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January 31, 2012

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Via email to john.bezdek@sol.doi.gov

Re: Windy Gap Firming Project Final Environmental Impact Statement (Final EIS)

Dear Mr. Collins, Mr. Ryan, Mr. Bezdek and Ms. Maldonado,

I am writing on behalf of Trout Unlimited to offer our comments on the Final EIS for the Windy Gap Firming Project (WGFP). Our intent is not to repeat or replace our Draft EIS comments but to highlight some of the most significant unresolved problems and to propose specific steps to resolve them without litigation. Attached you will find a more detailed description of these problems and our proposed resolution.

From the outset, Trout Unlimited along with EPA, Colorado Division of Parks and Wildlife (CDPW) biologists, Grand County, the Colorado River Water Conservation District, Colorado River landowners and others, have expressed serious concerns about the cumulative impacts of WGFP and the proposed Moffat Collection System Project on the upper Colorado River and on the future viability of its valuable trout fisheries. One of the most popular fly fishing destinations in Colorado, the river is showing signs of degradation – including stream bed armoring, sediment accumulation, algae and the documented loss of macroinvertebrate and native fish species (Nehring 2011). We are concerned that these projects, which will take approximately 23% of the remaining river flows and reduce the river to less than 25% of its native flows, will be the final death knell for this valuable, wild trout fishery. Our concern is shared by thousands of anglers, residents, business owners and citizens who fear for the future of our state's name-sake river.¹

¹ Over 1,000 individual comment letters were received by BOR on the Draft EIS asking for river protection. Four separate petitions, adding up to thousands of signatures, have been signed by concerned anglers, residents, citizens and business owners. On January 24, 2012, over 100 demonstrators gathered in front of EPA's Region VIII offices in Denver to plead for river protection. Links to signed petitions and media coverage of the Rally for the Colorado River can be found at www.defendthecolorado.org.

The Bureau of Reclamation (BOR) does not have an obligation to approve the use of Colorado Big Thompson (C-BT) project facilities for the benefit of WGFP. Nor does it have an obligation to minimize the burden of its proponent, Northern Colorado Water Conservancy District, Municipal Subdistrict (Subdistrict), to ensure that operations do not harm the Colorado River. On the contrary, BOR's primary obligation is to the C-BT project and to ensuring that, if approved, WGFP is operated in a manner that does not interfere with C-BT project purposes. One of the primary purposes of the C-BT project, as stated in Senate Document 80, is "[t]o preserve the fishing and recreational facilities and the scenic attractions of Grand Lake, the Colorado River, and the Rocky Mountain National Park." *SD 80 at p. 3*. BOR's first obligation is to ensure that WGFP operations do not impact Grand Lake, the Colorado River or its fisheries.

Given the current state of river depletion and decline, Trout Unlimited, EPA, CDPW, Grand County and others have repeatedly asked BOR to take special care in evaluating the cumulative impacts of WGFP on the Colorado River's aquatic ecosystem.² An impacts analysis of this magnitude and complexity cannot be accomplished without making significant assumptions. We have urged BOR to be conservative in its assumptions and to resolve uncertainty in favor of aquatic life protection. We have urged BOR to look at cumulative impacts as a continuum, trying to understand how stream depletions have affected and are currently affecting aquatic life and whether additional depletions are likely to make those conditions worse. We have urged BOR to look, not just at how aquatic life will react to single dry, average or wet years, but how the river hydrology will change over a period of years and how those changes will cumulatively affect aquatic life. Will aquatic life be exposed to lower flow conditions more often? For longer periods of time? How will these changes affect aquatic life? How will they affect their habitat? And we have asked the agencies to contemplate the possibility that the system is reaching its threshold for non-linear, catastrophic responses and to develop adequate measures to monitor for and prevent the loss of these prized fisheries.

In reviewing the Final EIS, Trout Unlimited is appreciative of BOR's progress in evaluating stream temperature impacts and their effect on aquatic life in the Colorado River. While stream temperature mitigation measures remain insufficient, Trout Unlimited applauds BOR's acknowledgment of the seriousness of the issue. We are dismayed by the Final EIS evaluation of other potential impacts of WGFP on the Colorado River and its aquatic life.

The Final EIS continues to use modeling assumptions that underestimate WGFP impacts. Data is presented through skewed statistics that mask the true magnitude of impacts. Even when incremental flow changes are acknowledged, their impacts are arbitrarily dismissed. Aquatic life is presumed to be healthy and thriving in spite of clear evidence of significant decline. Future aquatic life conditions continue to be evaluated through the artificial lens of historical year types and patterns, rather than a changed hydrological condition that could expose aquatic life to constant stress year after year after year. A critical report by the state's fish and wildlife agency, which findings contradict key findings in the Final EIS, is ignored. The very real possibility of threshold responses arbitrarily disregarded. In sum, while acknowledging significant potential stream temperature impacts, the Final EIS brings us no closer to understanding the potential impacts of anticipated additional reduction of peak flows and of prolonged, low flow periods on the health of the Colorado River and its aquatic life. These impacts can be as devastating as elevated stream temperatures.

² Comments reflecting these requests are part of the WGFP Draft EIS record.

Rather than taking special care to ensure that the proposed use of CB-T facilities for non-project uses can be accomplished without affecting the primary purposes of the CB-T Project, BOR appears to be going out of its way to ensure WGFP is approved with minimal risk or burden to its proponents. Indeed, the Final EIS offers not a single mitigation measure for the protection of the Colorado River and its fisheries beyond the limited and insufficient measures the Subdistrict has already agreed to undertake. The risk that assumptions and conclusions in the Final EIS are incorrect and that these errors will lead to further degradation or, in the worst case scenario, catastrophic loss, is placed on the Colorado River and its fisheries.

Trout Unlimited urges BOR to fulfill its obligation under Senate Document 80. We urge BOR to take a closer look at the risks posed by WGFP to Grand Lake and to the Colorado River and its fisheries with an eye to minimizing risks to those resources which BOR is duty bound to protect. We urge BOR to adopt enforceable mitigation measures designed to minimize those risks as a condition to any approval of the use of CB-T facilities for WGFP purposes. Those measures must include, at a minimum, (1) restrictions on project diversions *anytime* stream temperature nears acute *or chronic* state standards, (2) adequate flushing and channel maintenance flows, (3) a detailed, robust and *enforceable* monitoring and adaptive management plan that uses baseline conditions and specific thresholds to trigger additional protective action, and (4) bypass of Colorado River flows around Windy Gap Reservoir. These measures are further detailed in the attached.

