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August 19, 2005

Gary Bardini, PE
Chief, Hydrology Branch
Department of Water Resources
P.O. Box 942836
Sacramento, CA 94236-0001

Subject: SFPUC Submission to DWR Request for Information Regarding Hetch Hetchy

Dear Mr. Bardini:

By a memorandum dated July 20, 2005, San Francisco Public Utilities Commission General Manager Susan Leal formally conveyed to you four "technical reports" for your use in preparing the Hetch Hetchy Restoration Study report on which the State has been working since last November. Environmental Defense respects the concerns that the San Francisco Public Utilities Commission (SFPUC) expresses in the memorandum and its attachments. The modifications in the San Francisco water and power system that would be occasioned by any plan to restore the Hetch Hetchy Valley are indeed very substantial and must be carefully evaluated and pursued based on the fullest information provided by all interested parties. We therefore welcome the SFPUC's engagement in the State's review.

We do believe, however, that the SFPUC and its consultants have raised matters that deserve response. Accordingly, Environmental Defense, in this letter, provides information supplemental to what we have already provided to the State in our report, Paradise Regained. We also would welcome the opportunity to meet with you and your staff to answer any questions you might have of us, either with respect to what we have said here or elsewhere or with respect to matters raised by the SFPUC submission on which you desire to hear additional response from Environmental Defense.

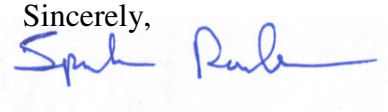
The SFPUC's covering memorandum begins with a section entitled "Cost to Taxpayers." It states that "the SFPUC's preliminary analysis indicates that the cost to restore Hetch Hetchy Valley and keep the San Francisco Bay Area whole would be, at minimum, $9 billion." Remarkably, no supporting documentation is provided for this assertion. We and others have asked for this documentation, but thus far it has not been forthcoming. This makes the assertion impossible for either the State or Environmental Defense to evaluate or critique.

The SFPUC also states that: "A 1987 Department of Energy review of a proposal to remove the O'Shaughnessy Dam estimated costs to exceed $6 billion." This is an incorrect reading of the 1987 DOE report in two important respects. First, the DOE report, relying on "estimates made by others, as reported in newspaper articles", cites a range of $2 to 6 billion, not a figure in excess of $6 billion (Report, p. 4). Second, DOE makes it clear that DOE is not vouching for these figures. The operative language in the DOE report states, "Some entities in the area have estimated the total replacement costs from $2 to 6 billion, but DOE can neither verify nor deny those figures (Report, p. 30)."

The remainder of the SFPUC's memorandum summarizes the four technical reports that it has submitted to you. In the remainder of our letter, we discuss these reports, beginning with the Camp, Dresser & McKee water quality review, followed by the Logan hydropower review, the MBK flood control assessment, and the Ellison, Schneider & Harris legal response.

Thank you for considering these additional materials in your review of potential solutions for restoring Hetch Hetchy Valley in Yosemite National Park.

Sincerely,



Spreck Rosekrans
Senior Analyst

Environmental Defense Response to

"Water Quality Review of Environmental Defense's 'Paradise Regained:
Solutions for Restoring Yosemite's Hetch Hetchy Valley'"
Camp, Dresser & McKee
May 2005

The first technical report submitted by the SFPUC, prepared by Camp Dresser & McKee, is entitled "Water Quality Review of Environmental Defense's 'Paradise Regained: Solutions for Restoring Yosemite's Hetch Hetchy Valley'" (May, 2005). At Environmental Defense's request, EOA, Inc. reviewed CDM's report. EOA's comments are included at attachment 1.[1]

While CDM's review identifies a number of water quality attributes that would enrich analysis of a given restoration scenario, neither EOA's original analysis nor CDM's review resolve the more germane question of the relative importance of various water quality constituents. How, for example, would a filtered Don Pedro water supply that resulted in lower levels of cryptosporidium and giardia , but higher levels of barium, chloride and TDS as asserted by CDM, compare to unfiltered supplies diverted directly from Hetch Hetchy Reservoir? Further vetting of this important question among independent and qualified experts would serve as a constructive next step in subsequent stages of study.

CDM asserts that Environmental Defense underestimated the costs of additional treatment, but provides no supporting data or independent estimates (section 4.2). We stand by the estimates for construction and operation of an expanded water treatment plant as presented in *Paradise Regained*.[2] These estimates are based upon recent experience of California water agencies. Environmental Defense would welcome additional data and independent review of water treatment costs.

While CDM extols the virtues of the high water quality present in the Tuolumne River supplies that are diverted from Hetch Hetchy Reservoir in Yosemite National Park, it barely acknowledges the fact that these supplies are blended with supplies from other sources. Approximately 15% of the SFPUC's current supplies are derived from local watersheds and are filtered, as are all Tuolumne supplies that are temporarily stored in Bay Area reservoirs. This proportion would increase if certain elements of the SFPUC's Water Supply Master Plan and Capital Improvement Program are pursued. Furthermore, while the SFPUC does not regularly use Delta supplies, it did purchase Delta water from the State drought water bank in 1991, and includes Delta supplies as an option in its Water Supply Master Plan (2000). And, of course, many of the SFPUC's wholesale customers blend their SFPUC supplies with supplies derived from the Delta, local groundwater and other sources. Given these realities, a more meaningful way to

[1] It is important to note that while EOA responds to comments made by CDM on the Executive Summary and Chapter 8 of *Paradise Regained*, these sections were written by Environmental Defense, and not by EOA. EOA was responsible solely for Appendix B of *Paradise Regained*. Environmental Defense is responsible for the main body of the report.

[2] Under separate cover we have submitted a memorandum from Bookman-Edmonston Inc. regarding the New York Water System Treatment Costs that were used as reference in Re-Assembling Hetch Hetchy, Sarah Null, 2003.

assess water quality implications of a restoration scenario would be to consider the quality of finished water, delivered to customers after blending and treatment has taken place.

Finally, it should be noted that Environmental Defense believes the SFPUC should continue its use of high quality Tuolumne River diversions, blended with local supplies, as its primary source of supply. As TREWSSIM model analysis has shown, use of an intertie to access supplies stored in either Don Pedro or Cherry Reservoirs could provide more than 95% of the supply currently available without use of Hetch Hetchy Reservoir and without adversely affecting the Turlock and Modesto Irrigation Districts. The source quality of the remaining 5% of total supply that would need to be acquired if a restoration scenario along the lines of the one presented in *Paradise Regained* is pursued is a parameter that would require additional consideration as choices are made among the several options.

EOA, Inc.

MEMORANDUM

To: Spreck Rosekrans
Environmental Defense

Date: August 10, 2005

Subject: Comments on CDMs Water Quality Review of Environmental Defense's "Paradise Regained: Solutions for Restoring Yosemite's Hetch Hetchy Valley"

The following are EOA's responses to CDM comments on the subject report. These responses are referenced to the Section numbering used in CDM's comment document. As a general statement, we believe that CDM's analysis contained a number of valid points (e.g,. the critical importance of watershed protection, the limitations of EOA's analysis, as freely acknowledged in Chapter 6 our report) as well as some errors, as indicated in our responses to specific comments below. Overall, we feel that CDM missed a basic point, which is that EOA examined a large amount of disparate (and in some cases incomplete) water quality data, and from that data drew reasonable, preliminary conclusions as to technical feasibility of maintaining a high quality water supply in the absence of the Hetch Hetchy Reservoir.

1. CDM Comments on ED Executive Summary

Section 1.1 CDM's assertion that "it is apparent that degradation of water quality is the inevitable result of ED's proposal" is not consistent with the quotation it addresses. The ED comment was "Any plan to restore Hetch Hetchy must assure Bay Area residents who drink Tuolumne River water that the quality of their water will not be diminished if it is stored and diverted further downstream". ED's comment clearly indicates that any plan to restore Hetch Hetchy Valley must assure that water quality will not be diminished. CDM's subsequent discussion in this section (p.2) is tangential this comment and editorial rather than germane to the quotation.

