have any effect on arroyo toad density.

Influence of Drying from Natural Flow Discharge on Bullfrogs

Dr. Sweet's comments indicate a high level of confidence that the summer drying will interrupt bullfrog reproduction. We note, however, that the EA for the project does not envision complete drying along Piru Creek, but rather that deep pools would remain, even during the driest years. According to the EA:

> The decrease in summer flows would likely decrease the amount of emergent marsh vegetation, reducing the amount of foraging habitat for great blue heron and great egret. However, *even during times when there is no flowing water in the project reach, deep pools of water would remain*, providing foraging habitat for the heron and egret (emphasis added, EA, p. 55).

The most applicable published scientific literature on this topic is a paper that models the frequency of winter floods and summer drying (by draining livestock ponds in their model) that would be necessary to decrease bullfrog density in a Santa Barbara to Ventura riparian system (including Piru Creek) to allow persistence of red-legged frog (Doubledee et al. 2003). This mathematical model indicates that draining of standing water any less frequently than every other year had no effect on persistence of red-legged frog.

The question then arises as to where and how often reaches of stream that are occupied by arroyo toads in middle Piru Creek would dry completely under the proposed regime and whether that drying would have any effect at all on persistence of other amphibians. No effort has been made on the part of the project applicant to provide such information, and the most relevant statement in the EA is that deep pools would remain even during years when no water flows at all (p. 55). Given the long over-land dispersal capability of bullfrogs, and the permanent source of bullfrogs in the reservoir downstream, it is not clear at all that the impact of bullfrogs on native amphibians (at least red-legged frogs as analyzed by Doubledee et al. 2003) would be reduced by the "natural" flow regime. By comparison, Doubledee et al. (2003) calculate that flooding every five years would facilitate coexistence of red-legged frogs and bullfrogs. The benefits of such winter flooding have already been shown in the reduction of bullfrog density and distribution during 2005 (Sandburg 2006), while the feasibility of bullfrog reduction to a degree necessary to influence dynamics of native amphibians through summer drying has not yet been shown in Piru Creek, or at least has not been published in the peer-reviewed literature.

Bullfrog Metamorphosis in One Season

Dr. Sweet objected to our citation of literature that indicated that bullfrogs can complete metamorphosis within one season as being too old and "anecdotal." Without making the claim that bullfrogs in Piru Creek complete metamorphosis in a single season, we stand by the claim that it does occur in other warm-climate locations. Additional citations are available, including in the 2009 volume of *Journal of Herpetology*, in which an entire paper is devoted to the influence of density on the proportion of bullfrog larvae that metamorphose within one season in ponds (Provenzano & Boone 2009). This recent, peer-reviewed article reviews the literature on this question as follows:

> Although Bullfrogs inhabit a variety of wetlands, they are typically found in permanent ponds (Bury and Whelan, 1984; Hecnar and M'Closkey, 1997; Govindarajulu et al., 2006). However, Bullfrog tadpoles are also known to metamorphose in less than one year (Viparina and Just, 1985; Cecil and Just 1979; Pechmann et al., 1989) with their larval periods ranging from four months in Louisiana to three years in New York (Wills et al., 1956; Bury and Whelan 1984). However, metamorphosis in a single season is generally believed to be probable only in warmer climates like the southern United States.

Their research, conducted in mesocosms, concludes:

> Bullfrogs are often assumed to have larval periods exceeding one year, but our study illustrates the potential for some percent of Bullfrogs that hatch early in the breeding season to complete larval development in a single season. This flexibility suggests that Bullfrogs can respond to conditions that indicate pond drying and that they could successfully use aquatic habitats that are temporary across large portions of their range across a range of larval densities (Provenzano & Boone 2009).

We bring up this point to illustrate that the periodic drying that might occur under the proposed flow regime might not be as effective at reducing bullfrog density as project proponents assume. Although these studies that document single-season development are not in California rivers, the evidence that bullfrogs can complete such metamorphosis under a range of weather conditions is robust.

