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PCWA-L-048

Placer County Water Agency

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A Public Agency

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October 4, 2004

Mr. Takeshi Yamashita, Regional Engineer
FEDERAL ENERGY REGULATORY COMMISSION
901 Market Street, Suite 350
San Francisco, CA 94103

Re: Gate Opening Incident, Ralston Afterbay Dam
FERC Project No. 2079-CA

Dear Mr. Yamashita:

In the days immediately after the large release of water on the morning of August 5, 2004 from Ralston Afterbay Reservoir, we requested that environmental specialists from Jones & Stokes conduct surveys of the Middle Fork American River downstream from the dam to assess the effects of the spill event on aquatic invertebrates, fish, and the river substrate. Specifically, we requested that Jones & Stokes provide a qualitative report as soon as reasonably possible summarizing their impressions of the impacts. As related in our previous report to you by letter dated August 19, 2004, the pulse flow appeared as shown on the enclosed graph at the gauging station located 1.6 miles downstream from the dam. Jones & Stokes provided fishery biologists who looked for stranded fish, an invertebrate biologist who reviewed the impacts on benthic macroinvertebrate (BMI) populations and collected samples for more in-depth study in the laboratory, and a geomorphologist who studied changes to the river substrate.

Their impressions are summarized in the enclosed report entitled, "Ralston Dam Gate Failure Assessment Report", September, 2004. They visited three control sites above or outside of Ralston Afterbay Reservoir to collect comparison data from locations that were not affected by the sudden water release. These control sites are on the North Fork of the Middle Fork of the American River, on the Middle Fork American River immediately upstream of Ralston Afterbay Reservoir, and on the Rubicon River immediately upstream of Ralston Afterbay Reservoir.

They also visited four monitoring sites below the dam:

- Indian Bar from about 900 to 1,900 feet downstream from the dam
- Junction Bar from about 2,400 to 4,400 feet downstream form the dam

OCT 8 2004

Water Conservation Is A Moral Obligation

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- A 3,000 foot stretch of river immediately upstream of where Volcano Creek flows into the Middle Fork American River, about four and one-half miles downstream from the dam.

- A 3,200 foot stretch of river immediately upstream of where Otter Creek flows into the Middle Fork American River, about eleven and one-half miles downstream from the dam.

Considerable baseline data was collected by Jones & Stokes environmental specialists in June, August and October of both 2001 and 2002 from all of the areas for the Ralston Afterbay Sediment Management Project Monitoring Plan. In addition to these sites, they also surveyed and documented their impressions of the impacts to American Bar, which is located immediately downstream of Junction Bar.

Flows in the river were too high on the days that the surveys were made for the environmental specialists to wade across the river or even to wade very far into the river. The purpose of the enclosed report is to provide their professional, qualitative impressions of the immediate impacts. Jones & Stokes environmental specialists will be visiting all these sites during the first three weeks of October. Flows in the river will be low during the first two weeks, allowing them to safely wade across the river. They will collect BMI samples, quantitative data on the river substrate and channel cross-section measurements. This information will allow us to determine in a more quantitative manner the impacts of the August 5, 2004 sudden water release and the health of the river. They have provided an estimate that the final report will be ready by the end of January, 2005.

If you have any questions, please call me at (530) 885-6917.

Sincerely,

PLACER COUNTY WATER AGENCY

Stephen J. Jones
Power System Manager

Enclosure

cc: David Breninger
Richard Johnson, TNF
Edward Tiedemann
Kevin Goishi, PG&E
Gary Hobgood, DFG
Kris Vyverberg, DFG