Section 1.2
CDM indicate that "The data used in the analysis is incomplete" and are specifically referring to TDS data from 1986 through 1992 from the Modesto Irrigation District (See page 11 of their comments). Section 6.1 of the EOA report specifically addresses the issue of data availability for this investigation. That section states that the planning level evaluation "is based on a compilation of the currently available data and information from all agencies that monitor the raw and treated source waters of interest. Based on the data summaries presented herein, it should be clear that in some cases, the available data were quite sparse and/or limited because many of the data were reported below detectable limits. Further, the analytical methods employed were not consistent between source waters for all constituents, and there was substantial variability among the analytical detection limits employed. Finally, data were only available for a representative, yet limited subset of all of the contaminants that may be of potential concern. "

CDM indicate in their comment that "TDS levels for SFPUC water normally range from 35 to 60 mg/L." The data presented in the water quality evaluation indicate means of 11 mg/L for Hetch Hetchy water, 31 for Don Pedro water, and 216 for Delta water. Although addition of these data that are between 10 and 20 years old may change the values reported in the water quality evaluation slightly, it is difficult to imagine how the overall findings of the "planning level evaluation of existing and potential future water quality" would have been changed by including the data in question.

Section 1.3
ED's basis for the term "or superior" is most likely rooted in the subsequent sentence, which states that "filtration should reduce the presence of giardia and cryptosporidium to levels lower than those present in the current system". If so, the statement should have been more carefully qualified (e.g., "superior with respect to some constituents"). EOA's overall conclusion is summarized later in this memo (Section 4).

Section 1.4
CDM indicate that filtration will be required if the SFPUC water system is operated without the use of the Hetch Hetchy reservoir and that implementation of technology is not without its own risks. It is agreed that careful consideration of treatment will be paramount. In fact, section 5 of the EOA report addresses potential appropriate water treatment technologies for the identified alternative strategies for operating the SFPUC water system without the Hetch Hetchy Reservoir. Nevertheless, it is important to consider the overall findings of the water quality evaluation within the context of CDM's comment. Those findings are as follows:

"From a screening level water quality perspective, there does not appear to be any technical reason that the SFPUC Hetch Hetchy water supply system could not be operated without the Hetch Hetchy Reservoir provided that adequate water treatment facilities were put in place and operated to meet state and federal drinking water regulations. If such an operational strategy were to be pursued, future engineering and health effects investigations would be needed to optimize water quality and treatment issues. Further, in a restored Hetch Hetchy Valley watershed practices would have to be developed, implemented and enforced to minimize the potential contamination of source waters associated with increased human and animal presence.

The analysis presented herein is as comprehensive as possible given the available information and data. Nevertheless, it should be clear that there are limitations to this type of evaluation, primarily those associated with limitations of the existing data. Further, it cannot be overemphasized that the financial, water supply, and political ramifications of operating the SFPUC water system without the Hetch Hetchy Reservoir are beyond the scope of this planning level water quality evaluation."

CDM's comments in section 1.4 are consistent with those outlined above and in the water quality evaluation.

Section 1.5
CDM agree that perception is important and notes that the degree of mineralization is important to industrial users. It is agreed that industrial users needs will need to be carefully considered. It

is recommended that these considerations be included in "future engineering and health effects investigations".

Section 1.6
CDM note that filtration would require the addition of new chemicals. It is recommended that these considerations be included in "future engineering and health effects investigations".

Section 1.7
In this section, CDM indicate that "water quality parameters may come close to matching current quality following conventional treatment with advanced disinfection, depending on how close is defined". This assertion is in agreement with the finding of the screening level analysis. CDM then postulates that the mixture of THMs in waters comprised of Delta water will be of greater toxicological significance than the current supply, and intimate that this will be true regardless of treatment.

Speculating on the potential mixture of DBPs in future finished waters was beyond the scope of the screening level water quality analysis. However, the issue of disinfection by-product formation was specifically addressed in the EOA report in section 6.2.2, as follows: "The extent to which THMs actually form during the water treatment process depends on a number of factors, including the removal of natural organic matter and type of treatment and disinfection employed. One reason for using chloramine disinfection rather than free chlorine disinfection is to reduce the potential for disinfection by-product formation (THMs are disinfection by-products).

Without monitoring data or more detailed analysis than was available for this study, it is difficult to know what the levels of THMs would be in Delta water after treatment. However, it should be clear that the TTHM formation potential of blended raw waters will vary with the proportion of Delta water making up that blend. It is also clear that treatment processes for Delta water would need to specifically address the higher THM potential of this raw water source. Thus in Section 5.3, the specified technology for (separate) treatment of Delta water includes enhanced coagulation (for reduction of TOC, a THM precursor), preoxidation with ozone, and use of chloramine for secondary disinfection." Protection of public health is paramount, and thus this issue should be included in future health effects investigations.

Section 1.8
CDM indicate that it may be necessary to include ozone or UV as part of the costs for a new filtration plant because of regulations that may be promulgated in the near future. The comment refers to the likely promulgation of the Long Term 2 Enhanced Surface Water Treatment Rule which will require unfiltered systems (such as SFPUC's Hetch Hetchy System) to add advanced disinfection. It should however be noted that filtered systems are addressed separately from unfiltered systems in that proposed rule. Implications for both filtered and unfiltered systems should be considered as this project moves forward.

Section 1.9
CDM indicate that source protection continues to be the first and most reliable means of protecting public health, not technology. In general this comment is reasonable, however two

items need clarity: 1) CDM indicate that "over-optimism about the capabilities of new technology should be tempered". This statement seems overly pedantic in response to the statement that "It is possible that new water filtration methods will soon cost-effectively provide even cleaner water than is projected using existing technology": and 2) While it is true that source protection continues to be the first and most reliable means of protecting public health, it should be noted that safe drinking water for millions of Californians currently comes form the Delta, and the water quality evaluation states that "watershed practices would have to be developed, implemented and enforced to minimize the potential contamination of source waters associated with increased human and animal presence."

Section 1.10
CDM indicate that it is unlikely that EPA will require the City to filter its supply in the future. Although we are unaware of any pending EPA actions to require unfiltered supplies to add filtration, EPA is extremely concerned about the potential health implications of disinfectant resistant parasites such as *Cryptosporidium* and *Giardia* in drinking water. Filtration is one means by which the concentration of these parasites can be reduced in drinking water.

Ingestion of viable *Giardia* cysts or C*ryptosporidium* oocysts in sufficient quantities can cause acute gastrointestinal illness. However, adverse health effects from ingestion of *Cryptosporidium* may be more severe for sensitive subpopulations (e.g., infants, AIDS patients, the elderly) and may even include the risk of death. Given that *Cryptosporidium* has been detected (albeit in low levels) in Hetch Hetchy treated water (see section 6.2.6 of EOA's report), the potential presence of parasites in finished drinking water should be of particular concern to SFPUC and the potential benefits of filtration should not be dismissed lightly.

2. CDM Comments on Section 8: Water Quality Analysis

Section 2.1
CDM agree with the quotation.

Section 2.2
CDM indicate that there are other filtration exemptions in the US which serve a combined population of approximately 15 million people. There are roughly 272.5 million people in the United States served by public water systems that supply treated surface water to their customers. Of those 272.5 million people, the vast majority are served by filtered surface waters, with the exception of those noted by CDM in addition to those served by unfiltered SFPUC water. Given this information, it seems a fair characterization that filtration exemptions are relatively rare.

Section 2.3
CDM indicate that industrial users could be adversely impacted by a change in source water. This is a good point and is worthy of consideration in "future engineering …investigations (that) would be needed to optimize water quality and treatment issues".

Section 2.4

CDM indicates that the term "minor" is vague and does not adequately capture the subtleties of the health risk associated with certain contaminants. They then cite an example indicating that an arsenic concentration of 0.2 and 2.0 ug/L are very different from a health risk perspective. This critique is misplaced for a summary of a screening level investigation of water quality. As noted above, the intention of the investigation was to understand the potential water quality issues associated with restoring Hetch Hetchy Valley, and to carry out a planning level evaluation of existing and potential future water quality, both with and without the Hetch Hetchy Reservoir. Relative comparisons of mean values as reported in the EOA report are appropriate for this type of analysis, and a general summary of overall findings as reported in Section 8 of the ED report is also appropriate for a less technically minded audience.

The cited arsenic example is misleading because the example is not germane to data presented in the report. Arsenic concentrations are similar in three of the four source waters (at ~2ug/L) and were primarily below detectable limits in the Hetch Hetchy water where a higher detection limit was used (Refer to Table 2.12 a in EOA's report). Arsenic concentrations are discussed in more detail in section 6.2.5 of the EOA report. None of the waters had mean concentrations of 0.2ug/L.