Predation by Bullfrogs on Arroyo Toad Life Stages

Dr. Sweet claims that no one has ever observed predation by bullfrogs on juvenile or larval arroyo toads. This conflicts with Sandburg (2006), who explains, "Predation upon arroyo toads has not been quantified, but it is most likely a significant mortality factor on all life stages of *Bufo californicus*." It furthermore conflicts with the FWS Recovery Plan for arroyo toad, which states, "Adult bullfrogs have been observed to eat juvenile and adult arroyo toads in the wild (Sweet 1993, Griffiths 1998)." Perhaps the FWS cited Dr. Sweet incorrectly, or he only observed predation of adults and Griffiths (1998) observed predation on juveniles. In either case, Dr. Sweet's unequivocal view that, "No one has documented predation by bullfrogs on larval or juvenile arroyo toads" conflicts with other authorities.

Overreaction to Sediment Replenishment Plan

We think that Dr. Sweet overreacted to our call for a sediment replenishment plan. Our plan focused on the first four miles below Pyramid Dam, identified in the EA as being degraded from erosion:

> Pyramid dam blocks the natural transport of sediment to the project reach, which is important in the development of sandy bars, terraces, and breeding pools used by arroyo toads. Sediment loads from the upstream reaches of the project reach and secondary sources, such as Agua Blanca Creek, provide the fine sediments needed by the arroyo toad in middle and lower portions of the project reach. The upper portions of the project reach, however, would lose sediment at higher rates because the more frequent higher flows in this area would move sediment downstream. Because the arroyo toad does not

> occur from Pyramid dam to Frenchman's Flat (RM 0 to RM 4), the increased loss of sediment in this area would not affect the toad. Monitoring the arroyo toad population in the project reach, as recommended by the CDFG and FWS, would allow the early detection of potential adverse affects on arroyo toads from the loss of sediment in portions of the system, either because the toads have become established in the upstream portions of project reach, or the loss of sediment extends farther downstream than anticipated. (EA, p. 61–62).

We also indicated the need for additional planning and compliance actions to develop and implement such a plan but asked that this action be tied to the increased releases from Pyramid Lake. This provides a mechanism to mitigate for what is an obvious and documented adverse impact of dam operation. This is not strictly an issue that would be regulated by FWS because the habitat is no longer occupied, but implementation of such a program would have to be designed to avoid impacts on lower reaches of the creek where local sediment sources are apparently adequate.

Variation in Climate and Climate Change Are Not "Hypothetical"

Dr. Sweet criticizes our effort to plan for variation in climate as "hypothetical" and having "no relevance." We disagree. Any change in the flow regime that is adopted and entrenched in the bureaucracy will be very difficult to change. It is completely foreseeable that there will be both secular and cyclical changes in climate in the years ahead. This is well recognized by the FWS, which includes consideration of future climate in its recovery planning efforts (e.g., the Recovery Plan for Quino checkerspot butterfly, U.S. Fish and Wildlife Service 2003). We do not agree that documented variation in climate such as the Pacific Decadal Oscillation and projected changes in climate from anthropogenic forcing should be dismissed as "hypothetical," nor is such an approach consistent with good practices of environmental impact assessment or endangered species management.

Arroyo Toads Found Around "Perennial Water"

Dr. Sweet objected to our reference to Cunningham's observation that arroyo toads were found around perennial water. We wrote:

> Arroyo toads do not require intermittent streams, and are more commonly found around perennial water in the northern part of their range (Cunningham 1962), which includes all areas north of Orange County. Cunningham (1962) found them to be most common along stretches of stream that were perennial, in areas were there are shallow reaches with sandy and gravelly beaches, and few boulders.

Dr. Sweet responded that this was a misleading citation because Cunningham worked on the Mojave River, which he does not consider to be perennial in "any common use of the word." We did not intend the term "perennial water" to be interpreted as flowing water, but rather as water that is available year round, which is how Cunningham used the term. Cunningham wrote:

> Although toads are most common along sections with perennial water, they are also found along sections of the stream which are intermittent in nature, usually drying in mid-summer.

The use of the term "perennial water" to describe areas that are arroyo toad habitat was taken directly from Cunningham. We used this citation to make the point that streams need not be intermittent to make arroyo toad habitat; toads can and do survive in locations where surface water remains year round. This point is also made by the historical record of the distribution of arroyo toad, which included stretches of river that were certainly perennial, both in the sense of having surface water present year round but also in the sense of having flowing water present. Even the Recovery Plan for the species makes this point:

> These studies revealed that the northern populations (from Monterey County to the Santa Clara River basin, Los Angeles County) exhibit habitat specialization that favors the shallow pools and open sand and gravel flood terraces of medium- to large-sized *intermittent or perennial* streams that are flooded on a fairly regular basis [emphasis added] (U.S. Fish and Wildlife Service 1999).