We believe the Final EIS to be legally defective. It fails to meet NEPA's substantive and procedural requirements and it fails to provide critical information needed by BOR and the U.S. Army Corps of Engineers to ensure compliance with their respective statutory obligations. Given the significant risks WGFP poses to Grand Lake and to the health of the Colorado River and its fisheries, we also believe that less damaging alternatives to meet WGFP participants' demands are available. Nevertheless, our primary interest is to ensure that adequate, enforceable mitigation measures, such as those we propose, are adopted. We urge BOR to do so.

Thank you for the opportunity to comment.

Sincerely,



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cc (w/selected attachments):

Anne Castle, DOI
John Tubbs, DOI
David Murillo, BOR
James Martin, EPA Region VIII
Rena Brand, USACE

Attachments

WGFP DETAILED COMMENTS
Attachment A
Trout Unlimited's Final EIS Comments Letter
Dated January 31, 2011

1. The Final EIS ignores new critical information

In September of 2011, the Colorado Division of Parks and Wildlife (CDPW), formerly the Colorado Division of Wildlife, released a report entitled "Colorado River Aquatic Resources Investigations – Federal Aid Project F-237R-18" (Nehring Report or Nehring 2011).³ A copy of the report is attached (Attachment C). The purpose of the report is:

To document the relative distribution and abundance of the mottled sculpin *Cottus bairdi* and the aquatic invertebrate fauna of the Colorado River in Middle Park, Colorado in 2010 and compare the results with historical data and records compiled over the past 25-40 years, prior to the construction and operation of Windy Gap Dam in 1983.

Nehring 2011 at p.1. The report summarizes data showing a dramatic decline in numbers and diversity of macroinvertebrate species in the Colorado River since the construction of Windy Gap Reservoir, including:

- 38% loss of total macroinvertebrate diversity from 1980-1981 to 2010
- Among the three most sensitive insect groups (EPT), losses from 1980-1981 to 2010 include 19 mayfly, four stonefly, and eight caddisfly species
- Sensitive species like *Pteronarcys californica*, *Pternarcella badia*, and *Drunella grandis* were eliminated below Windy Gap Dam
- Stoneflies have declined by 40% with the greatest losses at stations nearest WGD
- Species that were present and/or abundant at Reach One study sites WG11 and WG12 for most or all of the 1980-1981 period but greatly diminished in number or totally absent at these two sites nearest WGD in 2010 include *Psychomyia flavida*, and the large free-living taxa *Arctopsyche* sp. and *Cheumatopsyche* sp.

Nehring 2011 at pp. 13-21. The report goes on to describe the changes leading to the aquatic life declines, including:

- Reduction in flushing flows
- Loss of channel connectivity due to Windy Gap Reservoir
- Elevated water temperatures
- Fine sediment deposition and transport
- Rooting of vegetation mats dislodged from Windy Gap reservoir

Nehring at pp. 23-29. The report reaches the following overarching conclusion:

³ The report is dated June 2011 but it was not signed by its authors until September 1, 2011.

It is our conclusion that chronic sedimentation and clogging of the interstitial spaces in the cobble-rubble dominated riffles areas of the upper Colorado River below WGD is the overarching problem that has increasingly compromised the biotic integrity and proper function of the river over the past 25 years. The proposed firming projects at Windy Gap and the Moffat Tunnel are only going to further exacerbate this situation.

Nehring 2011 at p. 31.

The Nehring Report is the most comprehensive site-specific study of aquatic life impacts in the Colorado River downstream of Windy Gap Reservoir. It is a study conducted and released by the state's fish and wildlife agency. Its findings and conclusions are not only informative, they are in some cases diametrically opposite to and contradict critical findings and conclusions of the Final EIS, including the Final EIS's overall finding that reductions in peak flows will not affect aquatic life in the Colorado River.

The Nehring Report was made available to BOR by letter dated August 19, 2011 from the Upper Colorado River Alliance. Yet, the report is not considered in the Final EIS.

The Nehring Report constitutes "significant new information relevant to environmental concerns and bearing on the proposed action or its impacts." BOR's failure to consider it in a supplemental EIS is not only inexcusable in light of its Senate Document 80 obligations, it violates NEPA. *40 CFR 1502.9(1)(c)(ii)*.

2. The Final EIS arbitrarily selects modeling and other assumptions that favor project development over resource protection

Given the complexity of the analysis involved, the Final EIS must of necessity make assumptions. The Final EIS makes assumptions that consistently underestimate project impacts, placing the risk of error on the Colorado River and its aquatic ecosystem in direct contravention of Senate Document 80. The following is a non-exhaustive list of examples.

a. Selective use of modeling period

The Final EIS uses a 1950 to 1996 model period for all purposes except for the purpose of defining Windy Gap diversions, where the more recent 2004 to 2008 period is used. Because Windy Gap water diversions in the more recent period are higher, future depletions associated with WGFP appear smaller. BOR argues that the more recent period of greater diversions should be used because it is more indicative of existing conditions (although it ignores the declining aquatic health conditions during that time). In contrast, BOR uses hydrological patterns (sequences of dry, average and wet years) of the 1950 to 1996 period to model existing and future stream conditions in spite of known, significant changes in the last decade and anticipated future changes due to climate change.

b. Skewed statistics

The Final EIS calculates "average year" flows in a manner that significantly over estimates the amount of flows expected to remain in the Colorado River after WGFP in an average year. It does so by including the five wettest years of the period of record in its average year

calculations.⁴ Trout Unlimited suggested leaving the extreme events (i.e., the five wettest years and five driest years) out of the calculation or, in the alternative, the use of a median approach which reflects average conditions much more accurately. BOR acknowledges that its approach skews the outcome but insists that it is a legitimate, commonly used methodology. *Final EIS at F-491.*

c. One-sided corrections

The Final EIS acknowledges that the model used to predict reductions in peak flow does not have a “predictive” function, meaning that it assumes full diversion by Windy Gap and WGFP during the shoulder season regardless of whether Granby is projected to spill. If Granby is modeled to spill, the model assumes the projects’ pumping will be released as part of the spill. In reality, Windy Gap is not pumped when Granby is projected to spill to save on pumping costs.