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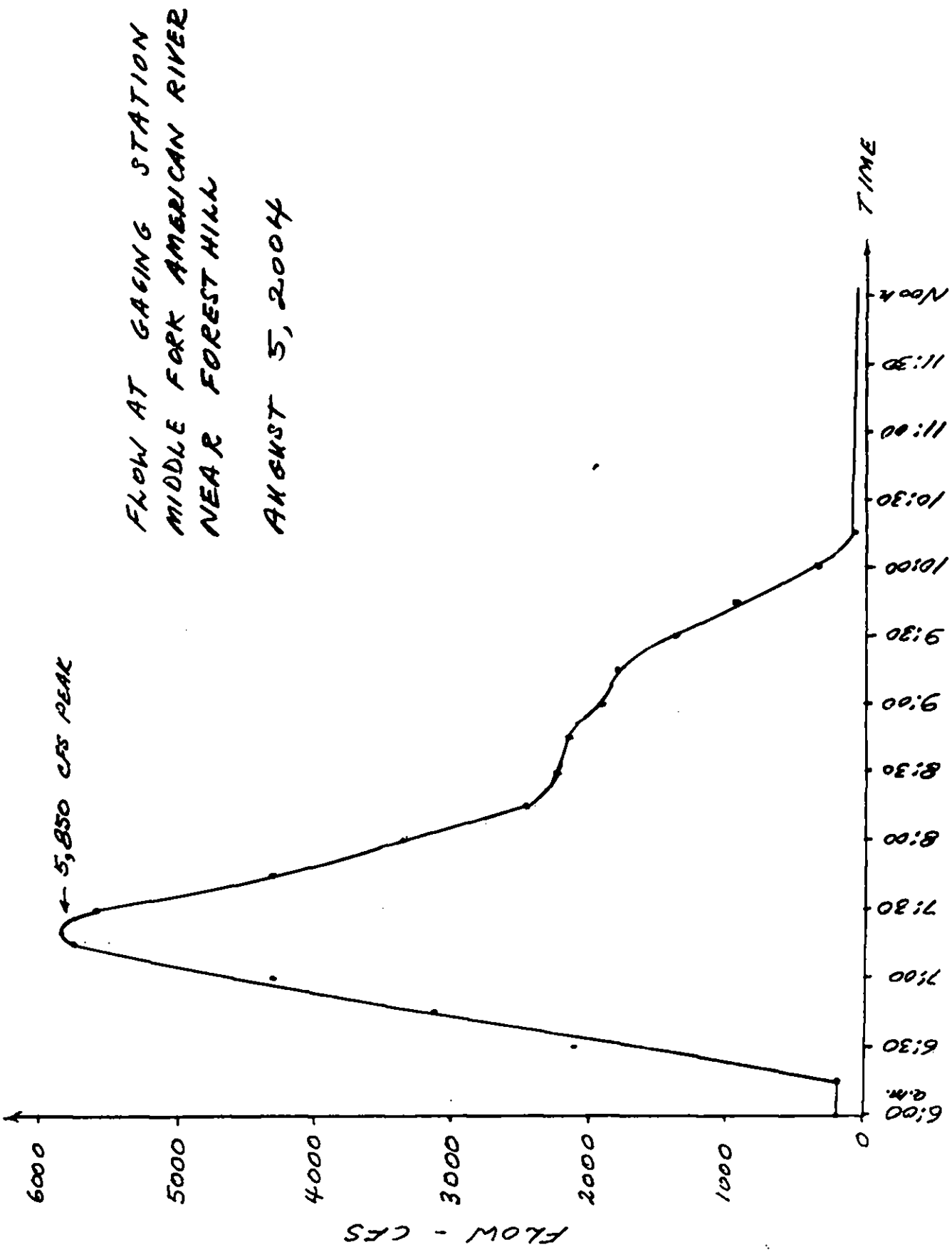

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Ralston Dam Gate Failure Assessment Report

Prepared for:

Placer County Water Agency
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September 2004

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Ralston Dam Gate Failure Assessment Report