The Cunningham reference does not apply to the entire northern portion of the range of arroyo toad, but rather to the Mojave River. However, much of our remaining differences seem to lie in the definition of perennial water as being surface water that persists throughout the year (as is the case on middle Piru Creek during many years) as opposed to being perennially flowing water. Dr. Sweet interpreted our use of the term "perennial water" to be his own, apparently different, interpretation of "perennial stream." Our use of the term is consistent with the cited reference and with the Recovery Plan for the species.

Need for Adaptive Management

We reiterate the need for adaptive management for the resources of middle Piru Creek. It would be advisable if the new flow regime could be tested while the sensitive species are monitored (including native fish) so that the assumptions and assertions made by all parties can be put to the test. Dr. Sweet asserts that the proposed license amendment is based on the best available science. That may be so for the species that were targeted (e.g., arroyo toads), but this flow regime will have adverse impacts on native fish. We continue to maintain that an alternative flow regime with a summer floor on releases from Lake Pyramid would better balance the needs of the various sensitive species in this system. The only way to see who is right is through an experimental adaptive management approach. Unfortunately the adversarial nature of this process and the rigidity of the bureaucracy preclude the type of adaptive management that is called for in such complex situations.

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To: U.S. Fish and Wildlife Service and California State Water Resources Control Board

From: Travis Longcore, William Haas, and Catherine Rich

Date: April 14, 2009

Re: Alternative Flow Regime for Middle Piru Creek

Land Protection Partners, working with herpetologist William Haas of Pacific Coast Conservation Alliance, proposed an alternative flow regime for middle Piru Creek that involves a floor on summer releases of 15 cfs from Pyramid Lake. This proposal was reviewed by the U.S. Fish and Wildlife Service (USFWS) in a letter dated February 17, 2009. This memorandum responds to some of the questions raised by the February 17 letter from the USFWS.

This alternative proposal to allow some enhanced summer flows in Piru Creek was prompted by concern for the native trout, which are genetically identical to the endangered steelhead downstream. The need to balance conditions for native fish and native (endangered) amphibians is a well-known attribute of the project that has been acknowledged as a need by the USFWS. In 2005, Ventura Field Office deputy field supervisor Don Reck stated in the Los Angeles *Daily News*, "We do want to coordinate with the state and through that process reach a proper balance between salmonids (trout) and the well being of the toads."

We were asked to propose a flow regime that would maximize benefits for listed amphibians as well as for native, resident rainbow trout. The rationale behind a proposal for an alternative flow regime is to prevent the adverse impacts to native rainbow trout that would result from implementing the proposed project as designed. The environmental review documents are clear regarding impacts on native trout, and subsequent comments and revisions to the Draft Environmental Impact Report have not disputed this point.

> "Rainbow trout in the proposed project area would be subject to direct impacts by implementation of the proposed project. Direct impacts from reduced summer flows would include a reduction in aquatic habitat, increased heat stress, and increased predation by aquatic and terrestrial predators. … Increased summer flows now occurring in middle Piru Creek are provided in an effort to maintain fish populations through the heat of the summer, but even under existing conditions trout likely experience thermal stress and reduced fitness (CDFG, 2004b)."

> "The proposed project would be likely to result in periods of reduced flows, as compared to current conditions, during the late summer and fall. This would result in increased water temperatures and further thermal stress on rainbow trout and would probably restrict fish to isolated pools and deep channels. While some fish would probably survive in deep pools and shaded canyons, implementation of the proposed project would result in an adverse impact to rainbow trout and would potentially eliminate the majority of trout occurring in middle Piru Creek between July and October. In addition, decreasing water levels would also increase the risk of predation from birds such as herons and egrets" (DEIR, p. 3-29).