The Final EIS notes this model shortcoming and warns that, as a result, more shoulder season flows should be available below Windy Gap Reservoir than the model predicts, resulting in fewer impacts during that season. What the Final EIS omits is the fact that the model shortcoming also results in the model’s predicting much higher flows during peak season than documented by the actual gage records. The result is that the Final EIS overestimates post-project peak flows by 53 percent.⁵ This error is carried throughout the Final EIS analysis, including the conclusion that further reduction in peak flows will not affect aquatic life and its habitat.

d. Speculative “no action” conditions

BOR compares WGFP impacts with the impacts of a future, speculative “no action” condition rather than to existing conditions. *See Final EIS at 3-2.* BOR’s “no action” alternative assumes that if WGFP is not approved, another reservoir enlargement will be built that will take significant additional Colorado River flows. As a result, WGFP impacts appear smaller.

Enlargement of Ralph-Price Reservoir is speculative at best, given the lack of any current plan for it and absence of firm yield from Windy Gap to justify its expense. Any expansion of the reservoir would also require a 404 permit and be subject to NEPA, running into the same issues as the WGFP.⁶ According to data presented by the Upper Colorado River Alliance, BOR’s assumptions regarding the no action alternative lessens the true impact of WGFP on peak flows by about 70 percent.

⁴ The model also uses three of the five driest years in the calculation. However, because high flows during the wettest years are orders of magnitude larger than low flows during dry years, averaging the wettest years results in flows that are significantly higher than if both extremes are left out of the calculation.

⁵ Resource Engineering, Inc., consultants for the Upper Colorado River Alliance, presented this information to BOR in a technical meeting on January 24, 2011. A copy of Resource Engineering’s slides from the meeting is attached as Attachment D (*see Figure 5*). These concerns were again cited in the Upper Colorado River Alliance’s letter to BOR dated January 3, 2012. The information is disregarded in the Final EIS. It is our understanding that Resource Engineering will supplement its earlier work in the near future.

⁶ Ironically, while deeming Ralph-Price enlargement, a project that is not even in the drawing board, “reasonably foreseeable,” BOR does not consider NISP, a project that is undergoing permitting and, as described below, could have serious impacts on the Colorado River, sufficiently “reasonably foreseeable” to evaluate it in WGFP’s cumulative impacts analysis.

e. Non-representative sampling locations

To evaluate WGFP impacts on the Colorado River's ability to transport sediment, the Final EIS relies on an analysis performed for the original Windy Gap EIS in 1981, then attempts to support the validity of that analysis by a more recent study done for the USACE which finds the sediment transport rate of the river exceeds the sediment supply. The site used in the more recent study, however, is particularly favorable to a finding of no impact and not representative of the reach most impacted by the project. The site is located immediately below the confluence of the Colorado River with Williams Fork, some 15 miles downstream of Windy Gap dam. Unlike Windy Gap, a shallow reservoir that collects and routinely releases large amounts of silt and sediment to the stream, Williams Fork Reservoir traps sediment, delivering an infusion of low-sediment flows to the Colorado River that benefits the sediment heavy Colorado River at the particularly selected site. As further discussed below, 15 miles upstream, the Colorado River stream bottom is armored due to the periodic release of sediment and silt from the shallow Windy Gap Reservoir that solidify in the river bed in the absence of sufficient peak flows to move materials downstream. (*Nehring 2011*).

The Colorado River site used in the more recent sediment transport analysis is not representative of current sediment conditions downstream of Windy Gap Reservoir, nor is it appropriate for use to describe how additional peak flow reductions associated with WGFP will impact this most severely affected portion of the Colorado River. Further, both the original 1981 EIS and the more recent analysis focus only on the transport of fine grain sediments and not the movement of larger particles needed for scouring and overall maintenance of channel health.

f. Arbitrary selection of aquatic life and river health data

One of the most serious deficiencies of the draft EIS is the assumption, imbedded in its aquatic impacts analysis, that the Colorado River and the aquatic life it supports is in good condition and not in a state of decline. If the river is in a state of decline, the cumulative impacts of WGFP and the Moffat Project could be devastating, a point brought up in many comments, including comments provided by EPA.

The Final EIS looks at aquatic life conditions in the Colorado River downstream of Windy Gap Reservoir.⁷ However, rather than carefully weighing all available evidence to reach a conclusion on this critical issue, the Final EIS ignores conclusive data evidencing significant aquatic life decline (*Nehring 2010 and 2011*) in favor of selective, unreliable and in some cases outright erroneous data that presents an inaccurate picture of river and aquatic life health.

Macroinvertebrate Data

To answer the question - is the Colorado River macroinvertebrate community in decline – the Nehring report compares macroinvertebrate data collected before construction of Windy Gap Reservoir to data collected in 2010. As previously discussed, the data reveals significant declines, including a 38% loss of total macroinvertebrate diversity, including the loss of 19 mayfly, 4 stonefly and 8 caddisfly species, the complete loss of key indicator species like the

⁷ See Amended Aquatics Report (2010); Miller Ecological Consultants Memorandum dated August 22, 2011 (Miller Memo); Final EIS 3-207 to 208.

Pteronarcys californica, *Ptneracella badia*, and *Drunella grandis*, and a 40% decline in stoneflies. *Nehring Report at pp. 13 to 21.*

Ignoring this data, the Final EIS looks not at how the macroinvertebrate community has changed over the years but simply compares recent macroinvertebrate counts to a hypothetical, reference condition using a modeling tool entitled “Multi-Matrix Index” (MMI). Using erroneous data, the Final EIS concludes that aquatic life downstream of Windy Gap Reservoir is healthy. *Final EIS at 3-208.* The Final EIS conclusion is both non-responsive and incorrect.

First, the MMI tool is designed to assess *impairment not degradation*. Whether or not aquatic life use is *impaired* - which as explained below it is – the question being asked is whether the river’s aquatic life has been *degraded* and whether further depletions by WGFP will cause or contribute to further degradation. This information can be best ascertained by comparing aquatic life data for the same stream over a period of years. Where this data is unavailable, searching for alternate methods makes sense. Here, however, the data is available. (Nehring 2010 and 2011). BOR simply chose to ignore it. BOR’s decision to ignore pertinent information in favor of the less relevant MMI approach is not only arbitrary and capricious, it reflects BOR’s bias toward selection of data that shows the least amount of impacts.