Section 2.5

CDM indicate that the potential for contamination grows as water progresses from Hetch Hetchy to Don Pedro and then through the Delta and that this is more important than bacterial indicator or pathogen monitoring data. For the purposes of the screening level analysis, it was felt that use of monitoring data was more transparent than a qualitative evaluation of vulnerability. It is agreed that a watershed's degree of vulnerability is important. This topic should be addressed in future water quality investigations.

CDM also indicate that *E. Coli* is a more reliable indicator for determining vulnerability than *Cryptosporidium* or *Giardia*. Inspection of Table 2.13 in the EOA report clearly indicates that *E. Coli* data were not available for all source water and thus a direct comparison of E. Coli concentrations could not be made. Additional *E. Coli* data are not needed however to draw general conclusions about relative *E. Coli* concentrations, as the fecal coliform data indicate the same finding (*E. Coli* is a subset of fecal coliform and typically comprises ~90% of fecal coliforms in ambient waters). Nevertheless, this point does not impact the findings of the report substantially.

Sections 2.6 and 2.7

Comments regarding MTBE, barium, arsenic, and THMS.

MTBE: CDM indicate that the presence of MTBE show vulnerability to contamination associated with recreation, and that gasoline, benzene, and toluene have been detected in Don Pedro, whereas Hetch Hetchy has no known sources of these contaminants. It is noted in EOA's report that the concentrations of MTBE are likely to decrease over time because of the new state regulations regarding this additive. Although the list of contaminants of potential concern was developed collaboration with SFPUC staff, critically reviewed and prioritized for this investigation based on the availability of monitoring data and the known public health concern, data for gasoline, benzene, and toluene were not explicitly considered in the screening level

analysis. Evaluation of the potential impacts of these contaminants in future studies would be a reasonable addition.

Barium: CDM have interpreted the barium data in Table 2.12a correctly. It is also important, as CDM notes that the levels in Delta water are well below the proposed PHG value.

Arsenic: CDM indicate that arsenic is a primary concern and states that arsenic is not detected in Hetch Hetchy water and is detected in Delta is water at levels equivalent to a 5 in 10,000 theoretical cancer risk. It is agreed that arsenic is an important constituent in raw waters, however the statement regarding risk is misleading. The results of the arsenic monitoring used in the water quality evaluation are discussed in detail in section 6.2.5 of the EOA report. That discussion reveals "close inspection of Tables 2.3, 2.4, 2.5, 2.7, 2.8, and 2.9 indicates that there may be slight differences in the concentrations of arsenic in the source waters considered in this analysis.

Hetch Hetchy raw water was analyzed 11 times for arsenic and the results were always below detectable levels. The detection limit ranged from 1 to 20 µg/L. Don Pedro water was analyzed 6 times for arsenic, and 5 of those observations were below the detectable limit of 2 µg/L. The other observation was reported at the detection limit (2 µg/L). South Bay aqueduct water (Delta water) was analyzed 6 times for arsenic, and all observations were reported above the detection limit. The average concentration of arsenic in these samples was 5 µg/L with a maximum reported value of 13 µg/L. California aqueduct water (Delta water – Banks pumping station) was analyzed 109 times for arsenic, with 108 observations reported above the detection limit, with a maximum concentration of 3 µg/L. The average concentration of arsenic in these samples was 2 µg/L. Calaveras Reservoir water (local water) was analyzed 9 times for arsenic and 6 of the observations were below detectable levels, with a maximum concentration of 3 µg/L".

Given those data, a true quantitative comparison of the arsenic levels in the various source waters was not possible. It is for this reason that arsenic was not included in the water quality comparison in Chapter 3 of the EOA report.[1] With respect to arsenic in source water, the water quality evaluation concludes "the potential for arsenic contamination should be considered carefully in any water supply strategy that may be used in the future for the SFPUC system."

THMs: CDM indicate that other DBPs and individual species of each DBP class are also important. Again "This planning level water quality evaluation is based on available data and information". Data on individual species of DBPs were not available for this screening level study, however evaluation of other DBPS would be appropriate for future health effects investigations. A discussion of THMs is presented in the EOA report in section 6.2.2 and discussed above in section 1.7.

[1] Arsenic was not carried forward from Table 2.12a to Table 2.13, which contained the parameters analyzed in subsequent sections. This did not conform strictly with the procedure described in Section 2.8.8 of EOA's report, but was done because the varying detection limits precluded a meaningful comparison of data from the various sources.

3. CDM Comments on Appendix B: Water Quality Evaluation for Hetch Hetchy Alternatives

Section 3.1 Data considered

a. CDM indicate that additional TDS data could have been reviewed. Refer to the comments above to Section 1.2.

b. CDM indicate that haloacetic acids, haloacetonitriles, and halonitromethanes should have been evaluated. Review of the EOA report will indicate that these constituents were identified as constituents of potential concern. However, data for these constituents were not available to EOA for this analysis for source waters. EOA agrees that DBPs are important contaminants in drinking water and suggest that to the extent possible these be considered in future health effects studies evaluating a restored Hetch Hetchy Valley.

Section 3.2 Quality of information

a. CDM indicate that the "Lack of analysis of seasonal and hydrological water quality differences biases the comparison of sources". CDM refers to TDS values presented in Tables 2.12 and 2.13, and argues that the comparison between Alameda East (27 mg/L) and Delta water (216mg/L) does not capture the variabilities associated with each of the waters.

This comment is misleading and inaccurate. The data presented in Tables 2.12 and 2.13 are summaries of data that presented previously in the report. Table 2.12 also clearly indicates which of the waters represent treated waters (including Alameda East) and which are raw waters (including Delta water). A more comprehensive data summary for Alameda East data is presented previously in the report in Table 2.10 which shows average concentrations as well as standard deviations (a measure of variability) for the list of monitored constituents. Similarly, more comprehensive data summaries for Delta water are presented in Tables 2.7 and 2.8. These tables also show average concentrations and standard deviations. Inspection of these tables clearly indicate that the variability associated with TDS in Delta water is greater than that associated with Alameda East Water. The exclusion of standard deviations in Tables 2.12 and 2.13 for the purposes of clarity does not bias the comparison of sources.

b. CDM claim that "The assumption that in cases where the majority of observed data was below detectable limits for all water sources, the concentrations of the constituent in all waters is equivalent not only does not focus the evaluation on detected contaminants (as claimed), but it may actually focuses undue attention on undetected contaminants".

It is difficult to understand the logic behind this statement. The water quality evaluation was to identify potential water quality issues associated with restoring Hetch Hetchy Valley. If all observations for a particular constituent were reported below detectable limits, there is quantitatively very little that can be said. This approach is clearly shown in Tables 2.12 and 2.13 in the EOA report. Inspection of Table 2.12 indicates that many constituents were below detectable limits much of the time. Table 2.13 shows those constituents which were detected. It is difficult to understand how Table 2.13 (which is the basis for the analysis presented in Chapter 3) "actually focuses undue attention on undetected contaminants".

c. CDM state "On page 29 of Appendix B, it is stated that MTBE concentrations in Hetch Hetchy are similar to that in the Delta. This statement is both outright wrong and misleading. It is a consequence of ignoring the vast difference in vulnerability of the sources and treating all non-detects the same... This incorrect conclusion is drawn simply because the source vulnerability is not considered and is further dampened by considering non-detects to be present at the method limit"

CDM's statement is incorrect and the subsequent arguments are spurious. Page 29 of the report clearly states "MTBE concentrations in the Hetch Hetchy raw water is similar to the local supply and lower than either Don Pedro or the Delta". (Note that local supply refers to Calaveras Reservoir water).

d. CDM state that the statement that the "predicted water quality shown in Table 3.2 is based on available data as described previously, and that constituents that were reported to be principally below detectable limits in all water are not shown" at the top of page 34 is untrue.

CDM is again incorrect. Inspection of Table 3.2 will reveal that all constituents listed are those that are shown in Table 2.13. Table 2.13 presents a summary of the average concentrations of detectable constituents in raw source waters and treated waters in the SFPUC water supply system. As defined in the report, only constituents that were detected in at least one of the source waters are listed.

d. CDM state that "In addition to the inaccurate calculations (those listed above) inconsistent method detection limits are used to calculate standard deviations for contaminants that were never detected." CDM then uses arsenic as an example of how the calculations were inaccurate and states that "These different detection limits are then averaged together to derive the weighted average arsenic concentrations for SFPUC sources… Other potentially more reasonable approaches to estimating the occurrence of undetected contaminants include treating non-detects at ½, ¼ or 0 of the detection limit, and using information about chemical use in a given watershed to guide the expectation of occurrence."