Jones & Stokes conducted surveys of the Middle Fork American River (MFAR) below Ralston Afterbay Reservoir in August 2004 to document the effects of the gate failure and subsequent spill event that occurred at Ralston Dam on August 5, 2004. The purpose of these surveys was to provide a preliminary assessment of the effects of the event on physical (geomorphic) and biological conditions in the MFAR. The surveys focused on the four reaches established below Ralston Dam in 2001 to monitor the effects of Placer County Water Agency's (PCWA's) Ralston Afterbay Sediment Management Project (Table 1). Preproject data on channel geometry (pool cross sections), substrate conditions (particle size distribution and cobble embeddedness), and benthic macroinvertebrates (BMI) were collected in 2001 and 2002 (Jones & Stokes 2002, 2003). The following memorandum summarizes the survey methods and results, a preliminary assessment of effects, and recommendations for future monitoring.

Methods

Jones & Stokes conducted reconnaissance surveys of the MFAR on August 5, 8, and 13, 2004. The survey team consisted of a geomorphologist, fish biologist, and invertebrate ecologist, all of whom have detailed knowledge of the river from conducting previous surveys of the affected reaches in 2001 and/or 2002 as part of PCWA's sediment management project. The reconnaissance surveys consisted of visual examination of channel bed and adjacent bars and qualitative sampling of BMI in each of the four monitoring reaches below Ralston Dam. On August 12–16, 2004, Jones & Stokes quantitatively sampled BMI in all monitoring reaches (including control reaches) using the methods described in the 2002 monitoring plan (Jones & Stokes 2003). Table 1 summarizes the preliminary results.

Table 1. Monitoring Reaches, Sampling Method, and Preliminary Results of August 2004 BMI Surveys

Survey Date	Reach	Method	Taxa Observed
August 8	Reach 3: MFAR at Junction Bar	Qualitative	Oligochaeta
	Reach 4: MFAR at Indian Bar	Qualitative	Oligochaeta, Chironomidae, Simuliidae, *Antocha*, *Skwala*, *Rithrogena*, *Baetis*
August 12	Reach 4: MFAR at Indian Bar	CSBP	Pending; diversity low
	Reach 7: Rubicon River	CSBP	Pending; diversity high
August 13	Reach 1: MFAR above Otter Creek	CSBP	Pending; diversity high
	Reach 2: MFAR above Volcano Creek	CSBP	Pending; diversity moderate
	Reach 3: MFAR at Junction Bar	CSBP	Pending; diversity low
August 16	Reach 5: MFAR above Ralston Afterbay	CSBP	Pending; diversity high
	Reach 6: North Fork MFAR	CSBP	Pending; diversity high

CSBP = California Stream Bioassessment Procedures

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Survey Results

Reach 4 (Indian Bar)

The riverbed and bar below Ralston Dam and above the confluence with the Oxbow Powerhouse tailrace and North Fork of the MFAR experienced substantial scour and bedload movement during the August 5 event (Photo 1). Cobbles and boulders in the bed of the river were abraded and much of the algae that typically cover these materials at this time of the year were scoured. Bed movement was most apparent immediately below the dam.

Evidence of high water along Indian Bar (Reach 4) included debris accumulations, wet banks (marking the high-water line), and downed vegetation. Erosion of the toe and face of the sediment pile resulted in a steep, scoured slope along the lateral and downstream margins of the pile (Photos 2 and 3). Sediment on the newly formed steep face was unstable, resulting in active sediment movement and mass failure in a few places. This is consistent with earlier modeling predictions of the effect of high flows on Indian Bar during the project planning and design phases (Mussetter Engineering 2001).

On August 8, segmented worms (Oligochaeta) dominated the qualitative BMI samples collected in Reach 4. Midge larvae (Diptera: Chironomidae), stoneflies (*Skwala* sp. [Plecoptera: Perlodidae]), and mayflies (*Baetis* sp. [Ephemeroptera: Baetidae]) were observed in moderate abundance. Noticeably absent from this reach were large-bodied species of caddisflies and mayflies that are not adapted to high velocity water (these taxa were observed in this reach in August 2002). The largest macroinvertebrate observed was *Rithrogena* sp. (Ephemeroptera: Heptageniidae), a genus adapted to high water velocity.