The project design has not changed since this assessment was made, yet in that time it has been determined that the rainbow trout found in middle Piru Creek are genetically identical to native southern steelhead — that is, they are native fish not genetically contaminated by hatchery stock and, but for the Santa Felicia Dam blocking their passage to the ocean, would be steelhead (Girman and Garza 2006). Furthermore, since the initial environmental analysis of this project, the National Marine Fisheries Service (NMFS) released a draft of the "Viability Criteria for Steelhead of the South-Central and Southern California Coast" from the Technical Recovery Team for the South-Central and Southern California Coast Recovery Domain (2007). This document forms the scientific basis for recovery criteria for the region. Relevant to Piru Creek, the document states:

> "Assessment at the group level indicates a priority for securing inland populations in the southern Coast Ranges and Transverse Ranges, and a need to maintain not just the fluvial-anadromous life-history form, but also lagoon-anadromous *and freshwater-resident forms in each population*" [emphasis added] (NMFS 2007).

In other words, populations of the freshwater-resident forms of rainbow trout in middle Piru Creek should be secured for the recovery of the species. NMFS thus envisions future interchange between freshwater and anadromous forms. Regardless of whether such interchange is currently possible in Piru Creek, the scientific advisors to NMFS put a priority on conserving the native trout population there. We believe that recovery needs for this species should be factored into any decision about water flow in middle Piru Creek, such that the needs of arroyo toads, red-legged frogs, and these native rainbow trout can be met. At the very least, it would be a significant adverse environmental consequence for native rainbow trout to be eliminated entirely from middle Piru Creek and the flow regime should be devised to ensure that this does not occur.

The review of the alternative flow regime by the USFWS raises some questions that deserve further discussion.

1. We agree that the first three points of our proposal are substantially similar to the proposed project. Our proposal differs, however, in ensuring that large flows are released on a 5–7 year return interval, while the proposed license amendment does not.

2. The USFWS concluded that summer flows of 15 cfs would scour middle Piru Creek, channelizing portions of the creek and causing exotic vegetation and predators to increase in abundance. We note that flows of this magnitude occur naturally during wet years. Our

proposed flow level is 40% less than the flow that has been in the creek since 1992. It is only 5 cfs greater than the flow that was in middle Piru Creek from the construction of Pyramid Dam through 1992.

> "After the installation of Pyramid Dam, stream flows from July through October were artificially maintained at approximately 10 cfs. In 1992, artificial spring and summer flows were increased and maintained at 25 to 35 cfs from May through October to support a recreational fishery" (Sandburg 2006).

It seems from the available reports that the overgrowth of vegetation in arroyo toad habitat occurred during the period after 1992 when 25 cfs was released. With a flow of 10 cfs, surveys still showed occupancy and reproduction of arroyo toads through the 1980s and early 1990s (summarized in Sandburg 2006). (There were other aspects of the flow regime during this period that were not desirable, such as water deliveries and gate testing during arroyo toad breeding season, etc.). We agree that enhanced flows over long periods without scouring flows would result in entrenched channels and excess vegetation growth. The reworking of sediments and channel morphology from winter scouring flows (as described in the EIR and EA for the project), however, should produce a channel that can accommodate greater summer flows without adversely impacting toads (p. 49, Sandburg 2006).