CDM's interpretation is incorrect. The results of the arsenic monitoring are discussed in section 6.2.5 of the EOA report and summarized above in the response to sections 2.6 and 2.7. The arsenic datasets included data points with different detection limits. The reported detection limits were used in the calculations unaltered, consistently and correctly.

Regarding the suggestion to treat non-detects at some fraction of the detection limit, it is noted that there are a number statistical methods for handling data below detectable limits. One limitation of many of those methods is that uncertainty increases with the proportion of data below detectable limits. However, multiplying the detection limit by an arbitrary factor (such as ¼) has no theoretical justification. Further, use of qualitative or subjective information to "guide the expectation of occurrence" is not consistent with traditional approaches to data analysis and could be interpreted as biased.

e. CDM note that the alkalinity data shown in Table 2.10 seems inconsistent. It is agreed that there does seem to be some discrepancy. These data were supplied by SFPUC for the specific purpose of this analysis. Reexamination of these data would be appropriate as this project moves forward.

f. CDM indicate that the TOC and microbial data employed for Don Pedro supply is incorrect. CDM further reports an average of 1.6 mg/l based on 49 samples from MID. As noted in section 6.2.4 of the EOA report, CDM is correct that the TOC data for Don Pedro reservoir shown in Table 2.13 is based on a single sample. During the initial stages of the water quality investigation, multiple attempts were made to obtain additional data from MID. These attempts were unsuccessful. Section 6.2.4 of the EOA report indicated that "If the potential restoration of Hetch Hetchy Valley is to move forward beyond the planning level stage, the TOC of Don Pedro water will need to be characterized more comprehensively". These new data cited by CDM provide information about TOC in Don Pedro. In that regard it is noteworthy that the average TOC concentration in Hetch Hetchy (1.4mg/L) is similar to these new results for Don Pedro (1.6 mg/L).

g. CDM indicate that "ED significantly underestimates microbial contamination in Modesto Reservoir, particularly for total coliform". Recent coliform data obtained from MID reveals total and fecal coliform values of 15 and 5 MPN, respectively for Modesto Reservoir. (Note that data from both Don Pedro and Modesto Reservoirs are used to represent the water quality in Don Pedro reservoir, as described in section 2.1 of the EOA report).

This statement is incorrect and these new data are very consistent with those used in the analysis. Table 2.12b indicates that "Don Pedro SFPUC coliform data was used to calculate average values for Don Pedro Supply". Review of Tables 2.12b and 2.13 indicate that the data used to characterize the total and fecal coliform levels in Don Pedro were 13 and 2 MPN, respectively. These values are very similar to those described above by CDM (15 and 5 MPN, respectively).

Section 3.3 Gaps in the Analysis

CDM contend that "In focusing the analysis on specific water quality parameters for which there is data, the vulnerability of sources is not considered". Further, CDM indicate that by not considering source vulnerability, and confining the analysis to parameters for which there is readily available data, emerging issues were not even qualitatively considered. CDM indicate that emerging issues include but are not limited to NDMA, brominated compounds, pharmaceuticals, algal toxins, pesticides and herbicides, and tastes and odors.

The purpose of the analysis was to understand the potential water quality issues associated with restoring Hetch Hetchy Valley. To facilitate this understanding, a planning level evaluation of existing and potential future water quality, both with and without the Hetch Hetchy Reservoir was undertaken. The approach was to use existing data and information in a logical, consistent, and transparent manner. Use of subjective or qualitative information was not included in the analysis to minimize biasing the results, to the extent possible. This approach is particularly applicable for this type of study, as it is not possible to estimate or predict concentrations of particular constituents that were not monitored. There are a number of limitations to this

approach, the most salient of which are discussed in section 6.1 of the EOA report. The results of this screening level investigation provide a concise summary of the relative water qualities of the potential future raw source waters and a framework from which insights may be drawn with respect to potential water quality issues associated with operating the SFPUC water system without the Hetch Hetchy Reservoir. In many cases the water quality evaluation indicates that if the potential restoration of Hetch Hetchy Valley is to move forward beyond the planning level stage, detailed engineering and health impact studies would be prudent and warranted. It is also acknowledged in section 6.1 of the EOA report that there are chemicals that are known or thought to cause adverse human health impacts in extremely low levels, and consideration must be given to the possibility that one or more of the source waters contain contaminants of concern that were not monitored.

EOA agrees that emerging issues may be important and could have an impact on whether to proceed with restoring Hetch Hetchy Valley. Such issues would best be addressed in future studies as noted above. The principal conclusion of the report was that from a screening level water quality perspective, there does not appear to be any technical reason that the SFPUC Hetch Hetchy water supply system could not be operated without the Hetch Hetchy Reservoir provided that adequate water treatment facilities were put in place and operated to meet state and federal drinking water regulations. None of the comments in Section 3.3 would substantially change this finding.

CDM's statement that "it is misleading to compare Hetch Hetchy treated water to projected raw water quality of other scenarios" is unfounded. This comment appears to be directed at Tables 2.12a, 2.12b, and 2.13 of EOA's report, which summarize available data for existing raw and treated supplies, and clearly distinguish between the two. EOA's analysis did not project numeric water quality concentrations in finished water for specific treatment alternatives, but did indicate in general terms how these would differ, e.g,. Section 5.3 "The TDS concentration would increase to over 100 mg/L in the finished water" (under the Maximizing Delta Diversion scenario). EOA agrees that projections for finished water quality concentrations that take into account "pick-up" during treatment would be an appropriate component of a more detailed engineering analysis that will need to be done after the specific treatment processes are identified.

CDM's comments on E. Coli were responded to previously (refer to section 2.5)

4. CDM Response to Conclusions drawn by EOA

The conclusions drawn in section 8 of the report are made by Environmental Defense, not EOA. EOA's conclusion which was reviewed by Drs. Cooper and Tchobanoglous are found on page 59 of Appendix B and are as follows:

> Based on the results presented herein, from a screening level water quality perspective, there does not appear to be any technical reason that the SFPUC Hetch Hetchy water supply system could not be operated without the Hetch Hetchy Reservoir provided that adequate water treatment facilities were put in place and operated to meet state and federal drinking water regulations. If such an operational strategy were to be pursued,

engineering and health effects investigations would be needed to optimize water quality and treatment issues. Further, in a restored Hetch Hetchy Valley watershed practices would have to be developed, implemented and enforced to minimize the potential contamination of source waters associated with increased human and animal presence.

Section 4.1
CDM indicate that quality differences between Hetch Hetchy and other water underestimates the significance of source vulnerability as well as the significance of the extremely low TDS and its consequence for municipal and industrial users. Comments on the screening level analysis methodology has been addressed above.

Section 4.2
CDM indicate that costs are likely to be higher than projected for a direct filtration plant and that E. Coli is higher in the Delta than in Hetch Hetchy water.

EOA's conclusion that "upstream" sources could treated by direct filtration was based on the low levels of turbidity and TOC observed in the data available for review by EOA. Actual treatment requirements would need to be determined as a result of detailed treatability studies, such as those that CDM has conducted for SFPUC in the past. Cost estimates for treatment were developed for ED by Schlumberger Water Services, as described in Appendix A and Chapter 10 of the ED report. Projected treatment costs (capital plus operating) varied widely depending on the specific water source and other assumptions associated with each scenario that was evaluated.

CDM is correct that the bacterial indicator levels are higher in the Delta than in Hetch Hetchy water. Table 2.12b in EOA's report clearly illustrates this point.

Section 4.3
a. CDM indicates that the MTBE analysis is colored by a risk discounting principal. The text in question is provided below:

> "MTBE concentrations in the Don Pedro Reservoir source water are of greater concern. The MTBE data are sparse and are limited by varying detection limits. An examination of Table 2.5 indicates one detectable result out of three raw water samples for Don Pedro Reservoir, whereas Hetch Hetchy raw water samples (11 observations) and Calaveras Reservoir raw water samples (7 observations) were all below detectable levels. It is reasonable to assume that the specified process (direct filtration) would not remove MTBE. Any detectable level of MTBE in the finished water, even below California Department of Health Services (DHS) drinking water standards, may be deemed unacceptable and require additional treatment for the water quality to be deemed equivalent. Possible additional treatment methods for MTBE removal in drinking water depending on the chemical matrix of the water include air stripping, granular activated carbon, and advanced oxidation (e.g. H_2O_2/ozone or H_2O_2/UV). The latter methods could be complimentary to other treatment objectives (e.g. pre-oxidation and cryptosporidium inactivation). However, based on a single detectable result in the Don Pedro water, it would be premature to conclude that treatment for MTBE removal would be required.