Second, when properly calculated, MMI scores show that macroinvertebrates downstream of Windy Gap reservoir are actually *impaired* within the meaning of section 303(d) of the Clean Water Act. For mountain streams, MMI values of 50 or less indicates non-attainment of aquatic life use and scores of 42 or less, impairment.⁸ According to the Final EIS, 2008 MMI calculations below Windy Gap reservoir provided by the Subdistrict’s consultant scored the segment at 89 (Rees 2009). However, at a recent hearing before the Colorado Water Quality Control Commission, the Subdistrict’s consultant indicated that the 2008 MMI score at that site was 44.6 (Rees 2011)(attached as Attachment E). The 44.6 score below the reservoir (Rees 2011) is well below the MMI non-attainment threshold and just 2.4 points shy of MMI defined impairment.⁹ Moreover, when data reported in the Nehring Report was added, the MMI for the site scored 37.4, well below the aquatic life use impairment threshold.¹⁰ Thus, the MMI methodology confirms that aquatic life downstream of the reservoir has not only been *degraded*, it has actually been *impaired*.¹¹

Fish Data

The Final EIS further evaluates the condition of aquatic life downstream of Windy Gap Reservoir by looking at fish data collected over the last 10 years. The data for this period shows an average fish population of approximately 7,740 fish per mile. The Final EIS concludes that “[w]hile species composition and streamflow has changed substantially from pre settlement conditions, the trout populations in the Colorado River are very high and comparable to the best fisheries in the state.” *Final EIS at 3-207.* Again, BOR insists in assessing the health of aquatic life in the Colorado River by reference to outside conditions, rather than by looking at available

⁸ See *Methodology to Determine Use Attainment for Rivers and Streams Policy*, Policy Statement 10-1, Colorado Water Quality Control Commission, at p. 10.

⁹ Rees Memo (11/30/11), Exhibit 5 to the Subdistrict’s Rebuttal Statement (attached).

¹⁰ WQCD Rebuttal Statement – 303(d) List and Monitoring and Evaluation List December 2011 Reg. 93 RMH at p. 26 (attached as Attachment F).

¹¹ MMI measures aquatic life impairment based on macroinvertebrate, not fish counts. Thus, based on available information, including the MMI scores, it appears that, while trout numbers are still strong, their food source is in serious decline.

data showing local changes over a period of years. In so doing, the Final EIS fails to assess the extent to which aquatic life has been degraded or the extent to which it will be further degraded by increased WGFP depletions.

Fish data for the Colorado River downstream of Windy Gap reservoir spans at least back to 1981, before the construction of Windy Gap Reservoir. According to the CDPW:

“In 1981, the trout population in the Kemp-Breeze State Wildlife area near Parshall included 89 trout per acre longer than 14 inches. In 2007, the estimate for the same reach of the river was 21 trout per acre longer than 14 inches. This data supports the popular notion among the angling public that the quality fishing on this reach of the river has steadily declined since the construction of the Windy Gap project.”

Final EIS at F-193. More recent data collected by CDPW shows a dramatic decline in trout population over the last 10 years. According to CDPW, the reason for the decline remains uncertain (Ewert 2010) (attached).¹² In any event, fish data clearly shows that trout biomass has declined since the construction of Windy Gap Reservoir and is currently in a state of decline.

3. The Final EIS fails to provide information and analysis critical to assess the cumulative impacts of WGFP on aquatic life

A major criticism of the draft EIS, waged not only by Trout Unlimited but by EPA and others, is its failure to recognize the importance of variable flows to aquatic life and stream health. Impacts to aquatic life were evaluated in terms of changes to available summer habitat using IFIM and PHABSIM or River2D methodology. Other factors affecting aquatic life, such as changes in peak flows, were evaluated in terms of stream morphology impacts but their effect on aquatic life was left unaddressed. The Final EIS is an improvement over the draft EIS in that it acknowledges the importance of variable (base, peak, shoulder season) flows to the aquatic ecosystem and describes how they are connected. *Aquatic Resource Tech Report (2010); Miller Memo (2011).*

Unfortunately, while the importance of variable flows to preserve aquatic life is acknowledged, the Final EIS fails to properly evaluate how anticipated hydrological changes brought about by WGFP, the Moffat Project and other future events will affect the aquatic ecosystem of the Colorado River.

a. Effect of reduced peak flows on winter habitat availability not analyzed

Even with the questionable assumptions discussed above, the Final EIS admits that WGFP will reduce summer trout habitat by as much as 34% but dismisses the impact claiming that winter, not summer habitat is limiting trout fisheries. *Final EIS at ES-17.* The Final EIS also admits that, by scouring the stream, peak flows create refuge habitat that adult and juvenile fish use in the winter to hide from harsh winter conditions. *Miller Memo at p. 9.* In another display of bias, while dismissing WGFP impacts in the summer, the Final EIS entirely fails to evaluate the impacts WGFP’s anticipated peak flow reductions will have on the availability of what has been identified as critical winter habitat.

¹² The Final EIS speculates, without a shred of evidence or support, that the declines are due to higher flows since 2002.

b. Armored and embedded stream condition ignored

Healthy stream riffle areas, free of sediment and armoring, are three-dimensional ecosystems that support a wide variety of aquatic insects, particularly large stoneflies and many types of mayflies that thrive on, above, behind and beneath cobble boulder substrates. These same three-dimensional ecosystems provide critical over-wintering microhabitats for many life stages of fishes. When these riffle areas become embedded and/or armored, they become a simplified one-dimensional habitat where only the surface in contact with the water is available for occupancy. To put it in anthropogenic terms, it would be akin to forcing all of the people living in a multi-story apartment building to move to the roof of the building and living in total exposure to the elements. The result is a vastly simplified aquatic invertebrate community and a reduced carrying capacity for fish as well.

The Colorado River below Windy Gap reservoir shows signs of both embedding and armoring. *See e.g., Nehring Report; Grand County Streamflow Management Plan, Phase III Report, CR-4 Stream Reach Summary; observations of CDPW biologists, anglers and landowners on the River.* Embedding of the substrates occurs when flushing flows are insufficient to remove sediment and silt. The sediments settle and compact in and around cobble, boulder substrates in riffle areas that provide critical habitat to aquatic life. Armoring of the surfaces of cobble, boulder-dominated riffle areas can occur when the flow regime is modified to provide lower, stable flow regimes, sometimes even flat-lining the discharge hydrograph. Under this flow scenario, the surface of the riffle areas develop a surface film comprised of an amalgam of very fine sediment, filamentous algae and sessile diatoms. Without channel scouring flows of sufficient magnitude to move cobble boulder substrates, and literally “sand-blast” those large substrates, this surface amalgam grows thicker and stronger and harder over time.

Further reduction in the frequency and magnitude of peak flows are likely to exacerbate these degraded conditions, exposing the river’s aquatic life to further declines. This is particularly alarming when, as further discussed below, the frequency of flows large enough to move cobble boulder substrates or “sand-blast” those large substrates are expected to be significantly reduced once WGFP and the Moffat Project are on line.