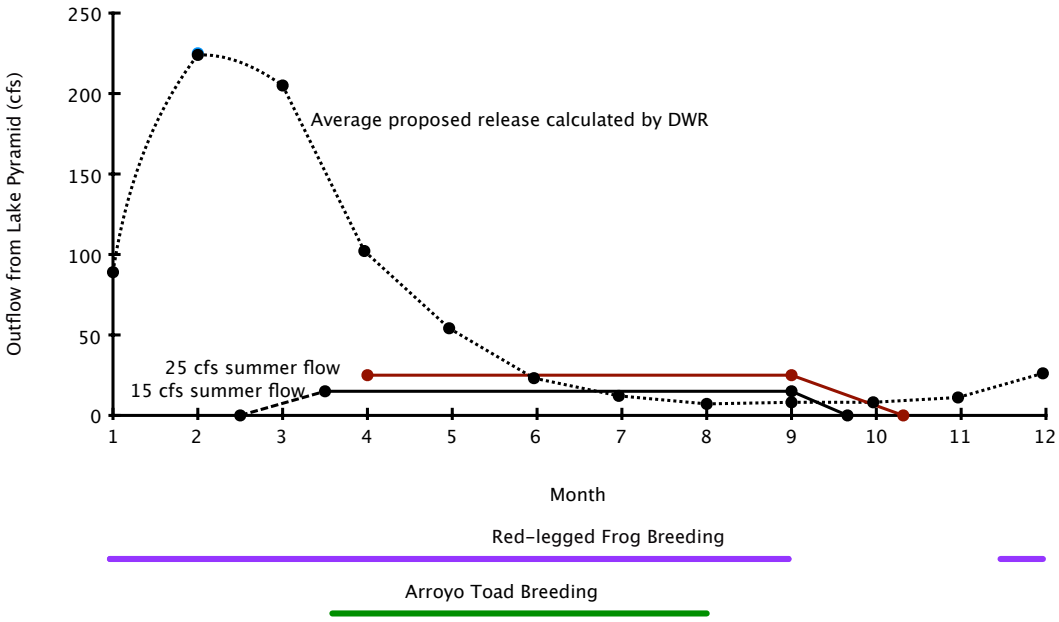

Figure 1. Predicted average flow from Pyramid Lake with alternative flow regime and previous flow regime. Breeding periods of arroyo toad and red-legged frog are shown for reference.

3. The USFWS expressed concern that gradual increase to 15 cfs in March would cause take of arroyo toads by flushing eggs downstream. We graphed the average outflow from Pyramid Lake as calculated by Department of Water Resources staff with our proposed flow regime and the previous flow regime (Figure 1). As these average numbers show, it is extremely unlikely that releases would have to be increased in March to meet the 15 cfs proposed release. The safeguard

that releases would be increased slowly would ensure that any changes experienced by amphibians in what would already be a drought year would be well less than that which could occur naturally (e.g., on March 14–15, 2003 the flows in Piru Creek above Lake Pyramid went from 12 cfs to 266 cfs). Moreover, USFWS's concern would apply equally to the "natural" flow regime proposed by the applicant here: if there is a storm event during the arroyo toad breeding season, increased flows will be released and cause take. (Our proposal would release this water as well, because it provides a floor to summer releases, not a maximum.)

We note that it may be worthwhile, even if our alternative proposal is not adopted, to condition the release of "natural" flows from Lake Pyramid such that extreme storm events do not wipe out reproduction of listed species during years with anomalously high precipitation during critical points in the breeding season of listed species. In May 2003, an "abrupt spring storm" caused flows in excess of 100 cfs, which eliminated breeding for arroyo toads for the season (p. 18, Sandburg 2006). Such events are a predictable outcome of the currently proposed project. Because the releases of natural flows would be part of a discretionary action in the operation of Pyramid Lake, it is conceivable that a court could conclude that such releases of spring storms would constitute take.

4. The USFWS did not find any support for a sediment replenishment project. Our inclusion of a sediment replenishment project is in response to the analysis already presented on the project in the EA and EIR. The EA concludes:

> "Pyramid dam blocks the natural transport of sediment to the project reach, which is important in the development of sandy bars, terraces, and breeding pools used by arroyo toads. Sediment loads from the upstream reaches of the project reach and secondary sources, such as Agua Blanca Creek, provide the fine sediments needed by the arroyo toad in middle and lower portions of the project reach. The upper portions of the project reach, however, would lose sediment at higher rates because the more frequent higher flows in this area would move sediment downstream. Because the arroyo toad does not occur from Pyramid dam to Frenchman's Flat (RM 0 to RM 4), the increased loss of sediment in this area would not affect the toad. Monitoring the arroyo toad population in the project reach, as recommended by the CDFG and FWS, would allow the early detection of potential adverse affects on arroyo toads from the loss of sediment in portions of the system, either because the toads have become established in the upstream portions of project reach, or the loss of sediment extends farther downstream than anticipated" (p. 61–62).

We have found that monitoring without explicit trigger conditions and a predetermined process to implement mitigation rarely results in corrective action. Furthermore, the project will result in additional erosion in the upper four miles of the project reach. Even though arroyo toads are not present in this portion of the creek, the operation of the dam eliminated habitat here and agencies should consider mitigative action in the form of a sediment replenishment plan. (See DEIR, p. 3-72, in which sediment provision was investigated because of the erosion impacts).