MTBE levels in Don Pedro Reservoir are likely to decline in the future as the result of California's phase-out of MTBE in the fuel supply."

Review of this text indicates a cautious tone (refer to underlined portions). In this regard it appears CDMs remarks are overly critical.

b. CDM indicate that the limitations of the analysis beg broader questions. Specifically CDM discuss NDMA, vulnerability and variability in source water concentrations in this regard. These same limitations were introduced in section 6.1 ("Limitations of the Water Quality Evaluation") of EOA's report. The analysis presented in the report are as comprehensive as possible given the available information and data. If SFPUC were to operate their water system in the future without the use of the Hetch Hetchy reservoir, engineering and health effects investigations would be needed to optimize water quality and treatment issues. It would be appropriate to consider addressing the broader questions raised by CDM in such studies.

c. CDM pose two questions: 1) Will a change in water source have a negative impact on public, and 2) would degradation of the water supply outweigh benefits that Bay Area customers and the environment enjoy by virtue of Hetch Hetchy? Both are interesting are relevant however both are beyond the scope of the screening level water quality evaluation. Clearly, answers to both questions will be needed before a final decision could be made on whether to operate the SFPUC water system without the Hetch Hetchy Reservoir. In the near term, the answer provided by the water quality evaluation that "there does not appear to be any technical reason that the SFPUC Hetch Hetchy water supply system could not be operated without the Hetch Hetchy Reservoir provided that adequate water treatment facilities were put in place and operated to meet state and federal drinking water regulations" should be of use to determine if the proposal warrants further consideration.

Environmental Defense Response to

"Review of Environmental Defense's Estimates of the Cost to Replace Lost Hydropower"

Robert F. Logan

June 22, 2005

The second technical report submitted by the SFPUC, prepared by Robert F. Logan, is entitled "Review of Environmental Defense's Estimates of the Costs to Replace Lost Hydropower" (June 22, 2005).

In Chapter 9 of *Paradise Regained* we presented an estimate of the losses in hydroelectric generation that would result from decommissioning O'Shaughnessy Dam along with a survey of the availability, cost and environmental impacts of potential replacement energy sources. Our analysis was based on results from the TREWSSIM model, publicly available data, and discussions with SFPUC staff about hydropower operations and the constraints imposed on them by the system's primary water supply function. We stressed the preliminary nature of this analysis, identifying data requirements and a series of questions that should be addressed in the more complete evaluation that would be needed to support development of a workable plan to restore Hetch Hetchy Valley.

The Logan Memorandum helps to clarify some of these questions and raises others that should also be considered. These are noted in the discussion that follows. Unfortunately the memorandum contains several inconsistencies and the memorandum also mischaracterizes, misinterprets or draws mistaken inferences from *Paradise Regained.* Our comments follow the organization of the Logan Memorandum.

Power Lost

The Logan Memorandum does not comment on our estimates of lost hydropower production.

New Power Uses

The Logan Memorandum correctly observes that *Paradise Regained* does not present explicit estimates of the average annual energy needed to pump and filter water. Our analysis does, however, factor in these costs. The Logan Memorandum notes the calculation of pumping costs in Appendix A, but apparently overlooks the discussion of variable water treatment costs in Chapter 8. The variable cost estimates shown in Table 8-2 include the cost of energy as well as other associated costs. We agree that costs of scheduling, firming and wheeling power should be added to our estimates of pumping costs. We also note that the Logan Memorandum's calculation of the average capacity needed for pumping assumes that pumping would occur around the clock and throughout the year: his assumption is consistent with our approach of using an estimate of the long run cost of base load power to calculate electricity costs for pumping.

New Capacity Needs

The Logan Memorandum incorrectly states that "ED does not address the need to meet peak demand." In fact, the impact of decommissioning O'Shaughnessy Dam on the SFPUC's dependable hydroelectric capacity—including the SFPUC's ability to meet peak demand—is discussed on pp. 72-74. Our focus in *Paradise Regained* was to characterize the resources that would be lost and identify potential replacements. We also identified new energy needs that would result from restoration. We did not examine the broader question of how the SFPUC (or the Districts) should plan to meet their peak loads going forward, although we did clearly state on p. 85 that more thorough analysis—based upon more detailed data than was accessible to us-- is needed to develop a robust plan to replace lost hydropower.

We agree that the cost of reserve capacity, scheduling and wheeling, as well as CAISO fees, should be examined further. We note however, that only *incremental* costs should be considered. Many of the costs that the Logan Memorandum contends we have omitted are in fact already being incurred by the SFPUC, the Districts and the SFPUC's wholesale electricity customers in conjunction with their current use of Tuolumne River hydropower. The relevant question, which should be given full consideration in subsequent analysis, is how these costs would change as a result of substituting alternative resources for hydropower lost as a result of restoration.

Peaking Capacity Lost

The Logan Memorandum overstates capacity losses because it is apparently based upon the assumption that the SFPUC is able to operate Kirkwood powerhouse as a peaking resource. As noted on p. 69, our analysis assumes that water supply operations and other considerations would continue to constrain the SFPUC's ability to dispatch its Tuolumne River powerhouses. SFPUC staff informed us that while they have limited ability to shape generation with Moccasin powerhouse, Kirkwood is restricted to base-load operation.

Our analysis of Moccasin powerhouse assumes that the SFPUC has full discretion over its dispatch. The Logan Memorandum apparently accepts the results of this analysis, which focuses on the hours Moccasin would be available to operate at rated capacity during adverse hydro conditions. However, we believe that the Logan Memorandum errs in also applying this criterion to Kirkwood. For a base-load facility, which cannot be freely dispatched, the average hourly rate of energy production during adverse hydro conditions is a more meaningful measure of how much capacity it can provide during peak periods. Based upon this more appropriate criterion, the capacity loss for Kirkwood ranges from 20-40 MW (p. 74), well below the figure the Logan Memorandum derives from Table 9-3.

We agree that more thorough analysis is needed to identify the optimal mix of resources that can replace the peaking capacity of Moccasin powerhouse. Firming and/or capacity costs should be factored into this analysis. We note, however, that our analysis does show that on average only about 5% of replacement energy requirements would be on-peak power (pp. 71-72, see especially Figure 9-3). Even though on-peak energy is much more costly than off-peak energy, a relatively small increment would be required. If cleaner options are not available, some gas-fired capacity (e.g. combustion turbines) could at times be needed to fill the gap[1]. Since Kirkwood is base loaded, its lost energy output should be replaced with another (firm) base-load resource, not combustion turbines, which are strictly a peaking resource.

Impacts on O&M costs should be considered. We agree that these costs may rise as a result of decreased operating flexibility. We note, however, that there is also the potential of reduced O&M costs in the event that Kirkwood powerhouse is decommissioned. A more thorough analysis should also evaluate these potential savings.

Replacement Options

Energy Efficiency, Dynamic Pricing and Renewables

Logan begins by incorrectly stating that *Paradise Regained* did not consider the costs of replacing lost hydropower with energy efficiency, dynamic pricing and renewable energy, then offers ungrounded speculation about our motives. In fact, we do discuss the long term (20 year) levelized cost of wind energy on pp. 82-83. The discussion of energy efficiency on pp. 75-76 also cites the Xenergy study that found that (up to a point) such investments are less costly over the long run than developing and operating new power plants. Thus the estimates of the long term cost of gas-fired and renewable energy presented in *Paradise Regained* represent an upper bound on the cost of realizing energy savings by investing in more efficient equipment.