No stranded or dead fish were found immediately after the event (August 5) or during subsequent visits (August 8 and 13). The occurrence of stranding is often difficult to detect because small fish are easily overlooked and are typically removed by scavenging birds and mammals shortly after an event. However, we believe that significant stranding did not occur because we would likely have seen some stranded or dead fish during the initial surveys that focused on the reaches immediately downstream of the dam within hours of the gate failure.

Reach 3 (Junction Bar)

Reach 3 was characterized by substantial deposition of coarse sand. Fresh sand covered much of the channel margins, with the largest accumulations on low-sloping bar surfaces immediately downstream of flow obstructions (mature willows) (Photo 4). The depth of deposition in these areas ranged from a few inches to more than 6 inches. Most deposition of sandy material occurred along the periphery of the wetted channel. The bed of the main channel consisted

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largely of coarser materials (gravel, cobbles, and boulders) but also contained a significant portion of sand (although in smaller quantities than along the channel margin) (Photo 5). In general, riffles appeared to have a larger proportion of finer materials (sand and gravel) and a higher diversity of substrate sizes than was observed in 2002. Cobble embeddedness in the main channel ranged from 0 to 50% (similar to the range measured in 2001 and 2002) and up to 75% along the periphery of the channel and on the adjacent bar.

The BMI community in this reach appears to have been highly disturbed by the flood event. The only taxon observed during the qualitative examination on August 8 was segmented worms (Oligochaeta). None of the mayfly, stonefly, and caddisfly species present in samples in 2001 and 2002 was observed. Several dead crayfish (between 5 and 10) were found in Reach 3 on August 8.

American Bar

American Bar exhibited evidence of scour and associated channel avulsion along its north edge directly adjacent to the canyon wall. Three separate channels were created. The channel farthest from the river (the one directly adjacent to the canyon wall) had two fresh standing pools. The other two channels were newly scoured and contained freshly deposited sand. Evidence of high-water marks included debris accumulations, wet banks along the canyon walls, and downed vegetation.

Reach 2 (Middle Fork American River above Volcano Creek)

There was no evidence of significant bedload movement and was relatively little deposition of fine material in the higher-gradient, confined portions of the channel in Reach 2 (Photo 6). Localized deposition of sand was evident in backwaters and along the margins of the channel immediately upstream of riffles. Sediment deposition was most apparent in the lowermost portion of the reach immediately upstream of the valley constriction associated with Volcano Creek. The depositional nature of this area was indicated in previous years by the presence of a sandy bar and relatively fine substrate in the main channel. Fresh deposition of sand was evident on the bar and in the adjacent pool on August 13 (Photo 7). A channel cross section surveyed at this location in 2002 (Pool 3, MFAR near Volcano Creek) will be resurveyed in October to determine the extent of deposition in the adjacent pool.

Initial observations indicate that the diversity and abundance of BMI in this reach may be lower than observed in previous summers, especially in areas of newly deposited sediment. However, moderate levels of diversity, attributable in part to the presence of mayflies, stoneflies, and caddisflies, indicate that the level of disturbance was lower than that experienced by BMI in Reaches 3 and 4.

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Reach 1 (Middle Fork American River above Otter Creek)

Although the effects of the flood were evident (downed vegetation, debris), no significant changes in channel and bed conditions were detected in this reach (Photo 8). The abundance and diversity of BMI appeared to be similar to that observed in 2002.