Our replenishment program focused on the top four miles below Pyramid Lake, not those reaches farther downstream. We wrote, "The arroyo toad habitat values of the first four miles of stream below Pyramid Dam have already been destroyed by clear water releases. Further stream

degradation will take place with the larger and more frequent winter water releases."

We also indicated the need for additional planning and compliance actions to develop and implement such a plan but asked that this action be tied to the increased releases from Pyramid Lake. This provides a mechanism to mitigate for what is an obvious and documented adverse impact of dam operation. This is not strictly an issue that would be regulated by USFWS because the habitat is no longer occupied, but implementation of such a program would have to be designed to avoid impacts on lower reaches of the creek where local sediment sources are apparently adequate.

5. USFWS asserts that management of bullfrogs as part of the project is only necessary if summer water is allowed. We disagree with this position. Bullfrogs will continue to be a part of the middle Piru Creek system, even with the "natural" flow regime. For example, in 2005, the flow rates under the natural regime were 15 cfs through the summer months, so the only benefit of the "natural" regime in terms of bullfrogs was derived from the large winter storms. Depending on climatic fluctuations discussed below, these summer flows could occur for extended periods of above average rainfall associated with the warm phase of the Pacific Decadal Oscillation. Benefits to arroyo toads and other native species would be maximized by incorporating a bullfrog control program such as the one we describe, regardless of what flow regime is ultimately adopted, because it is not prudent to count on future climate to provide conditions to appreciably decrease bullfrog abundance beyond any reductions from scouring winter flows. In the same vein, it is also not appropriate to depend on the natural flows to provide sufficient water to support listed and rare species (see below).

Our alternative scheme does allow for reduction of flows out of Pyramid Dam to zero during drought years, but reduces the period that native fish can be exposed to this stress. During the period from the middle of September to the first winter rains, outflows from Pyramid Dam may be reduced to zero or near zero under our plan. The difference between our approach and the proposed project is that the period of potential zero outflow is shorter. Under "natural" conditions, zero or near-zero outflow (< 1 cfs) could occur as early as June in dry years.

6. The USFWS objected to the idea of long-term management for arroyo toad and red-legged frog. We agree that in an ideal world recovery could be achieved without long-term or perpetual management. We doubt that the difference between our alternative flow regime and the "natural" flow regime is so great that it will require much if any additional management in the long term. For an average year, our alternative plan will only differ from the estimated natural releases from Pyramid Dam from the beginning of July to the middle of September, and then only by adding 7–8 cfs to the average flow (see Figure 1).

Our alternative plan would remove drought years, but otherwise it would be no different than wetter climatic periods characteristic of the warm phase of the Pacific Decadal Oscillation (Douglas et al. 1982). Such periods have multiple El Niño/Southern Oscillation events that are associated with above average rainfall (Goddard and Graham 1997) and associated higher than normal streamflow and sediment movement in the southwest (Ely 1997, Inman and Jenkins 1999). Historical records show extended periods where rainfall is at double or more the long-term mean for years or decades at a time (see data in Lynch 1931). If our alternative flow regime

is deemed to constitute take, then any wet periods associated with future warm phases of the Pacific Decadal Oscillation would cause take as well if the proposed "natural" flow regime is implemented under those rainfall conditions.

Drought periods more extreme than that experienced during the period that arroyo toad has been actively studied on Piru Creek could also occur, probably requiring intervention in the form of augmented summer releases to avoid extirpation of water-dependent native species. Such local range constrictions almost certainly occurred in the past, but the fragmentation of the system by presence of upstream and downstream dams means that normal variation in climate — let alone changes associated with human-induced climate change — now would require active management actions to allow persistence of native species.

Our assumption is therefore that ongoing management is necessary for persistence of arroyo toad, red-legged frog (for which middle Piru Creek is designated as critical habitat), and other sensitive species, regardless of the flow regime adopted, and that claims to the contrary are likely to be disproven. It is for this reason that we propose such management up front rather than waiting until after the fact when resources, commitments, and regulatory permissions are much more difficult to secure.

We hope that the USFWS will reconsider its determination that the alternative flow regime will cause take and work with interested stakeholders to achieve the balance between rare species that was promised by Don Reck in 2005.

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