Overall the Logan Memorandum presents a very negative view of renewable energy and demand side resources. Environmental Defense does not share this perspective. Nor is it consistent with current California policy or recent initiatives by the City and County of San Francisco (CCSF) and the SFPUC. Backed by the Governor and reaffirmed in the State's latest energy plan, California's "loading order" policy prioritizes meeting future energy needs first with energy efficiency and demand response, then with renewable power and clean distributed generation, and only last with clean and efficient fossil-fired

[1] If a net increase in gas-fired energy is used to firm up other programs that replace lost, Environmental Defense recommends approaches be pursued to offset any increase in emissions (*Paradise Regained*, page 108).

generation.[2] Similarly, San Francisco's 2004 *Climate Action Plan*[3] lays out an ambitious program by CCSF—both independently and in partnership with PG&E-- to increase investments in energy efficiency and demand responses.[4]. The plan also envisions CCSF maximizing development of solar power[5] and developing and installing wind facilities--both inside and outside the city[6]. As discussed in more detail below, actual policy experience in California has repeatedly demonstrated that investments in energy efficiency and renewable power are both cost effective and dependable.

Energy Efficiency

The Logan Memorandum mischaracterizes the Xenergy study referenced in our analysis of the role that investments in energy efficiency could play in displacing demand for lost hydropower. The Xenergy study assessed the economic potential for maximizing energy efficiency *statewide*, not just within the jurisdictions of investor owned utilities (IOUs). The principal conclusion of this study is that, despite considerable investments to date by utilities, municipalities and other entities within California, there are still abundant untapped opportunities to invest in cost-effective energy efficiency projects. Consistent with California's loading order policy, *Paradise Regained* simply suggests that, as a first step toward replacing forgone Hetch Hetchy hydropower, these possibilities be fully investigated since energy efficiency is the cleanest and perhaps also the least cost resource available.

California has achieved remarkable success in realizing energy efficiency, holding per capita electricity consumption flat for the last 30 years, while it has grown by 50% nationwide.[7] Yet the state's policy-makers acknowledge that there is still much untapped potential, including for example realizing all available cost-effective savings at customer-owner utilities (such as TID and MID), reaching out to low-income and other hard to reach communities, and building upon the success of the IOU's programs.[8] With vision

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2 California Energy Commission; California Public Utilities Commission, *Draft Energy Action Plan II, Implementation Roadmap For Energy Policies,* July 27, 2005, http://www.energy.ca.gov. < http://tinyurl.com/b9985 > (19 August 2005), p. 2.

3 San Francisco Department of the Environment; San Francisco Public Utilities Commission, *Climate Action Plan For San Francisco, Local Actions to Reduce Greenhouse Gas Emissions,* September 2004, http://www.sfwater.org. < http://tinyurl.com/c3z45 > (19 August 2005) SFWater.org See Ch. 3.

4 Ibid., pp. 3-18, ff.

5 Ibid., pp. 3-29, ff.

6 Ibid., pp. 3-31, ff.

7 *Energy Action Plan*, p.3.

8 Ibid., p.4.

and foresight, local officials in San Francisco and elsewhere *can* craft institutional arrangements that tap into the unexploited potential while overcoming the challenges that the Logan Memorandum identifies. Both San Francisco's 2004 *Climate Action Plan and* its proposed Community Choice Aggregation plan are both excellent examples of this kind of "can do", "outside the box" policy-making.

As discussed on p. 85 of *Paradise Regained,* the more complete energy efficiency analysis that we recommend would need to evaluate potential energy savings on a localized basis and propose institutional arrangements. We agree with the Logan Memorandum that an important consideration would be identifying opportunities to realize *incremental* savings, rather than simply appropriating savings that are already being realized by existing programs. Also as the Logan Memorandum notes, some parties have raised concerns about equity in the design and administration of existing energy efficiency programs. Environmental Defense believes that in developing new energy efficiency programs full consideration should be given to the resulting distribution of costs - - and benefits.

In this section the Logan Memorandum also appears to take issue with the long-run, social perspective employed in *Paradise Regained*. Environmental Defense believes that this is the appropriate perspective to use when considering such a long lasting resource allocation decision that affects people throughout California, the nation and indeed the world. However, we do also stress that the analyses that are undertaken to develop a workable restoration program must also weigh impacts on individual stakeholder groups.

Renewables

This section begins by reiterating the assertion that *Paradise Regained* contains no estimate of the cost of renewable energy. As noted above, this is not correct. We do discuss an estimate of the cost of wind energy (pp. 82-83). Transmission costs are not considered since the Hetch Hetchy supplies that would need to be replaced also incur these costs. These and other related costs may be higher (or lower) for alternative sources of energy. We agree that subsequent analyses should examine the incremental costs of firming, scheduling and wheeling replacement energy sources.

The Logan Memorandum also criticizes *Paradise Regained* for not proposing a specific portfolio of resources to replace forgone hydropower. Proposing an exact resource mix of replacement power was never the objective in *Paradise Regained* – we believe San Francisco and others who use Tuolumne River hydropower ought to have a hand in determining what replacement sources would be optimal. Furthermore, on p. 75 we explain that lack of data precluded such an analysis, and that our aim was to "provide an overview of the feasibility, environmental performance and relative cost of potential sources of replacement energy." Our emphasis on wind energy reflects its relative abundance in the western United States (p. 78).

Contrary to the Logan Memorandum's pessimistic outlook, California's RPS program is providing solid evidence that renewable energy can compete successfully with fossil-fired energy in the market place. California's two largest IOU's (PG&E and SCE) have recently completed their first round of renewable energy solicitations under the RPS and have contracted for hundreds of MW and thousands of GWh of clean renewable energy. While the actual prices remain confidential, it is known that all of the accepted bids have come in at or below the price thresholds established by the California Public Utilities Commission (CPUC) to determine cost-effectiveness. The CPUC's cost effectiveness test is based on a comparison to the "all-in" (e.g. including capacity cost and a hedge against natural gas price fluctuations) cost of energy generated from gas-fired units and was developed through full evidentiary proceedings with extensive stakeholder input.[9]

Altos Management Partners (AMP) recently completed an energy market analysis for the SFPUC and SF Department of Environment that provides an additional perspective on the cost-effectiveness of renewable energy. Although the AMP study does not specifically address replacing lost Hetch Hetchy hydropower, it provides a valuable window into the alternative energy options that would be available to the SFPUC were the valley to be restored. Among the questions AMP examined were CCSF's (and PG&E's) projected future cost of acquiring power. Of particular note is their conclusion that a "shaped" (i.e. firm) on-peak wind resource "is potentially competitive in the market as an on-peak product."[10] Based upon current market conditions, AMP used a figure of $42/MWh for wind power and an adder of $6/MWh for "shaping" (i.e. firming) services, for a total cost of $46/MWh. This estimate represents a long term, levelized cost, although AMP does note the potential for wind energy prices to fall if technological innovation reduces capital costs.[11] Environmental Defense has not reviewed AMP's

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[9] As implemented by the CPUC, the program sets a "market price referent" (MPR) that represents the long-run, levelized cost of energy from a new gas-fired power plant (combined cycle for base-load energy, simple cycle for peaking power). The MPR is effectively a ceiling price that bids must meet or beat: higher bids may apply to the CEC for Supplemental Energy Payments, effectively a subsidy. The 2004 MPR's are $6.05/MWh for base-load energy and $11.42/MWh for peaking power, both over a 20 year horizon.

[Peevey, Michael R., *Assigned Commissioner's Ruling Issuing Revised 2004 Market Price Referents For The Renewables Portfolio Standard Program,* April 22, 2004; http://www.cpuc.ca.gov. < http://tinyurl.com/d4lme > (19 August 2005). See also D.04-06-015, and D.03-06-071 for explanations of the MPR methodology.

[10] Nesbitt, Dale; Ash, Howard; and Forseman, Ted, *Community Choice Aggregation Draft Implementation Plan,* April 27, 2005, www.sfwater.org < http://tinyurl.com/dnqzq > (19 August 2005) Chapter 4: Resources and Costs, The Economic Costs and Benefits of Community Choice Aggregation by CCSF, p. 13.

[11] *Ibid.*, pp.29-30

findings in detail, but cites their report as an example of market data being provided to the SFPUC on the cost and availability of renewable energy for use in CCSF.

Natural Gas Combined Cycle Power Plant

Gas-fired generation is considered in *Paradise Regained* as a source of firming energy and, consistent with the loading order, as a means of replacing lost hydropower that cannot otherwise be replaced with savings from energy efficiency or renewable resources.

Like the Logan Memorandum, we recognize that natural gas prices are uncertain and volatile (p. 80). While financial hedges are available in the marketplace, investing in energy efficiency and renewable power are physical hedges that provide assured long-run insulation against even long term price fluctuations. The Logan Memorandum overlooks this benefit.