Summary and Discussion

The dam gate failure and subsequent spill event provided the first opportunity to examine the effects of a relatively large discharge event since monitoring began in 2001. As predicted, the magnitude of the event was sufficient to move a significant portion of the Indian Bar sediment pile. However, the event was not representative of proposed project operations (sediment pass-through [SPT]) because of major differences in timing, duration, and magnitude of increased discharge (relative to base flows), as well as differences in the operation and configuration of the gates. Therefore, the geomorphic and biological effects of the event on the MFAR below the dam may not be representative of the potential effects of proposed SPT operations.

Geomorphic Effects

The observed geomorphic changes in the Indian Bar sediment pile and MFAR downstream of Ralston Dam are generally consistent with past sediment modeling results and predictions. The MFAR has a high transport capacity because of its high gradient and channel confinement. Large materials (boulders and cobble) dominate the bed and are mobilized and transported only during relatively high and infrequent discharge events, while finer materials are effectively transported during most events. Geomorphic features in the MFAR, such as fans, landslides, and bedrock outcrops, create localized constrictions that cause upstream zones of sediment deposition where water backs up, slows down, and deposits sediment during high flow events. In general, the steeper, more confined reaches of the MFAR act to transport sediment while the lower gradient, less confined reaches act to temporarily store sediment between flood events.

In general, the magnitude of geomorphic changes resulting from the spill event decreased with distance downstream from Ralston Dam. The event resulted primarily in scour and bedload transport in the relatively steep, confined channel immediately downstream of the dam (Reach 4), resulting in movement of a significant portion of the Indian Bar sediment pile. Much of the coarse sand and larger bed materials (gravel and small cobbles) that were transported beyond the North Fork MFAR confluence appears to have been deposited in Reach 3 where the flow encountered the wider canyon, lower channel gradient, and riparian vegetation associated with Junction Bar. At American Bar, where the channel becomes steeper and more confined, the most obvious effect was localized scour although some deposition of coarse sand also occurred. Downstream of the tunnel and extending to Reach 2 (near Volcano Creek), little or no bedload transport was evident and the most noticeable changes in bed conditions were localized deposits

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of coarse sand in natural deposition zones upstream of riffles and channel constrictions. No signs of significant bedload movement or deposition were observed in Reach 1 (near Otter Creek).

Biological Effects

Benthic Macroinvertebrates

Qualitative sampling of the BMI community following the spill event indicated that the magnitude of biological effects (as indicated by reductions in species diversity and abundance relative to 2002 levels) was generally correlated with the degree of channel disturbance. The degree of channel disturbance appeared to have been greatest in the reaches immediately downstream of Ralston Dam (Reaches 3 and 4) where a large portion of channel experienced scour, sediment transport, and deposition. Farther downstream (Reach 2), the apparent effects of the spill on invertebrate communities were smaller in magnitude and extent, with the lowest species diversity and abundance of BMI in areas of localized sediment deposition. No detectable changes in BMI communities were observed in Reach 1.

Potential mechanisms causing reductions in diversity and abundance of BMI during flood events include direct mortality or displacement (drift) resulting from high water velocities, high turbidity and suspended sediment levels, and bed scour. Floods may also cause indirect, potentially longer-term effects on invertebrate communities through habitat changes associated with increases in fine sediments and embeddedness. These changes were reflected by the dominance of Oligochaete worms and reduced abundance of mayflies, stoneflies, and caddisflies in areas of newly deposited sand. Although the specific mechanisms are unclear, our preliminary observations indicate that direct displacement and mortality by swift currents and scour were major causes of reduced BMI abundance and diversity, especially in the reaches immediately below Ralston Dam. Farther downstream, it appears that the direct effects of the spill on BMI were attenuated with increasing distance from the dam. Future monitoring will be needed to evaluate the extent and rate of recovery of invertebrate communities in areas of local sediment deposition.