As further discussed below, rather than focusing on this most impacted reach of the Colorado River and the flows needed to prevent these degraded conditions from worsening, the Final EIS looks at stream conditions 15 miles downstream of the impact zone to conclude that reduction of peak flows will not impact the river or its aquatic life.

c. Flushing flow needs miscalculated

The Final EIS acknowledges the critical role of flushing flows and the importance of quantifying them in order to assess WGFP impacts. Unfortunately, the Final EIS fails to provide an adequate quantification of flushing flow needs.

1981 assessment is dated and wrong

To assess flushing flow needs, the *draft* EIS relied on sediment transport studies and predicted flushing flow needs conducted in 1981 for the original Windy Gap Project (Ward and Eckhardt 1981). This approach was severely criticized because the data is old and stream conditions have

significantly changed. Indeed, since 1981, one of the largest sources of silt and sediment – Windy Gap reservoir – has come on line.

Perhaps the best evidence that Ward and Eckhardt’s 1981 flushing flow needs prediction was wrong is the state of the river downstream of the reservoir. The river’s armoring and embedding, discussed above, offer better evidence of the current, degraded condition of the river than any model can possibly offer.

More recent assessments fail to assess needs in the most impacted reach of the river

The Final EIS attempts to “verify” the 1981 sediment transport and flushing flow needs analysis based on current conditions. According to the Final EIS, Ward and Eckhardt’s assessment is confirmed by a “recent evaluation . . . of available stream flow versus shear stress data at the Colorado River Breeze station, a riffle site located downstream of the confluence with the Williams Fork (ERC 2009).” *Final EIS at 3-96*. The referenced ERC 2009 study has not been made available for public review. Therefore, meaningful comment is not possible at this time.¹³ ERC’s previous sediment transport modeling and analysis, relied upon in the Moffat Project draft EIS (ERC 2006), has been severely criticized due to the inadequacy of the model used, fundamentally flawed assumptions, and conclusions that defy reality. *See e.g., Comments of Dr. Brian Bledsoe, PhD, Colorado State University Professor (March 16, 2010) (attached as Attachment G); comments by Resource Engineering Inc. (Attachment E – Figure 8)*. Whether the fundamental deficiencies identified by Dr. Bledsoe and others have been resolved is unknown to us.

Regardless of its validity, the ERC 2009 sediment transport analysis, as described in the Final EIS, models flushing flow needs at a site located 15 miles downstream of the reach of the Colorado River most impacted by WGFP and the Moffat Project. As previously discussed in these comments, the Colorado River at the Breeze station benefits from the influx of low-sediment flows supplied by its tributary, the Williams Fork River. Fifteen miles upstream, conditions are dramatically different as heavy influx of sediment and silt from Windy Gap reservoir and reduced peak flows combine to armor the stream bed and create degraded habitat conditions. The study is entirely inadequate to assess the flushing flow needs of the reaches of the Colorado River most impacted by WGFP and the Moffat Project or to assess the extent to which their additional depletions will further impact its already degraded condition.

Available data indicates that higher flushing flows are needed

Current data and evidence of stream armoring, embedding and degradation confirms that the flushing flow for the Colorado River downstream of Windy Gap reservoir, as identified in the original Windy Gap EIS, is insufficient. Other sources of information indicate that higher flows are needed.

The Grand County SMP identifies flushing flows of “*at least 600 cfs for a 3-day duration with a frequency of 1 in 2 years during late May to late June period.*” (Tetrattech 2010, CR-4).

¹³ The study constitutes “significant new information relevant to environmental concerns and bearing on the proposed action or its impacts” developed since the Draft EIS. NEPA regulations require that such information be made available to the public for review and comment in the same manner as the draft EIS. *40 CFR 1502.9(4)*. BOR has failed to do so in violation of NEPA.

However, according to the SMP, these flows are the *minimum* necessary to initiate “spawning gravel mobilization.” They are not sufficient to move larger material, such as cobbles, which is essential to maintain habitat. Indeed, in a previous version, the SMP recommended a range of flushing flows of 600 cfs at the low end and bankfull (1,245 cfs) at the upper end. The most recent version of the plan removes that upper end as too restrictive. In this regard, the SMP states:

The 2008 Draft Report flushing flow recommendations were presented as a range of values with a minimum flow, based on sediment transport, and a maximum flow, based on bankfull capacity. This has been modified to eliminate the bankfull value so as to not imply there should be an upper limit on peak flows for the purposes of producing a flushing flow.

Grand County SMP, Executive Summary, at pp. 8-9. Completely disregarding this clarification, the Final EIS relies on the Grand County SMP to assert that 600 cfs is a more than adequate flushing flow. The assertion, as the above SMP references indicate, is incorrect.

Importantly, the Draft EIS originally used U.S. Forest Service methodology (Schmidt and Potyondy, 2004) to calculate a channel maintenance flow of 510 cfs. At the technical meeting with the Bureau on January 24, 2011, Resource Engineering, Inc. pointed out that the Bureau had incorrectly implemented the procedure by utilizing a study period that was already impacted by diversions. The methodology requires the use of un-impacted flows. Resource Engineering reported that utilizing a study period consistent with the U.S. Forest Service methodology produced a channel maintenance flow of 3,334 cfs. (*See Attachment E – Figure 7*). While the Final EIS still references the U.S. Forest Methodology, it no longer applies it. In fact, the results obtained by Resource Engineering are not even discussed. Instead, the Final EIS resorts to the 1981 analysis. Clearly, since the proper application of a methodology that BOR first embraced results in needed flows of over 3,000 cfs, it is alarming that the Final EIS would now completely ignore that information in order to conclude that a mere fraction of such flows is adequate.

Given the state of information, additional analysis should be conducted to understand the flushing flow needs of the Colorado River, particularly that section that stands to be most impacted by WGFP and the Moffat Project. Absent this information, the impacts of WGFP’s reduction of peak flows on stream health and aquatic life cannot be ascertained.