Minimizing the role of gas-fired generation in the package of energy resources assembled to replace Hetch Hetchy hydropower is the surest way to protect against gas price risk. To the extent that gas-fired resources are needed, we agree that it will be important to examine projections of future gas prices and means of hedging against gas price fluctuations. Like the CEC forecast we cite in *Paradise Regained*, the Sempra projection the Logan Memorandum presents is one of many views on this subject. In weighing this critical uncertainty we recommend using forecasts that have been developed and vetted in a public forum with input from many stakeholders, as opposed to projections by individual stakeholders. A good example of this is the CPUC's process for choosing among available natural gas price forecasts to provide the basis for setting the market price referent in the RPS procurement process.

The Logan Memorandum incorrectly states that we calculate replacement energy costs using only a 20 year time horizon. In fact we employ a 50 year time horizon to estimate the net present value of replacement energy costs (p. 90). We used 20 year levelized cost projections in the calculations because no longer term projections were available. Longer term projections would be preferable.

O'Shaughnessy dam was definitely built to last— and we agree that if it is not decommissioned it will be around for more than 20 years, and probably longer than the 50 year time horizon we used. However, all hydropower facilities require ongoing O&M and periodic capital upgrades. Our analysis omitted any estimates of these costs, effectively treating hydropower from the SFPUC's system as completely free over this entire fifty year period. This simplifying assumption would obviously need to be relaxed in a more thorough analysis.

Conclusion:

Further analysis based upon more detailed data is needed to develop specific recommendations and refine cost estimates for replacement energy resources. *Paradise Regained* does not attempt to construct the optimal resource portfolio for San Francisco or the Turlock and Modesto Irrigation Districts, or for others who occasionally have received power from Kirkwood and Moccasin, but simply identifies and estimates the cost of alternatives that could replace the hydropower that would be lost if Hetch Hetchy Valley in Yosemite National Park were restored.

Environmental Defense Response to

"Assessment of the Flood Control Impacts of the Removal of the Hetch Hetchy Dam and Reservoir, Tuolumne River, California"
MKB Engineers
May 2005

The third technical report submitted by the SFPUC, prepared by MBK engineers, is entitled "Assessment of the Flood Control Impacts of the Removal of Hetch Hetchy Dam and Reservoir, Tuolumne River, California" (May, 2005). While *Paradise Regained* does not devote the entirety of a chapter to specific consideration of flooding issues on the Tuolumne River, our analysis deals implicitly with flood control by specifically building SFPUC-provided flood control criteria into our modeling of water supply alternatives.

Environmental Defense welcomes the input of the SFPUC and MBK on the topic of flood control, for the protection of downstream communities and facilities in the event of a flood should be of critical interest to both the City of San Francisco and the State of California. Indeed, Environmental Defense believes that restoration of Hetch Hetchy Valley should proceed only if the current level of flood protection for Modesto and other riverside communities is maintained or improved.

A first matter that should be clear when considering the flood control implications of altering the Hetch Hetchy system is that while pre-1970 operating guidelines for Hetch Hetchy Reservoir included criteria for maintaining flood control space during winter and spring, this requirement was moved downstream to Don Pedro reservoir when its construction was competed in 1970. However, even as Hetch Hetchy Reservoir today provides no explicit flood control space, practices for operating it may provide incidental flood control protection (this point is explicitly acknowledged in *Paradise Regained*, Chapter 12, p. 107).

As part of our research for *Paradise Regained*, we asked the San Francisco Public Utilities Commission about the flood control criteria that it uses in its reservoir operations. Based on their response, we included the flood control protections at Hetch Hetchy, Cherry and Eleanor Reservoirs that they use for planning purposes in all our modeling simulations.[1] The information provided by the SFPUC indicates that they assume, for planning purposes, that 30,000 acre-feet of storage capacity in Hetch Hetchy Reservoir during the October-March period is dedicated to retaining flood control space.

The restoration proposals embodied in *Paradise Regained* transfer this incidental flood protection currently at Hetch Hetchy Reservoir, as characterized by the SFPUC, to its water bank in Don Pedro Reservoir. Thus, all modeling of water supply alternatives to Hetch Hetchy Reservoir submitted to DWR included this additional 30,000 acre-feet of reservoir flood control storage that would be necessary, as indicated by the SFPUC, to make up for the incidental protection that might be lost at Hetch Hetchy Reservoir.[2]

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[1] The SFPUC letter, dated October 10, 2003, regarding "Flood Control Operation of SFPUC Reservoirs" is included as Attachment 2.

[2] We have done no sensitivity analysis to investigate the effects on water supply and/or hydropower if values greater than or equal to 30,000 acre-feet were used.

MBK's assessment appears to be based on the assumption that the operation of all other system components would not change. Our proposal, on the other hand and as incorporated in TREWSSIM model studies, is intended to incorporate whatever flood control protection O'Shaughnessy Dam provides elsewhere in the water system. Therefore, if any of our water supply proposals were explicitly adopted, the flood impacts projected by MBK Engineers would be significantly overstated.

As acknowledged in *Paradise Regained*, "Additional analysis of overall flood control on the Tuolumne River should be pursued." This analysis should first identify the level of reliable protection, if any, that the reservoir currently provides. Second, if operation of other facilities in the Tuolumne watershed must be altered to replace protection provided by Hetch Hetchy Reservoir, what effect—if any—there would be on water supply reliability should be evaluated. Finally, the analysis should investigate what other system modifications, to either water supply facilities or to the river channel, might be made to provide additional protection.

It is essential that the city of Modesto and other communities in the watershed be afforded the opportunity to assure themselves that the restoration of Hetch Hetchy Valley would not increase the risk of flooding along the lower Tuolumne River.

SAN FRANCISCO PUBLIC UTILITIES COMMISSION
1145 Market Street, Suite 401 • San Francisco, CA 94103 • (415) 934-5700 FAX (415) 934-5750

October 10, 2003

Mr. Spreck Rosekrans
Senior Analyst
Environmental Defense
5655 College Avenue
Oakland, CA 94618

Subject: Flood Control Operation of SFPUC Reservoirs

Dear Mr. Rosekrans:

I am responding to your letter dated October 3, 2003 regarding SFPUC flood control policies and practices at Hetch Hetchy, Cherry and Eleanor reservoirs. These reservoirs are located upstream of New Don Pedro reservoir, which is owned and operated solely by the Modesto and Turlock Irrigation Districts. We are aware of your investigation of our water system and how it might be modified to accommodate restoration of Hetch Hetchy Valley. We have agreed to cooperate by providing clarification of technical issues that you raise in your investigation.

It is the policy of the SFPUC to operate San Francisco's water system in a prudent manner that maximizes the reliability and quality of water deliveries. The 1987-92 drought demonstrated that there is a deficit between San Francisco's water supplies and its demands. Therefore, it is currently a normal practice to maintain maximum carryover storage until the forecasts of anticipated runoff into the reservoirs is sufficient to allow for discretionary releases. However, it is also prudent to operate those reservoirs with a buffer in storage during the winter to efficiently and safely manage storm events for the protection of downstream City facilities.

The table shown below describes the reservoir storage parameters used in our modeling (entered in spreadsheet W260H.wk4) to reflect the City's policy and practice. The data represent end-of-month storage levels that, through managed releases through the penstocks and valves, will not be exceeded.

HHWP Reservoir Storage Level Information (TAF)			
	Reservoir		
	Hetch Hetchy	Cherry	Eleanor
January Maximum Storage	330.000	248.000	21.495
February Maximum Storage	330.000	248.000	21.495
March Maximum Storage	330.000	248.000	21.495
April Maximum Storage	360.360	273.500	27.113
May Maximum Storage	360.360	273.500	27.113
June Maximum Storage	360.360	273.500	27.113
July Maximum Storage	360.360	268.000	27.113
August Maximum Storage	360.360	258.000	27.113
September Maximum Storage	360.360	248.000	18.000
October Maximum Storage	330.000	248.000	14.000
November Maximum Storage	330.000	248.000	21.495
December Maximum Storage	330.000	248.000	21.495

It should be recognized that there may be exceptions to the typical operation when maintenance of facilities warrant an additional draw down of reservoir storage. Although there is no explicit flood control reservation space required in our reservoirs, incidental benefits do accrue.

If you have any additional questions, please contact me at (415) 934-5787.