Aquatic invertebrates and other biota in the MFAR are adapted to floods, which are common natural events in Sierra Nevada streams, and would be expected to rapidly recolonize disturbed areas through a succession of opportunistic and specialized species (Resh et al. 1988). In general, the adverse biological effects of episodic inputs (versus chronic inputs) of fine sediment have been found to be temporary in high-gradient mountain streams because of effective transport of fine sediment and rapid recolonization by invertebrates from upstream sources (Waters 1995). Perhaps the most detrimental aspect of the spill event was the unnatural timing of the event. By late August, many species are typically in a late nymphal stage or a dormant pupal stage. These life stages are less capable of resisting high-velocity flows than smaller or more active stages, which are typically the dominant life stages in spring when high flows occur naturally. The result may be a reduction in the number of adults that emerge from the river this fall.

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Fish

The effects of the spill event on fish populations in the MFAR below Ralston Dam are difficult to assess because of a lack of baseline information. No direct impacts on spawning or reproductive success of trout and other species would be expected because of the timing of the event. Potential direct effects may include stranding of fish on flooded bars, downstream displacement, and temporary disruption of feeding. During floods, trout and other fish species may avoid displacement by moving laterally or longitudinally to find shelter (e.g., vegetated shorelines, flooded bars or terraces). The most vulnerable life stages during the summer are larvae and juveniles, which can be swept downstream by high flows or to off-channel areas where they may become stranded or isolated from the main channel. Although an extensive search was not conducted, no stranded or dead fish were observed on main channel bars or in off-channel ponds immediately after the event.

Trout and other stream fishes have behavioral and physiological adaptations that enable them to survive temporary high flows, suspended sediment concentrations, and turbidity during natural flood events. However, the unnatural timing of the spill event could increase the potential for adverse effects because of the importance of stable summer conditions for feeding and growth. It is unlikely that an event of this duration could directly affect growth or survival, but the potential exists for indirect effects if downstream displacement concentrates fish in areas where habitat is already occupied or unavailable. Indirect effects may also occur in the reaches immediately below Ralston Dam where reductions in BMI are expected to temporarily reduce food availability and potentially cause short-term reductions in abundance or production of fish in this segment of the MFAR.

Our initial observations indicate that changes in the quantity and quality of fish habitat were limited to localized reductions in juvenile cover attributable to the deposition of coarse sand in natural depositional areas in Reach 2 and 3. No changes in the distribution and extent of pools were apparent, although some decreases in depths may have occurred in pools within the largest depositional areas (e.g., upstream of the channel constriction created by Volcano Creek). Preproject measurements of substrate composition (pebble counts) and embeddedness in 2001 and 2002 indicated that most of the riffle substrates in the MFAR below Ralston Dam are unsuitable for trout spawning because of their large size (Jones & Stokes 2002). In the few areas where suitable spawning-sized gravels were noted (mostly in Reaches 1 and 2), little or no change in size composition or embeddedness was apparent following the spill event (e.g., Photo 6).

Conclusions and Proposed Future Monitoring

Based on our preliminary surveys, the spill event at Ralston Dam on August 5, 2004, resulted in disturbance of the channel bed and biological communities of the MFAR that diminished with increasing distance from the dam. The geomorphic (scour, sediment transport, and deposition)

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and biological (temporary reductions in BMI diversity and abundance) effects were most marked in the reaches immediately below the dam (Indian, Junction, and American Bars). The presence of sensitive life stages and the atypical characteristics of the spill relative to natural flood events likely magnified the biological impacts. Perhaps the most significant effect potentially affecting trout and other fish species is the reduced abundance or elimination of mayflies, stoneflies and caddisflies, which typically compose a large fraction of the diet of stream fishes. Therefore, these taxa will serve as key indicators for evaluating the recovery of these reaches and monitoring trends in productivity during the evaluation phase of the sediment management project.

While the event had direct and immediate impacts on BMI and probably other aquatic organisms (including fish), the biological community is expected to recover in response to recolonization of these reaches and subsequent readjustments in sediment conditions during future flood events. These readjustments are expected to include the transport of accumulated fine sediment and beneficial changes in aquatic habitat resulting from the continued introduction of intermediate-sized materials (gravel, pebble, and cobbles) from the Indian Bar sediment pile (Jones & Stokes 2002, 2003).