Channel maintenance flow needs are unknown

In addition to flushing flows, the Final EIS acknowledges the importance of “channel maintenance flows” to maintain a healthy stream ecosystem. *Final EIS at 3-91*. The Final EIS describes channel maintenance needs in terms of lower ranges with higher frequency (1.5 to 2 years) and higher ranges with lower frequencies (25-year event). *Id.* The Final EIS presents often conflicting data of channel maintenance needs in the Colorado River downstream of Windy Gap Reservoir. Given the state of information, additional analysis should be conducted to understand the channel maintenance flow needs of the Colorado River. Absent this information, the impacts of WGFP’s reduction of peak flows on stream health and aquatic life cannot be ascertained.

c. Impacts of “operational flexibility” of NISP unevaluated

In addition to WGFP, the Municipal Subdistrict is concurrently seeking approvals for its Northern Integrated Supply Project (NISP). NISP envisions using Colorado River water diverted through the C-BT and Windy Gap projects for an initial fill of the proposed Glade Reservoir. In addition to the one time fill, however, NISP contemplates the use of Colorado River water supplies, including Windy Gap water, to fill Glade Reservoir whenever the very junior and unreliable Poudre River sources for the project are not available. The draft EIS for NISP anticipates that these source may yield “several years in a row of divertible flow followed by as many as 8 years with no flow available. *NISP Draft EIS, section 2.4.1.3.*

Neither the cumulative impacts of the one-time initial fill nor the cumulative impacts of the proposed, routine fills to provide NISP participants “operational flexibility” are evaluated as a “reasonably foreseeable action” in the Final EIS. This is ironic as, unlike the Ralph Price Reservoir enlargement, assumed by BOR to be “reasonably foreseeable” and therefore used to inflate the impacts of the “no action” alternative, NISP is currently in the midst of permitting and “no insurmountable” legal obstacles for its construction have been identified. Given the foreseeable cumulative depletions of WGFP, NISP and the Moffat Project, these projects impacts must be considered together.

d. Possibility of non-linear, catastrophic responses ignored

As previously stated, a major concern with the proposed WGFP is the potential for non-linear, catastrophic aquatic life responses – “the tipping point” in lay parlance. Ecologists have long recognized that many ecosystems exhibit nonlinear behavior in response to human changes. A continued change in an independent variable (e.g., decline in stream flow) may not produce smooth changes in a response variable (e.g., fish productivity). Instead, if a threshold is crossed, the system may flip from one capable of supporting trout to one that cannot. The term “ecological resilience” has been used to describe the amount of disturbance required to propel the ecosystem across such threshold (Holling 1996).

Given the significant changes the affected portion of the Colorado River has been subjected to over the years and the fact that WGFP and the Moffat Project, combined, are expected to remove an additional 23 percent of the remaining 36 percent of its flows, a number of parties, including EPA, have expressed serious concerns about the potential for such responses. In this regard, EPA’s comments to the draft EIS state:

“[EPA] is concerned that further reductions to the existing hydrograph will reduce the resiliency of the system and place the system at much higher risk of threshold (non-linear) changes to the aquatic community . . . The EIS should assess the long-term cumulative impacts and uncertainty in the predicted responses. An additional component of a cumulative impacts analysis should address the potential for threshold responses.

Final EIS at F-241-2. The Final EIS does not discuss, much less contemplate the possibility of threshold (non-linear) responses. In its response to EPA’s comments, BOR simply indicates that “there is no indication that the river is at a critical threshold based on the data gathered for the existing conditions and the analysis of projected changes.” *Final EIS at F-241.* As previously shown in these comments, the Final EIS’s assumption that the aquatic ecosystem is healthy is unfounded. Alarming signs of degradation, including the loss of aquatic species

indicate that we may indeed be reaching that critical threshold. BOR's actions, including its persistent bias in data selection and willingness to draw conclusions in the absence of critical information are placing the Colorado River ecosystem in jeopardy in clear violation of Senate Document 80.

4. The Final EIS arbitrarily dismisses identified impacts

As discussed throughout these comments, the Final EIS makes arbitrary assumptions that over estimate future Colorado River flows and under estimate cumulative impacts to its aquatic life. Critical information needed to evaluate the impacts of WGFP is missing. Still, the Final EIS manages to identify a number of impacts. Unfortunately, the identified impacts are often expressed in statistical terms that minimize their gravity and then dismissed as not significant. Other times, the impacts are dismissed without much explanation. As a result, adequate measures to minimize the identified impacts are not proposed. The following is a non-exhaustive list of examples.

a. Significant loss of summer trout habitat disregarded

The Final EIS admits that WGFP will reduce summer habitat for trout in July and August of average and wet years. The greatest decrease in habitat would be in the segment between Windy Gap Reservoir and above the confluence with Williams Fork, where adult rainbow and brown trout habitat would decrease by 34 percent and 8 percent, respectively, in August of average years. *Final EIS at 3-322*. These are significant habitat losses, particularly for a system that has already been depleted and degraded, and is facing additional stresses brought about by climate change and increased stream temperatures. Yet, the Final EIS dismisses the losses, postulating that the real limiting factor is winter habitat availability. *Final EIS at 3-224*. The allegation that winter habitat is the limiting factor is speculative. Habitat curves relied upon in the Final EIS to evaluate fish habitat are based on *summer not winter* habitat. Fish have different needs depending on the time of year. Using summer habitat curves to draw conclusions regarding winter habitat limitations is unjustified and the resulting dismissal of clearly identified summer trout habitat impacts arbitrary.

b. Loss of sediment transport capacity dismissed

The Final EIS admits that “reductions in flow under all of the alternatives would decrease the sediment transport capacity of the stream below Windy Gap Reservoir.” *Final EIS at 3-96*. The Final EIS further admits that, under its own sediment transport analysis:

- 50 cfs are needed to mobilize fine sediments
- 200 cfs are needed to move fine gravel
- 400 cfs are needed to move medium gravel, and
- 850 cfs are needed to move coarse gravel.

Id. The Final EIS further admits that, under the Ward and Eckhardt 1981 study, flows ranging from 140 and 240 cfs are needed to move fine sediment. *Id.*

Using its own model calculations, the Final EIS predicts that the frequency of available flows in the Colorado River below Windy Gap will be reduced in all described categories as follows:

- Flows will be below 150 cfs 3.5 % more often. *Final EIS at 3-94.*
- Frequency of flows of 200 cfs will be **reduced by 25%** (from occurring 14 % of the time to 10.5 % of the time under WGFP conditions). *Id.*
- Frequency of flows of 500 cfs will be **reduced by 28.5 %** (from occurring 7 % of the time to 5 % of the time under WGFP conditions). *Id.*
- Frequency of 1000 cfs flows will be **reduced by 25 %** (from occurring 4 % of the time to 3 % of the time under WGFP conditions). *Final EIS at 7-253.*

This means that flows the Final EIS has determined are needed to move fine sediment (140 to 240 cfs under the Ward and Eckerdt 1981 model), coarse sediment (200 cfs), fine gravel (400 cfs) and coarse gravel (850 cfs) will be available **25 percent** less often than under existing conditions. This is indeed a significant reduction in frequency of available flushing flows, especially for a river where “channel armoring and chronic sedimentation” have already been identified as two of the most significant causes for the loss of aquatic species. (Nehring, 2011, p.79). The Final EIS concludes that these significant reductions will not impact aquatic life but fails to explain why. The conclusion is arbitrary and capricious.