Sincerely,

Michael Carlin
Planning Bureau Manager

Environmental Defense Response to

"Response to Legal Issues Raised by Environmental Defense Proposal"
Ellison, Schneider & Harris
May, 2005

The fourth technical report submitted by the SFPUC, prepared by Ellison, Schneider & Harris, was entitled "Response to Legal Issues Raised by Environmental Defense Proposal."

Environmental Defense's *Paradise Regained* includes a chapter entitled "Legal Status and Institutional Considerations" (Chapter 11, pp. 94-105) and an Appendix entitled "Memorandum: Hetch Hetchy Water and Power Issues," prepared by Somach, Simmons and Dunn (Appendix C, pp. 1-37). Environmental Defense understands that its analysis and that of Somach, Simmons and Dunn are by no means the last word on the myriad legal and institutional issues that would be implicated by any serious proposal to restore Hetch Hetchy Valley. Indeed, it is apparent from the much more comprehensive listing of issues on the Resources Agency's poster board entitled "Hetch Hetchy Removal: Legal Considerations" (July 14 workshop) that there are many issues that *Paradise Regained* does not purport even to begin to address. Nevertheless, we continue to stand fully behind the legal and institutional presentations in our report, notwithstanding anything written in the Ellison, Schneider & Harris "Response" (hereinafter the "ES&H Response").

This is not the say that the ES&H Response should be ignored. Indeed it is fair to say that it contains considerable commentary that should be incorporated in any future analysis that is undertaken by the Resources Agency or by others who are evaluating the potential and the means for restoring Hetch Hetchy Valley.

Most notably, the ES&H Response goes into some detail on points respecting: (1) the SFPUC Capital Improvement Program (CIP); (2) the Raker Act; (3) the distribution of water rights on the Tuolumne River; and (4) the Modesto and Turlock Irrigation District agreements.

With respect to the CIP, ES&H is correct in asserting that Environmental Defense sees elements of the CIP as providing an opportunity to study the potential for restoration of Hetch Hetchy Valley and that *Paradise Regained* pursues in detail a scenario that incorporates retrofit and enlargement of Calaveras Reservoir, construction of a fourth San Joaquin pipeline, and enlargement of the Sunol Water Treatment Plant (all of which are elements of the CIP). The ES&H Response is stretching credulity, however, when it characterizes the CIP as a "planning effort" rather than a construction program, and on that basis then criticizes Environmental Defense for suggesting that questions will be raised about expansion elements of the CIP by those who value Tuolumne River flows and who compete for water on the river. That the national non-profit organization, American Rivers, and the Tuolumne River Trust have declared the Tuolumne to be one

of America's ten most endangered rivers is ignored by ES&H, as are the many manifestations of TID's and MID's tenacious pursuit over the years of their perceived interest in restraining the quantity of the SFPUC's diversions from the river.

With respect to the Raker Act, the ES&H Response appropriately acknowledges Environmental Defense's frank assessment that Congress would eventually have to amend the Act if Hetch Hetchy Valley is to be restored and the SFPUC's interests are to be protected. Environmental Defense also has no real quarrel with the ES&H Response's aggressive defense of the SFPUC's Congressional grant in the Raker Act, although it should be noted that others including the U.S. Supreme Court, have taken a different view of the limitations of Congress' powers, especially in the context of San Francisco's management of the power side of its Hetch Hetchy operations, see, e.g., United States v. City and County of San Francisco, 310 U.S. 16 (1940).

It is with respect to San Francisco's Tuolumne River water rights that the ES&H Response goes into greatest detail in seeking to undermine the arguments put forth in *Paradise Regained*. Referring to what it believes is "continued and constant recognition of San Francisco's water rights to divert at least 400 million gallons per day (mgd) from the Tuolumne River," the ES&H Response accurately characterizes Environmental Defense and particularly Appendix C of *Paradise Regained* as having raised serious questions about whether San Francisco's water rights encompass such an extraordinary increase in the potential for the SFPUC to divert water from the Tuolumne.

If the CIP is indeed a "planning effort" and incorporated within that plan is an intention to exercise all or most of San Francisco's alleged 400 mgd pre-1914 diversion rights, then ES&H has identified a major issue that is likely to be engaged initially in the environmental impact assessment processes, under state and federal law, that *Paradise Regained* itself indicated would be an appropriate forum to tackle disputes regarding San Francisco's expansion plans.

Finally, with respect to MID and TID contractual issues, ES&H champions the interests of the districts, which its response earlier brushed aside when asserting that San Francisco holds Tuolumne River water rights at or above 400 mgd. Again, however, the ES&H Response does not significantly dispute most of the analysis in *Paradise Regained*. *Paradise Regained* goes to considerable trouble to set forth the long and detailed history of conflict and resolution of disputes between the districts and San Francisco, that eventually resulted in a series of Agreements between the parties, each building on the agreement prior. Environmental Defense then suggests several bases upon which the parties might be persuaded to modify their contractual relationships once again, to

accommodate restoration of Hetch Hetchy Valley and to meet other objectives they and their constituents may want to pursue. This is perhaps a place where ES&H and Environmental Defense do indeed have an irreconcilable difference. For ES&H, "[a] negotiated resolution to this impasse [involving storage and water rights] is impossible to envision, no matter how great the 'statesmanship' of San Francisco and the Districts. (Response, p. 19)" For Environmental Defense, this is a failure of imagination on the part of ES&H, based on a failure to understand the historical record in which at least equally apparently intractable differences among the parties were eventually resolved to the satisfaction of all.

These are not the only issues raised by the ES&H Response. Environmental Defense means no disrespect in choosing to address only these principal issues highlighted by ES&H, in this preliminary study effort being undertaken by the Resources Agency. Certainly we understand that BAWSCA may well have the most at risk when it comes to the remarkable role that the SFPUC plays in controlling its water lifeline. We also understand that any discussion of a Delta water source, even in emergencies such as took place in 1991-1992, when San Francisco indeed was assisted by the State Water Project in diverting Delta water, is uncomfortable for the SFPUC to contemplate. Environmental Defense, however, welcomes BAWSCA's involvement in the continued discussion of restoration options and has no real quarrel with BAWSCA's fundamental position that restoration of Hetch Hetchy Valley should not proceed until an alternative is funded, built, and operational and associated institutional arrangements also are in place and fully funded. We also continue to stand four square behind our recommendation that San Francisco should forthwith negotiate an agreement with the SWP that would provide redundancy in emergencies for both systems. There is far more to fear from a catastrophic outage in the event such an agreement is not negotiated than from any threat that the SWP would take San Francisco's water south in non-emergency conditions or that the state would otherwise undermine San Francisco's interests.

In summary, Environmental Defense welcomes the engagement of ES&H and others in investigating the legal and institutional issues raised by an effort to restore Hetch Hetchy Valley, because we know that many perspectives will need to be assessed and reconciled in order for this ambitious project to proceed.

In *Paradise Regained*, Chapter 11, page 104, we openly concluded "that substantial legal and institutional hurdles must be overcome in order for a restoration scenario to actually come to pass." In the three final paragraphs of Chapter 11 that follow, *Paradise Regained* lays out what Environmental Defense considers to be potentially promising avenues that might be pursued in overcoming the principal hurdles. They include federal action, a very

considerable set of state involvements, and perhaps most hopefully a plea for cooperation among the myriad interests who would be affected by any restoration plan. Environmental Defense, contrary to assertions in the ES&H Response, acknowledges the complexity; it just believes that complexity in the modern age is no reason to abandon an otherwise good idea.

In this context, it must be stated that the most disappointing element in the ES&H Response is the conclusion ES&H reaches in its final paragraph. The ES&H Response argues: "The Environmental Defense proposal stands to set off a staggering array of disputes, all of which would likely end in long-term complex litigation (emphasis added)." (Response, p. 26). This is an unfortunate threat. Litigation, of course, can be a valid means to resolve a dispute, in public as well as in private matters. For the ES&H Response to proclaim that every dispute that is raised by Environmental Defense's proposal is likely to be litigated, however, we believe improperly assumes bad faith on the part not only of such major involved actors as BAWSCA and the Turlock and Modesto Irrigation Districts, but of San Francisco itself. Hopefully this is a case in which a consultant has taken a position considerably more extreme than the client for which it is working. San Francisco, indeed, after initially taking a very confrontational position, has often distinguished itself in many other settings (e.g. the Embarcadero Freeway removal and the proposed Airplane expansion), as an entity that ultimately seeks to address complex environmentally controversial proposals with an open mind and a cooperative spirit.