To refine our assessment of the geomorphic and biological effects of the spill event, quantitative sampling of BMI at all monitoring reaches was completed on August 16, 2004 (following the spill event) and will be repeated in October 2004 along with substrate (particle size distribution and embeddedness) and channel cross-section measurements. These data will be used to quantitatively assess the recovery of BMI community following the August 5 event and document changes in geomorphic conditions and BMI communities since 2002. Potential longer-term adjustments in channel morphology, substrate conditions, and BMI communities will be documented during subsequent monitoring years.

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Photo 1. MFAR downstream of Ralston Dam after August 5, 2004, gate failure (Reach 4)

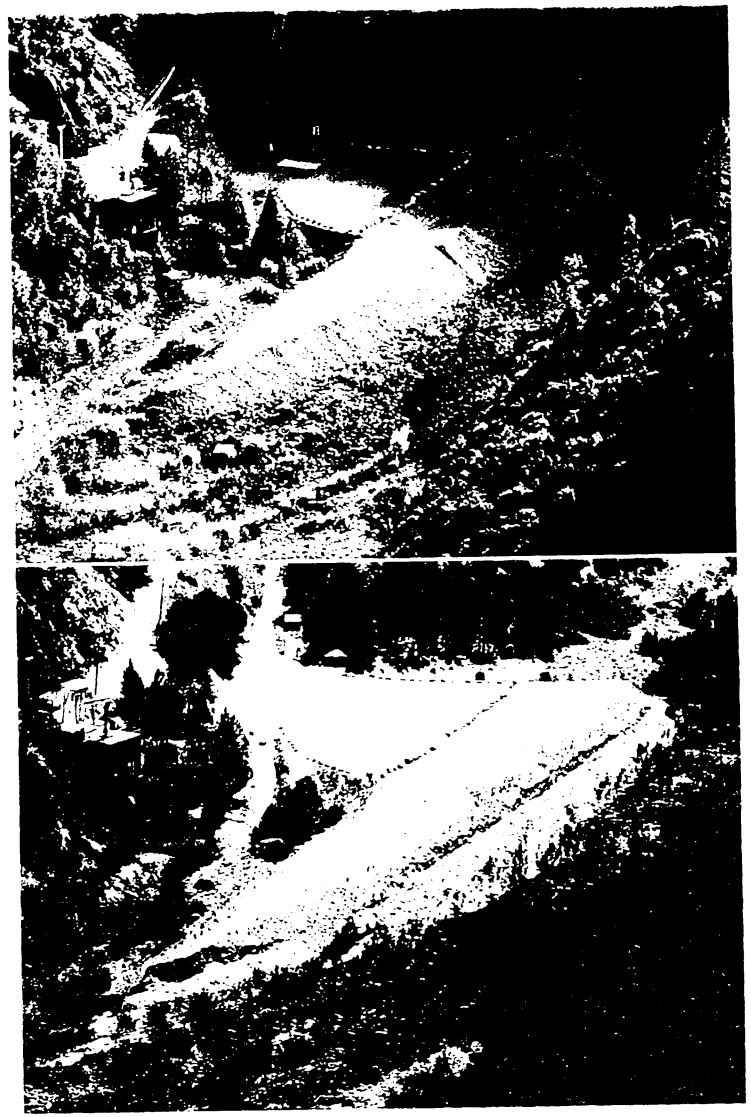

Photo 2. Indian Bar before and after August 5, 2004, gate failure (Source: Gary Hobgood, DFG)

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Photo 3. Slope of Indian Bar sediment placement site after August 5, 2004, gate failure

Photo 4. Deposited sand along the margins of MFAR after August 5, 2004, gate failure (Reach 3)