c. Loss of channel maintenance flows dismissed

The Final EIS evaluates changes in the frequency of availability of channel maintenance flows due to WGFP using the following ranges:

- 510 to 1,240 cfs with a recurrence interval of 1.5 to 2 years
- 1,240 to 3,160 cfs with a recurrence interval of 2 to 5 years
- 3,160 to 4,600 cfs with a recurrence interval of 5 to 10 years
- 4,600 to 6,520 cfs with a recurrence interval of 10 to 25 years

Final EIS, Table 3-32 at 3-97. Based on its own modeled hydrology, the Final EIS predicts the following reductions in frequency of available channel maintenance flows for the above identified ranges as follows:

- **17.7 % reduction** in 1.5 to 2 year peak flows (from 62% to 51% of the time)
- **10.5 % reduction** in 2 to 5 year peak flows (from 38% to 34% of the time)
- **43.3 % reduction** in 5 to 10 year peak flows (from 30% to 17% of the time)
- **53.8 % reduction** in 10 to 25 year peak flows (from 13% to 6% of the time)

Final EIS, Table 3-32 at 3-97. These figures represent a very significant reduction in the frequency of peak flows even when looking at the very broad flow ranges evaluated in the Final EIS (i.e., 510 to 1,240 cfs, 1,240 to 3,160 cfs, etc.). The impacts of additional WGFP and Moffat diversions could be even more dramatic when looking at how much they will reduce peak flows *within* each range (e.g., reduction of flows of 500 cfs vs. 600 cfs vs. 1,240 cfs, etc.). This is particularly troublesome in the case of the 1.5 to 2 year peak flow, as the lower end of the range (i.e., 510 cfs) is even lower than the lowest channel maintenance flow need identified immediately downstream of Windy Gap Reservoir (765 cfs). Since the Final EIS does not identify reduction in the availability of peak flows in the low end, as opposed to the higher end of the range, the true dimension of WGFP impact is not really known.

In any event, the Final EIS identifies significant reductions in channel maintenance flows. Yet, it concludes that the reductions are insignificant without basis or explanation.

5. Mitigation measures proposed in the Final EIS are insufficient to enable BOR and the USACE to comply with their respective statutory duties

BOR's approval of the use of C-BT project facilities and special use permits for WGFP purposes is subject to Senate Document 80 and compliance with other federal and state laws. Under Senate Document 80, BOR cannot approve use of C-BT facilities in a manner that would negatively impact Grand Lake or the Colorado River scenic attractions and fishery. The USACE's may not issue a 404 permit that "causes or contributes" to "violations of any applicable State water quality standard" or to a "significant degradation of the waters of the United States." *40 C.F.R 230.10(b) and (c)*. In addition, the USACE is prohibited from issuing a 404 permit "unless appropriate and practicable steps have been taken which will minimize the potential adverse impacts of the discharge on the aquatic ecosystem. *40 C.F.R 230.10(c)*."

As these comments demonstrate, the Final EIS fails to provide sufficient information needed to assess the cumulative impacts of the WGFP on the Colorado River and its aquatic resources. Mitigation measures offered in the Final EIS fail to address identified impacts, much less provide relief from the uncertainty created by the absence of critical information. The following is a non-exclusive list of problems associated with proposed mitigation, together with specific, proposed measures to resolve them.

a. Reliance on the Fish and Wildlife Mitigation Plan (FWMP) misplaced

The Final EIS relies entirely on the FWMP to supply sufficient mitigation for WGFP's impacts on fish and wildlife in the Colorado River. No specific mitigation measures are proposed beyond those included in the FWMP. BOR's reliance on the FWMP is misplaced.

As acknowledged by the very Wildlife Commission and its legal counsel, the Commission's authority to impose mitigation measures on water projects is quite narrow. Most troublesome is the state's statutory prohibition against the Commission's imposition of mitigation measures that could have the effect of "impairing" WGFP water rights. *C.R.S. §33-1-120(3)*. A mitigation measure would be deemed to "impair" the Subdistrict's water rights if it requires the Subdistrict "to forego water to which they are entitled under a water right." *Id.* In other words, to the extent mitigation measures result in WGFP diverting one drop of water less than the 600 cfs the Subdistrict's water rights allow, state law prohibits the Commission from imposing them regardless of the consequences to fish and wildlife. For this reason, mitigation measures in the FWMP are not based on what is needed to preserve fish and wildlife, but on what the Municipal Subdistrict has been willing to agree to do.

Both BOR and USACE have statutory duties well beyond those imposed on the Wildlife Commission by state law and are not restricted by the restrictions imposed by those laws. The FWMP does not offer critical mitigation measures needed to enable the agencies to comply with federal law. Additional mitigation measures must, therefore, be adopted if WGFP is to move forward.

b. Reliance on “enhancement” promises misplaced

The Subdistrict has offered to undertake certain measures to help improve current degraded conditions in the Colorado River downstream of Windy Gap reservoir as reflected in the Fish and Wildlife Enhancement Plan. While potentially helpful, these measures are *expressly not* intended to mitigate the impacts of WGFP. Because they are not intended as mitigation, no significant evaluation has been made in the Final EIS to assess their effectiveness or helpfulness in ameliorating WGFP impacts. Most importantly, the Subdistrict is not responsible if they are not. Indeed, because the so-called “enhancement” measures are not *mitigation* and have not been proposed as terms and conditions of federal approval of WGFP, the Subdistrict is under no obligation to perform them under federal law. For these reasons, while “enhancement” measures, if implemented, may or may not help conditions in the river, they fail to provide enforceable measures to mitigate (i.e., avoid, minimize or mitigate) the impacts of WGFP.

c. Proposed mitigation allows violation of stream temperature standards

Acute temperature violations. The Final EIS proposes specific measures to prevent violation of state stream temperature standards. For *acute* stream temperature standards, the Final EIS requires reduction or curtailment of Windy Gap pumping whenever monitored stream temperatures are within 1°C of the state standards. However, the measure is suspended if “there is no material causal relationship between” project operations and the exceedence of acute standards. The measure is a good start, but has two fundamental problems. First, if placed upon the federal agencies, the burden of establishing causality would render the mitigation measure entirely ineffective. Moreover, the proviso is contrary to law. Under the CWA, restrictions must be placed on 404 discharges that “cause or contribute” to water quality violations. Second, a 1°C warning is unlikely to be sufficient to prevent the project from causing or contributing to the violation. A demonstration that it is sufficient has not been made.