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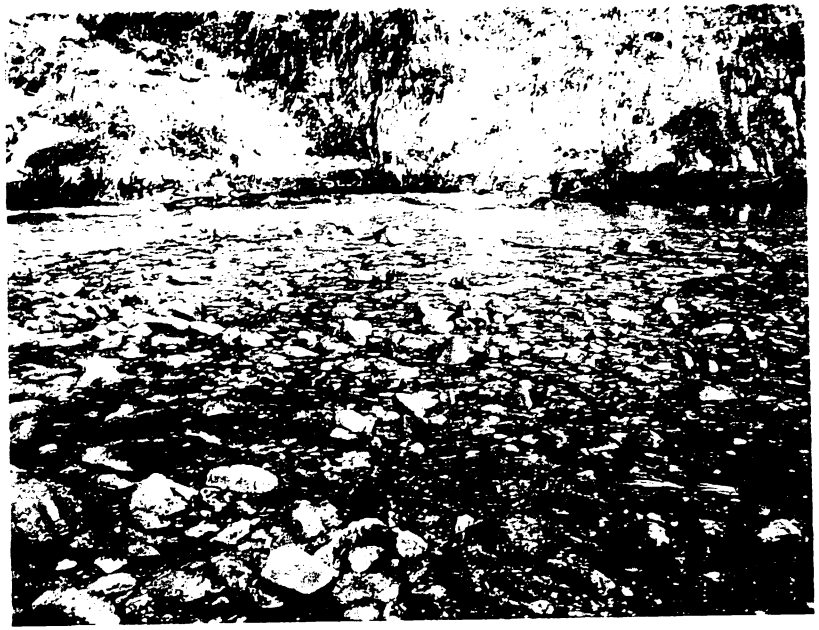

Photo 5. Riffle in MFAR at Junction Bar after August 5, 2004, gate failure (Reach 3)

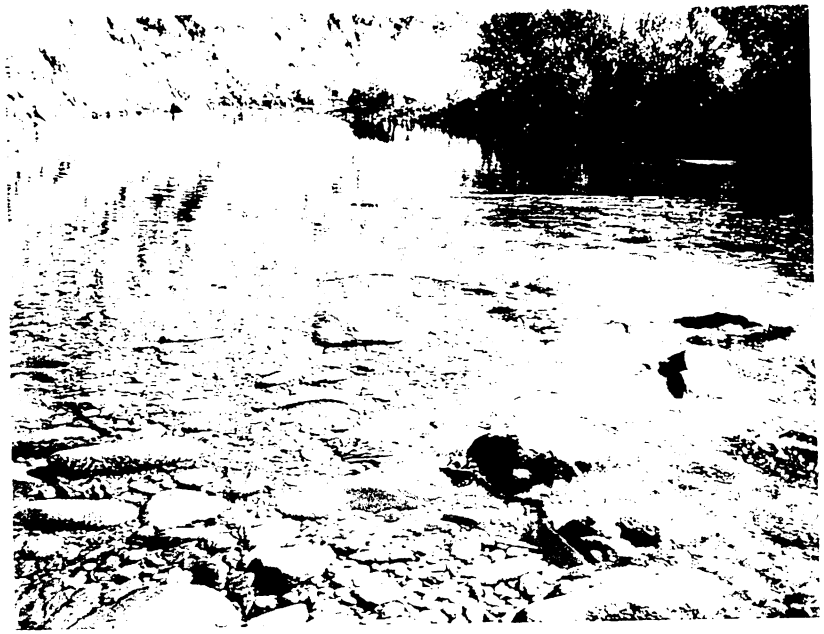

Photo 6. Riffle in MFAR above Volcano Creek after August 5, 2004, gate failure (Reach 2)

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Photo 7. Bar and riffle in MFAR above Volcano Creek after August 5, 2004, gate failure (Reach 2)

Photo 8. Riffle in MFAR above Otter Creek after August 5, 2004, gate failure (Reach 1)

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