Proposed solution: Eliminate the causal relationship caveat and require a determination of an adequate threshold to trigger pumping restrictions as part of monitoring and adaptive management.

Chronic temperature violations. To prevent the project’s contribution to *chronic* stream temperature standards violations, the Final EIS requires reduction or curtailment of *WGFP* pumping whenever the weekly average temperature (WAT) levels violate the chronic (MWAT) standard. The measure is subject to the same “causal relationship” restriction proposed for acute standard violations. In addition, pumping must be restricted or curtailed only to the extent the Municipal Subdistrict predicts that Granby will spill. The restriction is portrayed as making a distinction between original Windy Gap pumping and *WGFP* pumping. Such distinction is groundless. *WGFP* can pump at times other than when Granby is expected to spill. Moreover, approval of *WGFP*’s further degradation of degraded conditions created by the original Windy Gap project is prohibited under both Senate Document 80 and the CWA. The distinction is neither relevant nor administrable.

Proposed solution: Require restriction or curtailment of Windy Gap pumping whenever WAT measurements indicate that the MWAT is likely to be exceeded. Require a determination of an adequate threshold to trigger pumping restrictions as part of monitoring and adaptive management.

c. Proposed mitigation fails to adequately protect flushing and channel maintenance flows

The Final EIS proposes to increase current flushing flow requirements from the current 450 cfs to 600 cfs for 50 consecutive hours every three years. Windy Gap pumping will cease to allow higher flushing flows if Subdistrict water supplies in Chimney Hollow exceeds 60,000 acre-feet on April 1.

While an improvement from current restrictions, which are known to be inadequate, the proposed measures are insufficient to prevent further degradation of the aquatic ecosystem. First, even though the mitigation measure purports to follow recommendations of the Grand County SMP, it does not meet the frequency (once every two years) and length of time (three consecutive days or 72 hours) recommended under the plan for this minimum flow. Second, as further discussed in these comments, the Final EIS fails to provide an adequate analysis of flushing flow needs. Third, allowing flushing flows to occur only when Chimney Hollow is at 60,000 acre-feet puts the health of the Colorado River second to the desires and convenience of the Subdistrict and, in any event, is meaningless if its supply is to be relied upon to fill Glade Reservoir as part of NISP. Fourth, no restriction to ensure sufficient flows to maintain channel maintenance functions is provided.

Proposed solution: Determine flushing and channel maintenance needs prior to project operation as part of monitoring and adaptive management. Restrict or curtail Windy Gap pumping whenever flushing and channel maintenance needs are not met.

d. Proposed mitigation fails to address added impacts from Windy Gap reservoir

Windy Gap Reservoir has been identified as one of the primary sources of degradation of the Colorado River downstream of the reservoir (Nehring 2011). Increased pumping from WGFP and further reductions of peak flows due to WGFP and the Moffat Project are anticipated to cause or contribute to further degradation (Nehring 2011). Solving the problems caused by Windy Gap Reservoir is described as one of the critical measures needed in order for any new mitigation to be successful. (Nehring, 2011, p.79). Yet, the Final EIS does not analyze the issue and proposes no operational measures or limitations on the reservoir to deal with the problems.

Proposed solution: Develop and implement a bypass channel or similar modification to bypass river flows around Windy Gap Reservoir to be funded by the Subdistrict while allowing the reservoir to operate off-channel.

e. Proposed mitigation fails to address uncertainty associated with additional depletions, including potential for threshold (non-linear) responses

As described in these comments, the Final EIS fails to answer critical questions and provide critical information necessary to fully assess the impacts of WGFP. Both BOR (DOI) and USACE have agency guidance directing the use of monitoring and adaptive management in cases such as WGFP, when significant uncertainty regarding impacts and adequacy of

mitigation remains.¹⁴ Monitoring and adaptive management has been urged by experts as a means to address concerns over the resiliency of aquatic ecosystems.¹⁵

The Final EIS provides:

In the event that identified mitigation measures are unsuccessful in reducing or avoiding resource impacts as anticipated, Reclamation would coordinate with the Subdistrict and other appropriate entities to determine what steps should be taken to correct any deficiencies in planned mitigation or develop alternative methods to achieve mitigation objectives.

Final EIS at 3-399. While a good hint at a potential monitoring and adaptive management plan, the language does not provide sufficient detail to constitute an actual plan. An adequate monitoring and adaptive management plan must be developed, made available for meaningful public comment, and once approved, incorporated as a term and condition of BOR and the USACE's approvals, the carriage contract, and the 404 permit.

Proposed solution: Require the Subdistrict's development and implementation of a detailed monitoring and adaptive management plan for the express purpose of monitoring, preventing and responding to negative changes in the aquatic ecosystem of the Colorado River from the outlet of Granby Reservoir to Gore Canyon. The plan must be submitted for public comment and approved by BOR and USACE as a condition of any final approval or permitting of WGFP. The plan must include, at a minimum:

Monitoring Plan

- Monitoring necessary for the development of flushing flow and channel maintenance flow targets
- Biologic monitoring to evaluate changes in fish, aquatic invertebrate and aquatic plant populations
- Water temperature and stream flow gauging stations sufficient to monitor changes in water quality and water quantity in the Colorado River
- Sufficient stream transects to monitor and evaluate future changes in ecological condition associated with changes in channel maintenance and flushing flows

Adaptive Management

- Baseline of existing hydrological alterations before WGFP
- Baseline of existing ecological conditions (existing fishery and fish biomass, aquatic macroinvertebrate and channel geometry data)

¹⁴ See 43 CFR §46.145(DOI), 33 CFR Parts 325 and 332 (USACE) and 40 CFR Part 230 (USACE and EPA). A detailed monitoring and adaptive management plan was required by BOR and USACE as a condition to approval of the Southern Delivery System Project, another Colorado water project which involves significant less scientific uncertainty than the upper Colorado River.

¹⁵ National Research Council. "Executive Summary." *Adaptive Management for Water Resources Project Planning*. Washington, DC: The National Academies Press, 2004.

- Baselines to be developed over a period of at least 2 to 3 years; sampling frequency should be sufficient to gauge variability and sampling locations sufficient to identify potential impacts
- Establish key indicators of aquatic life and stream health (e.g., fish biomass) and threshold levels that reflect declines in aquatic life and stream health
- Requirement to implement actions to prevent further decline and restore aquatic life and stream health
- A process to inform and involve stakeholders in the monitoring and adaptive management process